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IT APPLICATIONS IN POLISH CONSTRUCTION SECTOR

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ABSTRACT

The paper presents a review of problems of usefulness of IT solutions on offer in construction sector. Universal development trends in IT are compared with conditions and capabilities of construction market in Poland. Shortcomings of proposed IT solutions for construction industry, as well as conditions for IT implementation are presented. Relationships between prosperity in construction market and usage of new planning methods, decision making, and IT systems are not very optimistic. The reasons for such a state of things have been indicated. Competition in the market does not result in increased demand for IT tools. Current problems experienced by builders and real estate developers have been indicated. The discussion of those problems may be addressed to potential IT suppliers. The phenomenon of saturation of construction sector with IT tools has been highlighted.

KEYWORDS

Evolution of IT, saturation in the IT tools, construction management

1. INTRODUCTION

Polish construction sector is, in principle, influenced by four factors. Factor **S** is a general tendency towards knowledge based economy. Factor **W** is IT equipment development, development of methods, including decision making methods; a new way of functioning of a business. Factor **E** encapsulates technical and economic conditions; good economic climate in construction sector; fast growth of profitability of the sector; and even the philosophy

underlying company management. Factor **N**, the **REALITY**, it is situated on the borderline of all conditions, equipment capabilities, as well as psychological barriers (i.e., in new IT methods implementation).

A review of the basic factors, **E** and **W**, in the context of IT development and implementation is the subject of this paper. Construction Management is the context of the discussion.

2. CHANGES IN APPROACH TO INFORMATION TECHNOLOGY

Deeper and quite sudden interest in IT has resulted from changes in manner of decision making and production planning. Fig. 1 presents those changes: what is clear is a tendency to replace intuition with research [1]. This is undoubtedly fostered by the development of IT tools. The universal trend is marked as (d). The situation in EU before 1990, and in 2005 is presented in (a), whereas the situation in Poland before 1999 and in 2005 is marked as (b) and (c).

What is characteristic is the evolution of IT tools in construction project management (Fig. 2). The dominating identification covers the area from identification of promotion state to object identification. The right side of the graph presents respective techniques: from statistical analysis to radio frequency identification. Constant and dynamic development of those techniques can be observed – see Fig. 3 [2].

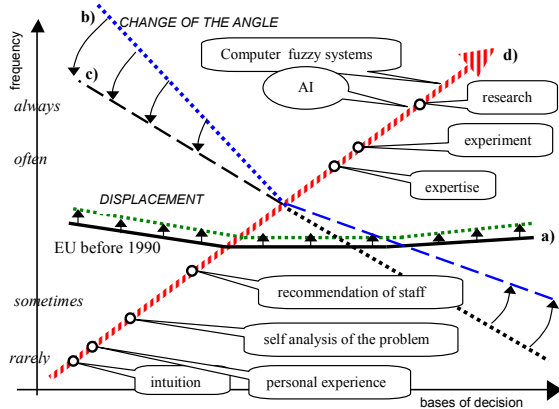


Figure 1. Change in foundations of decision making in companies

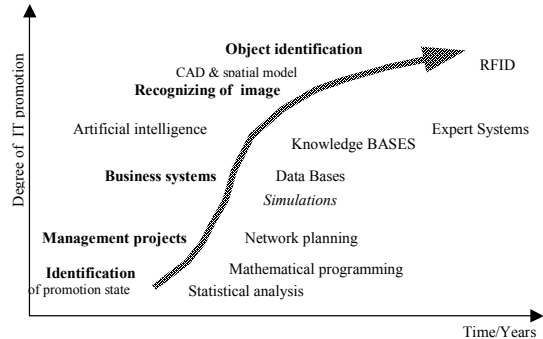


Figure 2. Evolution of IT tools in construction project management

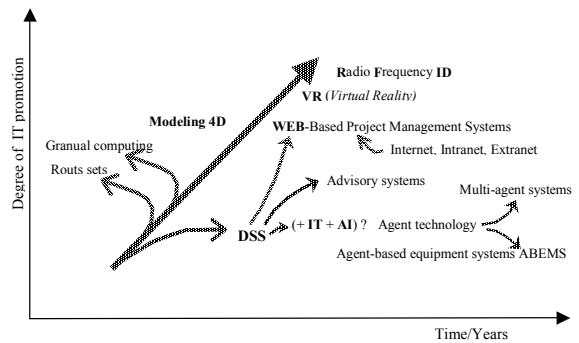


Figure 3. Evolution of IT tools: an example of DSS transformation

3. DIVERSIFICATION AND VARIETY OF IT SOFTWARE

Due to a specific situation (growth in profitability) and relatively low level of investment in the area of management systems, Polish construction companies may be an ideal market for IT companies. The character of activity (construction services) makes project management a dominating issue. Companies generally look for such project management systems which would be integrated with financial management, human resources, stock management and machinery maintenance. All companies create timetables but, unfortunately, they use different systems. What dominates here is the package called **MS Project**. Source data on materials, availability of workforce and machinery is introduced using a

variety of applications (for example, **Oracle**, **Lotus Notes/Domino**), by hand, or with considerable delay.

ERP (Enterprise Resource Planning) has recently been the best known IT offer for construction industry [3, 4, 5]. Unfortunately, it usually is a standard package which does not take specific character of construction industry into consideration. This is why, there are more and more IT companies in Poland who have been making modifications focused on construction industry. Some of them create modules supporting solely building companies. The following tendencies can be observed: management of the building site on-line, which makes it possible to acquire information from the Internet (for example, tender announcements, supplier price lists) and **WORKFLOW**, supposedly based on processes. It is known from experience that an ERP package must be equipped with cost estimation tools. What Microsoft offers seems to create quite a mess in the Polish construction market. **MS Office System 2007** (with **MS Project** and **EPM** – [Enterprise Project Management family] project management elements, **Unified Communications** solutions for communication) is a modified proposal [6]. Additional internal **Windows Sharepoint Services** website makes building site status reporting more precise. This is foreign software, nonetheless, capable of supporting an order portfolio. Some Microsoft Office mutations have also appeared. The best graphic solutions are offered by **Microsoft Office Enterprise 2007** package which is based on the following applications;

- Microsoft Office Professional Plus 2007,
- Microsoft Office Groove 2007,
- Microsoft Office OneNote 2007.

The package offers to users the availability of information regardless of the fact that they may be using their computers on-line or off-line. Notably, industrial companies are major clients for such applications.

There exists software assisting communications, namely **Microsoft Office Communication 2007**. On the other hand, **Microsoft Unified**

Communications enables effective communication between an individual and an organisation

Some interesting Polish solution of integrated management have already appeared, for example: **ERP-Impuls 5** (written by BPSC), and **Microsoft Dynamics AX** (formerly **Axapta**), [7]. The latter is an **ERP II** class IT system, i.e., a merger of **ERP** and **e-Biznes**.

Software for construction companies is individually written and tailored. This is how **Xpertis Developer** (created by Macrologic) was created, including a number of modules, also a communications management module [3]. This software is addressed to real estate developers and general contractors.

An example of efficient adjustment of an integrated **SAP** type (SAP Global Hosting Partner) IT system to the construction sector is an offer of a company called *intelligence*. This software, called **it.construction**, is addressed to the industrial construction sector (see [8]). It is particularly useful at the offer presentation stage. It takes into account the following: changes, for example in material and service prices, currencies; sub-contractor cost valuations. The companies which took interest in **it.construction** have been using it to search for new offers, and comparing them to historical data.

Valuation and cost-quotation software is another major group of applications. They use a wide range of interactive price databases. Traditional spreadsheets are replaced with interactive applications which facilitate simultaneous work of team members on the same spreadsheet. Users indicate that such applications make sense if they help in timetabling and monitoring the process of erecting a building. Athenasoft proposes to integrate **Norma Pro** cost quotation development software with **Capital**, a construction company management system (see [9]). **Capital** system uses the **XML** standard, and co-operates with **MS Project** network planning packages, as well as **Planista**, a Polish application. The integration is based on uploading information on resources (labour costs, materials, equipment) gathered in the estimate to the **Capital** system, and processed in the timetable. A four stage model of implementation of a construction work contract embraces the following: procuring an offer,

preparing production, construction work as such, accounting stage.

There is an abundance of software used to make cost estimates. Apart from **Norma Pro** mentioned above, there are other software packages: **Edbud, Expert, Forte, Kobra, Leonardo, Norma 3, Norma Standard, Rodos, Seko, Skobud, Strix, Sykal Winbud, Zuzia**. They use the following pricing databases: **Sekocenbud, Orgbud-Serwis, Bistyp, PZU**, and **Intercenbud** databases (on CDs and on-line), [10]. Apart from those mentioned above, there are software packages which will write cost estimates in **ath** and **XML (ath2)** formats, which is especially important when cost estimates are transferred to investors - public investors in particular - who often do not have any cost estimate software at all. It also fosters data exchange between building companies (basing their work on different software) in electronic form. The **XML** format facilitates storage, publishing, and exchange of data between users. This format is supported by major software producers. Moreover, the software which produces cost estimates in keeping with foreign documentation, for example in the **FIDIC** or **PRINCE2** standards [11], or based on German standards, is more competitive, for instance: **DBD-Bauteile, STBL-Bau, DBD-Baupreise** [10].

It is worth mentioning that 20% of construction companies use their own databases of labour consumption and prices. The remaining 80% use averaged databases (for instance, **KNR**).

As it is clear from own experience, IT products in the Polish market satisfy 80% of needs in electrical and machinery sector; barely 2% of the construction sector; while the remaining 18% can be allocated to other sectors.

The best software saturated branch of the construction sector is the branch of building materials production and distribution [4, 12, 13]. It has surpassed the bridge branch, i.e., generally speaking, the area of bridge management [14]. Further down the line there are industrial construction and real estate companies.

The building material branch is slowly turning away from **SCM** (Supply Chain Management). For

instance, **Polskie Składy Budowlane** (Polish Construction Warehouses) have based the recent version of their system (distribution network) on **Microsoft SQL Server** [12]. This step was caused by growing competition from international networks, such as **Castorama** and **Leroy Merlin**. Mostostal implemented **Business Intelligence** [13]. A number of companies have set up their own **EDI** (Electronic Data Interchange). This branch will probably be first to introduce an **RFID** system.

In construction sector, following a number of experiences, there is a belief that:

- there is an irrevocable demand for a thorough analysis before IT software is bought,
- a supplier ought to be chosen who can offer a tailored application package, not a ready made system; the system should be created to meet the needs of the company. It must analyse crucial data, for example cost of labour, cost of materials, etc., and be able to compare them with the scheduled budget,
- the system to be implemented must have open architecture, as in the future it is supposed to enable extension and guarantee openness to co-operation with application packages from other IT suppliers,
- complete hardware and network infrastructure should be secured.

4. PROSPERITY IN CONSTRUCTION INDUSTRY AND IT SOLUTIONS

The profitability trend in construction sector has been evident since 2002. In the years of stagnation, building companies rarely invested in IT systems. A specific paradox can be observed, namely that favourable market conditions in the sector and rapid development of construction companies makes IT solutions implementation more difficult, especially **ERP** class systems. It can be explained by the fact that the choice between distant benefits (which an IT system may bring in the future) and a short term profit resulting from the number of projects which are worked on is difficult. In Poland at the moment, it is the builder who dictates conditions in the market (see: [2, 4, 5, 13, 15]).

The degree of utilisation of techniques and methods (mentioned in Fig. 1 and Fig. 2) under discussion in

Polish enterprises is insufficient. Their usage before 1990 has been compared to 2005 [2]. The interest in mathematical programming decreased. Similarly to digital simulation. The said degree, regarding expert systems stayed at its level. There has been an increase of: scheduling 4D (modelling space + time), WEB-based project management systems and RFID.

The research on the degree of software utilisation (mainly: planning methods, decision making techniques are illustrated in Fig. 1 and Fig. 2) has been made basing on two surveys (in 2000 and in 2005), interviews in the Wielkopolska Building Chamber, and data obtained at BUDMA, an annual construction fair (International Trade Fair in Poznań). In January 2008, an “IT island” has been created at the fair, with IT systems proposals [6].

With such results in mind, the author has checked the relationship between the degree of usage of the above mentioned methods and techniques and their type, size (see Fig. 4), and properties of a building enterprise. Regression and correlation calculation methods have been used. Unfortunately, R^2 coefficient was nearly equal to zero in all cases. The lack of such a relationship proves scarce utilisation of construction management (CM) tools. It may be the result of limited usage of research results, and excessively refined questions, as well as a result of companies’ reluctance or aversion to such confessions which may violate secrecy, obligatory in a competitive market.

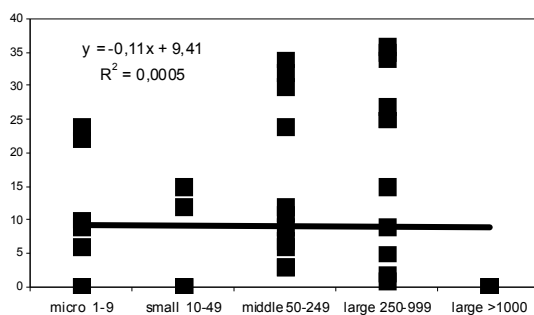


Figure 4. Relationship between the degree of IT usage and size of a building companies

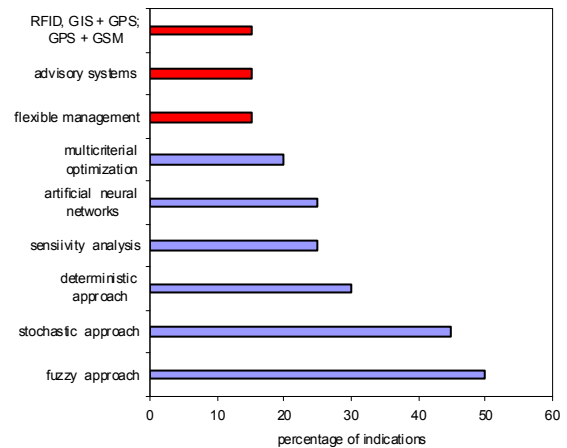


Figure 5. Recommendations by academic teachers and research institutes

Further research has made it clear that there is a discrepancy in the assessment of “attractiveness” of recommended or used methods between academics and businessmen (see Fig. 5 and Fig. 6). The academics found fuzzy and stochastic approaches most attractive. After 2005, such issues as flexible management, advisory systems appeared, as well as a range of problems with GIS, GPS, and GSM.

Building managers have high hopes not only about RFID, but also about GIS working together with GPS navigation system supported by GSM. This merger can bring about an interesting effect regarding monitoring and controlling production in construction industry, for example with respect to sequencing deliveries, site of construction, and precision of assembly.

On the other hand, planning departments find the following most attractive: scheduling & network methods; risk analysis; cost analysis programmes. After 2005, there has been more demand for ERP, communication, as well as information and documentation transfer (see Fig. 6).

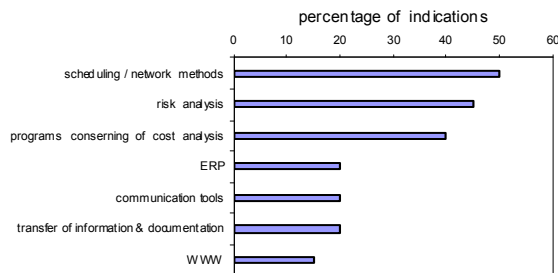


Figure 6. Present requirements from IT tools by Polish building companies

The following are currently experienced problems: human resources management (including head hunting for professionals and skilled craftsmen); PPP; cash flow. What it means is that there is more demand for software packages focusing on budgeting, risk management, time and cost contingency, ways of financing investment.

5. THE PHENOMENON OF SATURATION WITH IT SOLUTIONS

Various methods flourish in various periods of time, followed by periods of stabilisation or stagnation. The major criterion of their assessment is usefulness. The following course of events can be observed: it so happens that some methods become extinct. It confirms the author's earlier thesis that "pure" methods – for practical reasons – lose to combined and hybrid methods. **DSS** (Decision Support System) – c.f. Fig. 3 – is a good example of such an evolution. **DSS** methods initiated other methods, such as: WEB-management systems, advisory systems, as well as agent technology (see [2]).

Parallel to the development or extinction of IT methods and techniques, a phenomenon of saturation with IT solutions can be observed. Those methods and software will not be available to all potential users. What it means is that there will never be a full (i.e., 100 per cent) saturation with a given product, for example with a specific software package, and so on. This situation is presented in Fig. 7. There is, hypothetically, a saturation limit. The point is that it would be better to "move" those lines more to the

right in order to "take over" the area in the middle. The existence of the area towards the far right also results from inertia (in acquiring new tools); the barriers mentioned above (resulting from the possibility of achieving profitability without investing in IT); as well as the time threshold (new methods appear, old solutions have to go). IT suppliers should investigate this phenomenon in depth.

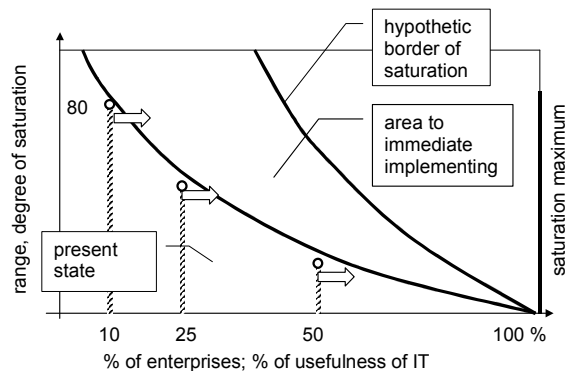


Figure 7. Hypothetical saturation with IT tools

6. CONCLUSIONS

- What follows from the review of IT methods and software in construction sector is that the development of those tools is dynamic, though not all solutions account for specific character of the construction industry.
- Expenditure and investment in IT tools in construction sector is insufficient.
- The market for IT suppliers is huge. Nonetheless, IT suppliers (and designers), in order to satisfy their ambitions, should take into account the phenomenon of saturation with IT products.
- The period of prosperity for building companies who chose not to use IT on the regular basis is coming to an end.

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