

# Virtual Concept Use in the Construction Industry

**O. K. B. Barima**

*University of Hong Kong, Hong Kong*

## INTRODUCTION/BACKGROUND OF ORGANIZATION

### Introduction

History is laden with many technological breakthroughs which have had enduring impacts on business affairs (e.g., automobile, mass power generation, etc.). It also appears that modern information and communication technology (ICT) tools, especially the Internet, have had some impact on the way in which business and other task deliveries are conducted. Aligned to this is the emergence of virtual model in business where people are able to operate independent of time and space via dependence on modern ICT tools to attain specific goals. During the previous decade (1990s) various virtual organizations (or “dot-coms”) emerged and they were touted to be the future of business, and hence with the potential to completely overthrow traditional companies (see, e.g., Mandel, Ho, Himmelstein, Foust, & Muller, 2001; Ousthuizen, Koster, & Rey, 1998). Although the end of the 20<sup>th</sup> century saw the demise of most of these companies, however, a few surviving ones like the search engine company Google have made significant impact in recent times by overtaking traditional companies like General Motors and Ford Motor Co. in terms of market capitalization (via an estimated value of about \$27 billion in year 2004) (see, e.g., Shinal & Kopytoff, 2004).

Further to the above generic review of the impact of the virtual organizations, seminal accounts also exist on the significant use of the virtual concept to support engineering task delivery by traditional companies. In the aviation sector, for example, Boeing Co. pioneered the use of the virtual concept to support task value delivery processes via its first virtual collaborative design using 230 design/build teams which started in 1990 and resulted in the unveiling of Boeing 777 in 1995 (see, e.g., Rayport & Sviokla, 1999; Russell & Flack, 1998). Boeing Co. thus avoided the use of traditional physical airframe prototypes of the proposed aircraft, and leveraged information-based virtual product prototypes (with the relevant laws of physics and material science) assembled on computer, and this aided the avoidance for physical means to solve conflicts of space (Rayport & Sviokla, 1999; Russell &

Flack, 1998). This initiative led to massive gains in terms of 75% reduction in rework, testing of many designs at lower costs, better speed, and hence gains in efficiency (Rayport & Sviokla, 1999; Russell & Flack, 1998). On the other hand, Ford Co.’s first initiative via the Advanced Vehicle Technology project to use virtual model across geographic locations over traditional physical collocation resulted in efficiency levels which were a third less than physical collocation delivery (Russell & Flack, 1998). To sum, the accounts given above concern the potential success and “failure” in leverage of the virtual concept in business activities, from both generic and specific applications. One may extend this thinking to explore what lessons may also be learned from other industries like the construction industry on the leverage of the virtual concept to deliver value? With the virtual model depending to a great degree on the use of modern ICT, a track of diverse research on ICT in construction may be useful to enhance comprehension of the trends of research in this area.

There has been useful research on the use of ICT and its related applications in the construction industry for both academic and non-academic purposes. Research on pedagogic applications for architectural “studio” studies (see, e.g., Dave & Danahy, 2000), or construction and technology purposes (see, e.g., Clayton, Warden, & Parker, 2002) have provided understanding in the use of the concept in training students to experience the virtual concept. Studies focused on virtual structural designing/analysis, etc. (see, e.g., Deng & Nguyen-Minh, 2003); or software development and description oriented studies (see, e.g., Connell & Tullberg, 2002; Craig & Zimring, 2002); or virtual reality tools for the management and operation of construction activities (see, e.g., Caneparo, 2001) have assisted in moving the field forward, and also enhance actual construction operations. Survey-based studies which track the generic use of IT in construction (see, e.g., Howard, Kiviniemi, & Samuelson, 1998; Rivard, 2000; Samuelson, 2002) provide awareness on the trends in the extent of use of ICT in construction generally. The case-based research like that of Rivard et al. (2004) which gave an account of specific applications of IT use in the Canadian construction industry offer knowledge on emerging pioneering trends in the industry. However due to the

relatively “youthful” age of this area of research there appears not to be much empirical studies which focus on the use of the virtual concept in construction value delivery. This article explores the leverage of the virtual model in delivering value in the construction industry by a construction company in Hong Kong. First, general issues (which includes an overview of the research activities) and the background of the company is given, before descriptions and the impact of the applications are presented.

## General Issues and Overview of Research Activities

The aim of the study was to explore the experience of the use of the virtual concept by a selected company in Hong Kong. Thus, to explore the question on how it uses the virtual concept in its task delivery processes to deliver value? This study (which is part of a broader study) is hence exploratory and descriptive in nature and has the unit of analysis at the organizational level. For the sake of confidentiality this company will be referred to as Case 1. This company is a construction contractor, and it was selected on purpose. A key reason for selecting this company was that it is perceived as one of the leaders in the local industry. The evidence provided herein is an analyzed data based on cross-verified in-depth interviews of senior company executives, archival data, observations, etc., and the use of a research study protocol (see, e.g., Rahim & Baksh, 2003) which set out (among others) the research rationale, objectives and methodology (which included procedures to guide the data collection process). A brief schematic diagram of the research activities is given in Figure 1.

A set of formulated questions was used to aid in the data collection process. This enabled gathering information on the following to achieve the aim of the research:

- The background information of the case company;
- The extent of leverage of the virtual concept in the firm; and

- Improvements attained (over previous traditional operational methods) through the use of the virtual concept in the case company; challenges and exploratory lessons learned.

The next sections give the details on the case company, descriptions of the application (with prior definition of key concepts), impact, before the conclusions are offered.

## Background of Company

Case 1 is a construction company which is over 50 years old with headquarters in Hong Kong. Case 1 maintains other international branches (mainly in Asia) and it has an average annual turnover of about 1 billion dollars (U.S.). The activities of the firm cover a wide scope and include the construction of the following: residential houses (various types); railways, industrial buildings, varied commercial structures including shopping complexes, environmentally based projects and roads and bridges.

## DESCRIPTIONS OF E-COMMERCE, E-GOVERNMENT, AND/OR MOBILE COMMERCE

### General Issues

Before presenting descriptive applications of the concept, it may be useful to define the virtual concept and value delivery as applied in this article to aid comprehension.

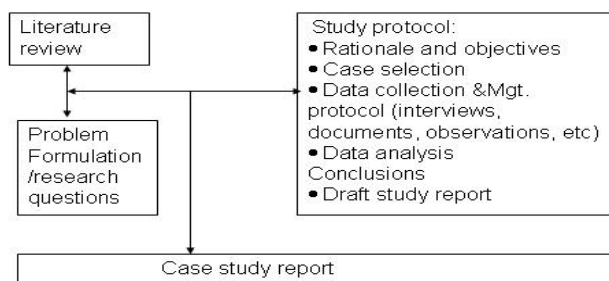
### Virtual Concept

Despite the varied inconsistent definitions which exist in literature for this term, this article will adopt this operational definition of the term virtual:

- When specifically applied to the organization or construction project to mean: the combination of skills by firms/groups/individuals (outsourced or otherwise) who depend on modern ICT to imitate the real world or operate independent of time and space, and collaborate to achieve common goals (see, e.g., Barima, 2003; Duarte & Snyder, 1999; Ousthuizen, Koster, & Rey, 1998).

To enhance understanding of the virtual model, a comparison with the traditional construction concepts may also be useful. In the traditional models there may be the reliance on traditional means like physical face-to-

Figure 1. Brief overview of research activities



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