

E-Business in the construction industry: a search for practical applications using the Internet

Hans Wamelink¹ & Wim Teunissen²

*¹Eindhoven University of Technology, Faculty Technology Management
Postbus 513 NL 5600 MB Eindhoven, The Netherlands*

j.w.f.wamelink@tm.tue.nl

*¹Infocus Management Consultants BV
Postbus 4103 WR Culemborg, The Netherlands*

jwamelink@infocus.nl

*²LogicaCMG
Postbus 133 NL 1180 AC Amstelveen, The Netherlands*

wim.teunissen@logicacmg.com

ABSTRACT: New technology often drives organisational changes. The influence of Information and Communication Technology (ICT) on modern business is enormous. ICT not only supports improvements in the primary process but, for example, also enables better planning and much improved logistics. Here communication technology is equally or even more important than information processing itself.

In the current economic downturn, the construction industry will be forced to answer to the ever-increasing customer demands for flexibility both in relation to the end product as well as to the construction and production process. Construction companies need to anticipate these new requirements. A complicating factor in this context is the way the construction industry is organised: many companies with varying expertise, working on a project base together, all contributing their own - often small - part to the end product. This makes the use, and above all the efficient use, of ICT in the whole construction process difficult when we try to tackle the subject of collaboration: all participants are confronted with slightly different ways of working which make the exchange and reuse of information difficult. To be able to manage communication, co-operation and collaboration, the Internet is already playing an important role.

Internet technology can be the source of many improvements. Initiated amidst the e-Business hype, the project DigiBouw has resulted in an overview of seven concrete functional areas where the Internet may provide the construction industry with the technology to improve performance. In this paper we present the findings of this research and focus on the area of e-Procurement, and specifically on one of its aspects, e-Ordering. We will show not only what it can bring to a single company, but also offer some advice on how to start introducing e-Ordering.

KEYWORDS: e-Business, e-Procurement, e-Ordering, project webs, document management, workflow management, knowledge management.

1. INTRODUCTION

In 2000 the DigiBouw project was started as an initiative of VGBouw, an organisation of larger construction companies in the Netherlands. The objective was to investigate the (practical) use of e-Business solutions in the construction industry [Wamelink-2003].

The various participants in a construction project traditionally have a pragmatic approach towards new technology: it should be convenient to use and bring convincing advantages when compared

to current common practice.

Given this down-to-earth attitude and the well-known hype surrounding e-business, people are suspicious of internet solutions. This paper describes the results of the DigiBouw project, with a special focus on e-ordering. The next sections describe not only the possibilities of e-business in construction, but also how to implement them.

The first section describes the meaning of e-Business in general. Then the e-Business application areas important to the construction industry

are examined in more detail. To illustrate the meaning and consequences from E-business in practice, section 3 focuses on one specific area: e-ordering. Finally, conclusions are drawn and a general approach is offered for starting to use e-Business solutions in the real world.

2. E-BUSINESS

The term “E-business” is defined as the use of information and communications technology to change and improve business relationships [Hartman]. The “business relationships” referred to are not only limited to those between the business and its customers, suppliers, etc., but also include those with employees and governmental institutions.

With respect to the technology part of the definition of e-business, the Internet is an important enabler, giving a host of new possibilities. Literature (see for instance [Hartman]) describes many advantages. Examples are the strengthening of relationships with customers (termed “customer relation management”) or increasing their market. Process efficiency improvement is also often quoted.

2.1 E-business in the construction industry

The benefits of the Internet also can be applied in the construction industry. Many researchers point at the need for construction organisations to make the necessary investments that will enable them to take advantage of the new technologies available [Anumba] [Brandon]. During the Digibouw project, research was undertaken to investigate which functional e-business areas can be truly relevant mainly to construction companies.

Possible e-business applications can be divided into three main groups (see also figure 1):

1. e-business applications supporting communication processes with the customer/principal (e.g. concerning design information)
2. e-business applications supporting communication processes on the purchasing side of the company (concerning information about contracted out supplies)
3. e-business applications supporting internal processes within the construction company.

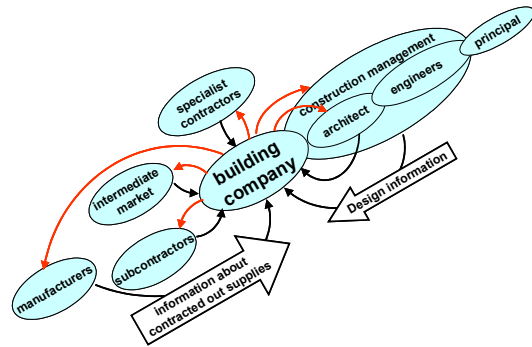


Figure 1: roles in the construction process

2.2 E-business in relation to the customer

In fact this is the sales side of the construction company. In this case e-business can improve the relation with the principal. Examples of using the Internet are: gathering customers’ expectations (principal, tenants); providing information about the progress of the building process; handling complaints; creating and operating a helpdesk, etc..

Specifically in housing the Internet can be used to facilitate communication between the customer and the contractor about changes in design.

Electronic support in the form of project webs, optionally with workflow functionality, will lead to a better control of the whole process and will result in less confusion and disputes because of missing and failed communication.

2.3 E-business in relation with suppliers

At the purchase side of the construction company relevant e-business areas are E-procurement (including e-ordering) and E-tendering. E-procurement is examined in detail in section 3. E-tendering concerns the support of the subcontracting process. After placing the tender information on the Internet, potential subcontractors can subscribe to the bid. Advantages are enlargement of the market range and aggregation of different tenders, which will lead to lower costs.

2.4 E-business supporting internal processes

E-business is often connected with communication between different companies. As seen in the definition of E-business (see section 1) internal applications are also part of this definition. Each com-

pany always searches for the most effective and efficient processes to reduce costs (of failure). In other words: improvements in integration and management of (internal) processes. In this area the application of ICT can be of great interest. Examples of E-business concerning internal processes are knowledge management, document management [Björk] and workflow management [van der Aalst] [Wamelink-2002].

Besides this, the intense use of ICT within the firm itself is an important precondition to implement the applications supporting communication *between* companies.

2.5 Summary of relevant e-Business application areas

In the preceding section seven relevant examples of E-business in the construction industry are given:

- Projectwebs
- E-procurement (including e-ordering)
- E-tendering
- Knowledge management
- Document management
- Supporting the principal
- Approaching the individual customer

In the Digibouw project these areas are mentioned as potential contributors to major improvements within construction processes and projects in general. To demonstrate this contribution to improvements, the next section describes one of the above application areas (e-ordering) in detail.

3. E-ORDERING

3.1 Definition

What is e-Ordering? Simply put, e-Ordering is calling-off supplies based on an agreement that was reached earlier between the construction company and the supplier.

Consequently e-Ordering does not involve finding a supplier or determining a price; nor closing the contract. In fact it is everything that follows after the contract has been signed:

- Determining the batches and setting their preliminary date of delivery;

- confirming that date, possibly modifying some of the details;
- ordering the supplies so that they arrive just in time;
- verifying the shipment for completeness;
- invoicing and payment.

3.2 The benefits

So where are the benefits of e-Ordering? Currently, the process of ordering:

- requires significant administrative book keeping by the foreman on site
- is error-prone due to the fact that orders are generally taken by telephone;
- incomplete deliveries cause delays and more importantly 'improvised buying on site' causing uncontrollable prices;
- the process comprises several points at which (sometimes the same) data has to (re) entered;

The process of e-Ordering should solve all of these problems. This is accomplished by moving all the administrative tasks to the project administration (who may be on site or not), and offering the 'foreman' ordering capabilities at the push of a button. This need not involve all kinds of fancy software, but could just mean a well-prepared paper order form supplied by the project administration and drawn from the existing detailed project plan. This form is (for example) faxed or e-mailed to the supplier (referring to previously made agreements) so errors are reduced to the minimum. Upon delivery, the supplies are checked against the order, differences noted, and payment can proceed (possibly even without an invoice present, because a contract was already drawn up at the start of the project).

In the Digibouw project, a calculation of the Return On Investment (ROI) was made for the housing division of a large construction company. Table 1 shows the parameters, used as starting point to determine the ROI.

Table 1: parameters used to calculate ROI

Parameter	Value
Total spend a year	€ 75,000,000
Number of suppliers	2.600
Number of call-off orders a year	20.000
Number of invoices a year	14.000
Number of contracts	750
% bought on contract (before implementation)	90%
Target percentage bought on contract	98%
% reduction in improvised buying on site	5%

During the research, the following expected savings were quantified:

- a reduction in administrative work in the logistic and billing process;
- reduction of improvised buying on site
- less errors;
- better procurement contracts (e.g. through additional discounts)

Table 2: savings after implementation e-ordering

Component	Saving
Process order efficiency	
Savings on goods ordered purchase orders	€ 84,459
Cost of goods ordered logistics process	€ 50,676
Cost of goods ordered billing process	€ 59,122
Reduction of errors	€ 10,135
Commercial savings	
Savings by more on contract	€ 30,000
Percentage discount spend aggregation	€ 187,500
Savings on paper, fax, mail, etc.	€ 1,000
Total savings	€ 422,892

The calculated savings form almost 0.6% of the total spending. Taking into account that approximately 70% of total building costs is in purchasing (including subcontracting), these savings result in an extra revenue of almost 0.5% on the turnover. The average profit of a building company is 2% of annual turnover. This means that an improvement of 25% in profit can be achieved. It is important to realise that other savings like the reduction of costs of failure are not included. The savings as a result of the reduction of errors mentioned in table 2 concern administrative errors. This means that the total savings will be (much) larger then calculated in table 2.

The total investment was calculated at € 380,000 (including implementation and organisational change). So the payback period turned out to be less than one year. Although a lot of assumptions influence these calculations it is clear that e-ordering will be very interesting for a medium or large sized building company.

The success of e-Ordering relies on the quality of project preparation, more than currently is the case. This is because now much is left to the ingenuity, flexibility and inventiveness of the project leader and foreman: dealing with things going wrong: a delayed plan, changing specifications or just plain mistakes. Although this may lead to the desired outcome (the building being built), it always involves higher cost or delays or both.

To achieve this, an organisational change process must be started, involving much more than just the introduction of new technology. This change process is discussed in more detail in the next section.

4. INTRODUCING E-ORDERING

As was made clear in the previous section, e-Ordering's success depends in turn on the success of a major organisational change process. It requires designers, planners and purchasers to plan accurately and to a more detailed level. Beside this they have to record very carefully and in detail.

But more importantly they need to work together (in parallel) to achieve one specific goal: an accurate plan to deliver the desired construction for the desired price and on time. Now, requests for proposal are sometimes sent at three different stages and from three different departments all trying to realise the best price. This can be easily improved upon, but only as long as the responsible department is kept involved throughout the long design and planning process, rather than only at one point.

For the change to have a chance of being successful, a company-wide agreement on the goals is required, together with the commitment to succeed. The latter should be communicated and shown in deed by the entire management. The change requires careful planning, sufficient budget and above all, flawless execution, both in time as in the outcome.

Beside organisational change, successful implementation of e-ordering needs fully integrated information systems and a professional ICT infrastructure to centralise all the information gathered by different departments with the company

e-Ordering can be a first step in several ways. For example on the way to a more efficient and effective procurement process (whether implemented as e- or not). But more importantly, the success of the project may help to create a mood for change. The momentum gained should be seized to start other projects.

5. CONCLUSIONS

In this paper we focused on e-Ordering as an area where construction companies may benefit from ICT. The Digibouw research showed that a business case can easily be made for the investment in the necessary organisational change.

However, the research also showed that, to achieve success, e-Ordering – and in fact each of the seven relevant functional areas of e-Business – requires more than just the implementation of an Internet-based application. It involves organisational change. Change in the way of working. Change in the relations internal to the (construction) companies; but also external with clients and suppliers.

6. REFERENCES

[Van der Aalst], Van der Aalst W.M.P., M. Stoffele, J.W.F. Wamelink, 2003, Case handling in Construction, in: Automation in Construction, Volume 12, pp. 303 – 320.

[Anumba] Anumba, C.J., R. Ruikar, 2002, Electronic commerce in construction: trends and prospects, Automation in Construction 11 pp. 265-275.

[Björk] Björk, B., The impact of electronic document management on construction information management, in: K. Agger, P. Christiansson, R. Howard (eds.), Proceedings of CIB W78 Conference 2002: Distributing knowledge in Building, Aarhus, Denmark, International Council for Research an Innovation in Building and Construction, Rotterdam, The Netherlands

[Brandon] Brandon, P., M. Betts, J.W.F. Wamelink, 1998, Information Technology support to Construction Design and Production (special issue IT in Construction), Computers in Industry 35, pp. 1 –12.

[Hartman] Hartman A., J. Sifonis, J. Kador, 2000, Net Ready, Strategies for success in the Economy, McGraw-Hill

[Wamelink-2002] Wamelink, J.W.F., M. Stoffele, W.M.P. van der Aalst, 2002, Workflow management in construction; opportunities for the future, in: K. Agger, P. Christiansson, R. Howard (eds.), Proceedings of CIB W78 Conference 2002: Distributing knowledge in Building, Aarhus, Denmark, International Council for Research an Innovation in Building and Construction, Rotterdam, The Netherlands, pp. 115 – 122

[Wamelink-2003] Wamelink, J.W.F., Teunissen, W.J.M., 2003, *e-business in de bouw, een gids voor bouwbedrijven op zoek naar toepassingen van het internet*. Stichting Research Rationalisatie Bouw (RRBouw), Gouda.