

HUMAN RESISTANCE TO THE USE OF INFORMATION TECHNOLOGY IN CONSTRUCTION COMPANIES

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ABSTRACT

The process of implementing information technology (IT) often fails to bring the intended result because the human dimension is not given adequate consideration. Yet despite some evidence of failure, little has been written on the nature of human performance, compared to abundant resources about technical and procedural aspects, as it applies to the ideals of the IT philosophy. To combat people's deficiencies, this paper focuses mainly on the question why people resist IT. It explores sources of human resistance to the use of IT. A survey is conducted to personnel working for construction companies to examine the resistance sources. The result reveals personal money, habit, and threat to information security as most dominant sources for such resistance, instead of fear of employment instability as many previous researches have discussed. The paper discusses the resistances and suggests possible solutions to deal with them.

Keywords: human resistance, construction, information technology.

INTRODUCTION

Nowadays the role of information technology (IT) cannot be separated from every business organization. In the construction industry it is believed that the use of IT will contribute to improved performance and reduced cost by, for examples, reliably tracking and managing construction materials, documents, payrolls, invoicing, costing, and scheduling [1]. Further, the applications may improve operational efficiency, improve and innovate functions, or restructure business processes [2]. In short, information technology with all its capabilities promise a big potential for construction companies to gain competitive advantage in the market [3,4].

For the purpose of this paper, the term information technology encompasses three categories of IT capabilities as defined by Ahmad et al. [5]. They are: (1) communications (such as voice mail/e-mail/fax, electronic network and multimedia), (2) data accessibility (such as shared database, Electronic Data Interchange, bar code and 3-D graphics), and (3) common systems (such as knowledge-based systems, decision support systems and groupware).

Despite its promising advantages, the application of formal computerized information system for planning and controlling construction site operation,

especially in developing countries, has been progressing slowly or ineffectively [6,7]. The reason for the ineffectiveness is due to the lack of fundamental understanding of the principles of information management [8].

Navon et al. [9] and Yeo [2] argue that the success or failure of the information systems implementations will depend on numerous technological and human factors, but it tends that construction organizations pay less attention to the latter. Drawing on experiences from others [10,11,12]. Navon et al. describe that human resistance does impede the success of new technologies implementation and is expected to be more in the construction industry, which is well known for its unique characteristics [13] and conservatism [14].

Resistance may show up in many phases; it can be in the early planning of the IT development, once implementation begins and even when the new system in use [15]. To find the reasons for such resistance, Paulson [15] suggests that it is necessary to understand the basic human nature and social behavior. Though the paper by Navon et al. [9] has summarized the sources and the causes of resistance to the introduction of automation, it does not indicate which factor(s) are indeed critical to construction organizations. This paper thus aims to identify the most dominant sources of human resistance perceived by personnel working in construction companies (contractors).

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This paper first describes the process of change due to the introduction of information technology in an organization. It then explores the general categories of resistance from organizational behavior and management as well as construction literature. The results of a survey conducted to medium and big-sized construction companies are reported next. Finally, the paper discusses and addresses strategies to deal with the factors.

INTRODUCTION OF INFORMATION TECHNOLOGY AS A CHANGE

Danielson (in [16]) defines information technology as “knowledge and methods and the technology tied to information handling.” Since most information technologies today cannot be separated from the use of computers, it can be defined as any computer-based tool that is utilized by people to deal with information and supports and processes information needed by the organization [17].

According to Steers and Black [18] and Robbins [19], change in an organization can be approached through modification of its certain elements. There are at least four options: changing technology (encompassing modifications in the way is processed and in the methods and equipment used), changing structure (making an alteration in authority relations, coordination mechanisms, job redesign, or similar structural variables), changing physical setting (altering the space and layout arrangements in the workplace) and changing people (changing in employee attitudes, skills, expectations, perceptions, and/or behavior). Therefore, introducing new or modifying existing IT systems is facilitating change, which usually yields impact to the other elements in an organization [20].

For the change to be successful, one key aspect is to redesign many of the organization functions and processes so that people will exchange and use information generated by the systems as a natural part of their workplace [17]. Ahmad et al. [5] suggest that there is a profound need for uniformity of procedures and standardization of data to enable this in a construction organization. However, changing the working and the information cultures and expecting people to simply share information are not easy. Haag et al. [17] say that it is easier to develop an advanced and complex IT system rather than to change the way people think about their work processes and share information naturally. It requires altering the basic behaviors, attitudes, values, management expectations and incentives that relate to the information [21]. Yet, as Davenport argues, in most organizations, “many managers still believe that once the right technology is in

place, the appropriate information-sharing behavior will inevitably follow”. People who felt threatened by IT for a variety of reasons will show resistance, which is capable of hampering adaptation and progress of it. The next section explores the sources of human resistance.

HUMAN RESISTANCE TO CHANGE

Formally defined, resistance to change is any attitude or behavior that reflects a person’s unwillingness to make or support a desired change. Managers should not only see the resistance as something that must be overcome for change to be successful. It is more helpful to view resistance to change as feedback that can be used to help accomplish the change objectives. The essence of this notion is to recognize that when people resist change they are defending something important that appears threatened by the change.

Basically, there are two sources of resistance, i.e. individual and organizational sources [18]. In the real world however the sources often overlap [19]. The first column of Table 1 lists several reasons why individual may resist change as summarized from [9,15,19,22,23,24,25,26,27].

Though the list is not exhaustive, it represents essential resistance sources applicable to the introduction of IT. It was initially expected that fear of employment and economic securities would be the most common sources of resistance in construction organizations, as many papers have discussed [9,15,28]. This paper will investigate it empirically through a survey study, which will be explained in the following.

RESEARCH METHOD

Results of this research were based on a questionnaire survey. The questionnaire contained closed and open types questions and was structured into three major parts. The first part asked general information about the respondents, the second focused on the resistance sources, and the last comprised some points that might help increase user readiness for IT implementation. To examine the resistance, twenty-four questions were prepared. The questions asked the respondents’ agreement about the resistance sources using rating scales from *Strongly Agree* (1) to *Strongly Disagree* (5), in which the lower the score the more resistant the respondent toward the source will be. Totally, 205 sets of questionnaire were distributed to 24 construction companies in Surabaya, and 60 (29.3%) were returned.

GENERAL INFORMATION

For the purpose of analysis, the respondents were classified into home-office and on-field personnel. The home-office personnel were then divided into top and mid-level managements, whereas the former included the directors and president.

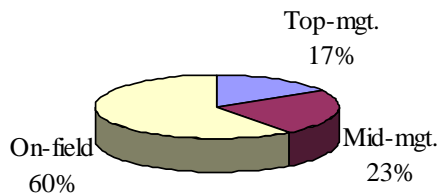


Figure 1. Percentages of Respondents Based on Their Position

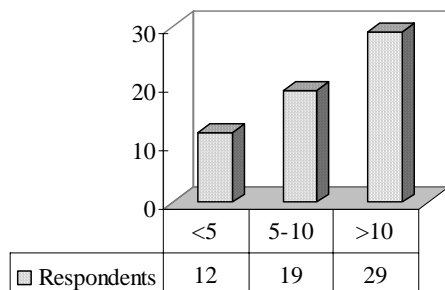


Figure 2. Number of Respondents Based on Their Working Experience

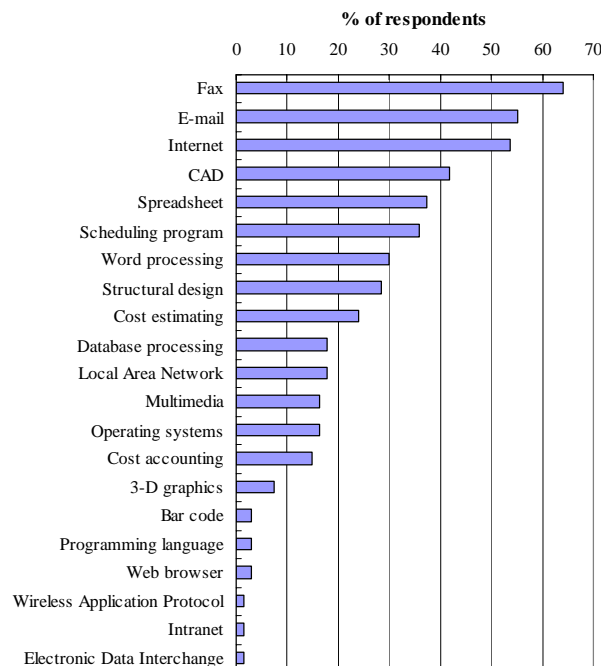


Figure 3. Percentages of Respondents Using Selected Information Technologies

Figure 1 denotes the compositions of respondents

participating in the study, where almost 80% of them held a bachelor degree in civil engineering. Meanwhile, personnel with more than 10 years working experience dominated the proportion (about 48%) of the respondents as can be noticed from Figure 2.

Among the general questions, one section was asking the respondents of types of information technologies they commonly used in the companies. Figure 3 depicts the respondents' respond. The high rate utilizations (by more than 50% of respondents) were found in IT for general communication purposes, such as fax and e-mail. On the other hand, the use of IT supports for project management purposes-scheduling and cost estimating programs-were still limited.

ANALYSIS OF RESISTANCE SOURCES

Table 1 presents the mean scores and ranks of twenty-four sources of resistance perceived by different groups of respondents. In general, the respondents did not show any significant resistance as indicated by the minimum mean score of 2.70. Through open discussion, most respondents expressed that they would welcome new IT systems in their company and would commit to the implementation. In addition, the rankings of the resistance sources as perceived by different groups of respondents have some agreement. This is shown in Table 2, where the null hypotheses (H_0), i.e. there are no significant differences in the perception of respondents from different positions (top-management, mid-management and on-field personnel) regarding their perception of the resistance sources, are accepted at $\alpha = 1\%$. It can be concluded that there is general agreement between the respondents' perception, regardless of their different position in a company.

The order of resistance sources, which were sorted by their total mean score, generated some interesting findings. First, fear of employment instability and economic factors did not appear as expected. The two factors are ranked very low in the list. This indicates that the respondents did not see the IT as a threat to their job or salary. As told by many respondents, one reason was that the IT was intended to help increase their work performance, but was not necessary to reduce the number of staffs. Further, they argued that their practical experience was much more important than IT, and there was no way that IT could substitute for their position or reduce their salary. Considering the argument, the researchers then hypothesized that the position and working expe-

rience of the respondents might influence their perceptions toward the two factors. Table 3 portrays *P*-values of one-way ANOVA statistical tests performed. It shows that only one test was statistically significant at $\alpha = 5\%$, in which respondents with more experience in the construction industry exhibited less fear of employment instability for the introduction of IT.

Table 1. Mean Scores and Ranks of Resistance Sources by Different Groups

Resistance Sources	Top-Mgt.		Mid-Mgt.		On-Field		Total	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Reluctant to use personal money for training	3,10	1	2,43	1	2,69	1	2,70	1
Disruption to others' existing habits	3,30	3	2,93	3	2,78	2	2,90	2
Threat to information security	3,20	2	2,79	2	2,89	3	2,92	3
Disruption to friendships and familiar relationships	3,70	7	3,57	12	3,22	4	3,38	4
Disruption to privacy	3,40	4	3,21	6	3,64	12	3,50	5
Reluctant to spend extra time for training	4,00	10	3,57	11	3,47	6	3,58	6
Felling overloaded with current work	4,00	9	3,21	5	3,64	11	3,60	7
Fear of unknown changes or uncertainty	4,10	12	3,71	15	3,44	5	3,62	8
Threat to group' goals and objectives	4,20	17	3,29	8	3,58	9	3,62	9
Having different perceptions of the situation	3,70	6	3,64	14	3,61	10	3,63	10
Having no self-confidence to handle new requirements	4,20	13	3,50	10	3,53	7	3,63	11
Doubt to top management capability of handling the change	4,00	11	3,64	13	3,56	8	3,65	12
Disruption to personal habits	3,90	8	3,29	7	3,78	14	3,68	13
Difficulty to adapt to new community	4,40	24	3,14	4	3,86	16	3,78	14
Lack of understanding the reason for change	4,20	14	3,43	9	3,81	15	3,78	15
Cannot see the benefit of the change	4,20	15	3,79	17	3,89	17	3,92	16
Reluctant to give extra energy for training	4,20	16	3,86	18	3,89	18	3,93	17
Lack of trust to top management	3,60	5	4,00	20	4,03	19	3,95	18
Having no atmosphere of openness	4,30	18	4,29	24	3,75	13	3,97	19
Threat to position	4,40	22	3,79	16	4,14	20	4,10	20
Threat to authority and power	4,40	23	4,00	19	4,17	21	4,17	21
Fear of employment instability	4,40	19	4,14	21	4,22	22	4,23	22
Loss of face/feeling humiliated	4,40	20	4,29	23	4,31	23	4,32	23
Fear of economic factors: pay, bonuses	4,40	21	4,21	22	4,36	24	4,33	24

The highest ranked resistance in Table 1, as agreed by all respondents, is unwillingness of using personal money for training. Whilst the respondents seem to be confident in handling new requirement (as this resistance ranked low in the table), many of them acknowledged that they had just little/no

familiarity with IT (computer) systems. A training program is thus deemed indispensable if they are expected to actively be involved during the implementation. In order to anticipate the resistance, it appears that the company should provide special funding to support such a costly training program. But as said, the respondents were uncertain for this to happen. This point will be detailed later.

Table 2. Test of Agreement on Ranking of Resistance Sources as Perceived by Different Groups

Respondents position	<i>R</i> s	<i>P</i> -value	Significance	Reject <i>H</i> ₀
Top and Mid	0.58	0.003	Sig.<0.01	No
Top and On-field	0.72	0.000	Sig.<0.01	No
Mid and On-field	0.70	0.000	Sig.<0.01	No

Note: *R*s = Spearman's rank correlation coefficient

Table 3. ANOVA Test for Respondents' Position and Years of Experience

Resistance	<i>P</i> -values	
	Position	Experience
Fear of employment instability	0.679	0.045 ^a
Fear of economic factors: pay, bonuses	0.960	0.334

^a Significant at $\alpha = 5\%$

Habits of others (superiors or subordinates) were ranked second by on-field personnel and third by top- and mid-management personnel. This is not surprising. As many other researches have pointed out, it is difficult to expect construction personnel to easily leave the old way to do their work. They may have felt so overloaded by the current work that could not have time to spend extra time to learn the new way of work required by the IT systems. Note that these related resistances are ranked high in the list too. The researcher argues that this habit of resistance basically mirrors the respondents' personal habit, which is ranked lower in the list.

The surprising result is the presence of information security as an important source of resistance (ranked 3rd) felt by the total respondents. Differences were not significantly found, at 95% confidence interval, in the respondents' perceptions observed from either their position (*P*-value = 0.823) or their experience (*P*-value = 0.066). This resistance is closely related to another similar resistance, i.e. loss of personal privacy, which is also ranked high (the 5th).

In explaining, the respondents were very concerned about important or personal data/information from being stolen or destroyed by others, especially when they had to use common computers in the working

place or when the IT systems permitted information access from the company’s mainframe. The researchers, however, could not obtain any real examples of the problems from the respondents surveyed. This was because almost none of the companies had employed such a system. Drawing experience from other industries thus may be helpful to gain understanding about the resistance. The following paragraph captures such a story.

As an effort to increase its performance and to obtain an ISO 9000 certification, a leading paper-manufacturing company just recently implemented an integrated information system under the supervision of its MIS department. Worried about the security of important information, one of the company executives, who narrated the story, always kept important data in removable disks instead of in computer hard disk. The reason was that the initial design of the system allowed anyone to access other computers without limit, and worse, some people in the company, who had an unhealthy competition to advance in their career, used this circumstance to steal others’ work or ideas. The researcher considers that the latter problem, i.e. fear of information thieves, provokes construction personnel’s resistance in using an integrated information system.

USER READINESS AND GENERAL OBSTACLES TO THE USE OF INFORMATION TECHNOLOGIES

Fifty-seven respondents (95%) stated that a training program would be very important for them to be ready for IT implementation, and as aforementioned, the role of top management was expected to fully support and fund the program. The next important point is participation and user involvement during planning. It is considered to be particularly valuable to deal with the problems involving information security. Here, the prospective users may help decide which information is restricted for public access. Other necessary points are listed in Table 4.

Table 4. Some Points that can Increase User Readiness

Points	Number of respondents	Percentage
Training program	57	95.0
Top management support	50	83.3
User involvement during planning	30	50.0
Prior discussion of the change	18	30.0
Others	3	16.7

When asked whether in the near future the companies would enhance their IT use, about half of

the respondents were unsure. The most important reason is, as expected, the funding problem. This result is similar to that of a previous survey conducted under the subject of productivity improvement in the Indonesian construction industry [29]. Though Indonesian contractors fully supported the introduction of new improvement techniques (including the IT systems), they felt unwilling to contribute funds for the implementation, especially during the current economic condition where the construction business is in a gloomy period.

SUMMARY AND CONCLUSIONS

Information technology and its capabilities have received attention in the construction industry and its usage is expected to grow in the near future. To help guarantee its successful implementation, it is crucial for managers to take both technological and human issues into account. The paper found that the wide use of IT tools in construction companies was still limited to general communication purposes, such as fax, e-mail and internet, whereas less than 50% of the respondents have utilized IT’s capabilities for project management and construction, such as CAD, scheduling and estimating software.

In general, the respondents did not show significant resistance to the introduction of IT. The interesting point is the rank of the resistance sources. Instead of fear of employment instability, as many construction papers have discussed, the highest ranked of resistance was found on unwillingness to use personal money for training. This was followed by habits and information security as the most important sources of resistance.

It appears that, among other things, a common thread underlying all of the sources for resistance is the cost for change. The top management is required to provide special funding not only for developing IT but also for training the intended users. This may combat the first resistance and equip the potential users with the required IT skills, but will not be easy to fulfill in the current condition.

The paradigm of “old habit is hard to change” seems to be very relevant to the introduction of IT. To respond to this resistance, considering the culture in this country, the researcher argues that an evolutionary approach will be more appropriate to introduce the change than a revolutionary one. Through the evolutionary approach, a gradual process is expected to lessen the chance for failure, because it is not too offensive and thus may increase more openness and readiness of the Indonesian construction personnel. A supportive and patient supervision can often overcome the resistance.

In developing an IT based information system, the analyst should pay attention to the information security of the users. Involvement of and prior discussion with the prospective users are thus critical during the feasibility study and planning processes. These may reduce the personnel fear of their important information being stolen by others.

While this paper has highlighted important sources for human resistance to IT, it is believed that the process of understanding the resistance in reality is not the ease. Resistance may occur overtly and immediately, in which management can then decide on appropriate tactics to deal with it. The greater challenge, however, remains on managing those implicit or deferred resistances. Robbins [19] notes that implicit resistance efforts (such as loss of loyalty to the organization, loss of motivation to work, increased errors or mistakes, increased absenteeism due to “sickness”) are more subtle and difficult to recognize, whilst deferred actions may cloud the link between the source of the resistance and the reaction to it. It may need weeks, months, or even years later for the resistance to surface.

Given the cultural and social aspects of this nation, managers are likely to face the latter challenge. In general, Indonesian people tend not to directly or explicitly say no (especially to their superior), even though they have a disagreement toward something. It is because they either do not want to hurt or humiliate others or are afraid of being punished by their superior. Future researches can investigate it in detail by observing actual implementation of IT.

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