ORGANIZATIONAL FACTORS INFLUENCING CONSTRUCTION MANPOWER PRODUCTIVITY IN TURKEY

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This research reports an investigation of organizational factors affecting labour productivity in the Turkish construction industry. In this survey, it is aimed that these organizational factors are formed and evaluated thoroughly. To this aim, numerical values reflecting respondents' ideas were obtained by a questionnaire applied to managers, engineers, and architects of 82 large scale construction firms with one-to-one technique. The results were calculated by the relative importance index method. The survey results showed that site management, material management, and systematic flow of work were ranked as the three most effective organizational factors on labour productivity.

Keywords: labour, organizational factors, productivity, Turkey.

INTRODUCTION

Construction sector has a strategic role in all of the developed and developing countries. Employing more than 7% of Europe's workforce, the sector is the largest industrial employer in the continent (Proverbs *et al.* 1999a). Similar to Europe, construction industry accounts about 14% of the gross national product and 8% of total employment in the US (Thieblot 2002). In Turkey, labour intensive production is still in use in the construction sector. Therefore, construction process results in relatively high costs, and labour becomes a more important input in the production stage. Labour cost, in general, is somewhere between 15 and 25% of the total project cost, and reduction of these costs can be best realized by the productivity improvement.

Many factors have potential to affect labour productivity such as physical, economic, socio-psychological, etc. Organizational factors are one of them, and these are nearly ignored in construction to date when the labour productivity issue is the point in question. Any study investigating organizational factors in terms of manpower productivity is not available in the construction management literature. Some authors such as Kaming *et al.* (1997) and Zakeri *et al.* (1997) investigated various factors affecting labour productivity without any classification. In the survey of Rojas and Aramvareekul (2003) which is the unique exception in this regard, very limited factors were briefly examined although differently classified. Accordingly, it is aimed in this survey that organizational factors influencing construction worker productivity are

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determined, defined, and evaluated in detail. In this way, it will be possible to create plainer and more intelligible criteria for these factors in terms of producing various solutions to productivity-based problems. In addition, different individuals have different experiences and therefore different opinions about similar occurrences or situations. It means that there is a lack of common reference point in establishing these factors, and this study is a suggestion in this regard. As a conclusion, the current level of construction workforce productivity in Turkey will be revealed from the organizational viewpoint.

SURVEY METHODOLOGY

To obtain the data required for the study, a questionnaire comprised of 16 detailed questions was first prepared (Ulubeyli 2004). Then, Turkish Employers' Association of Construction Industries (TEACI) and Turkish Contractors Association (TCA) were contacted. The member firms of these associations execute approximately 70% of the total investments made in Turkey, and have also undertaken 90% of the work done abroad in the field of construction. 187 construction firms to be interviewed are totally available in the two associations. The questionnaire was applied to managers, engineers, architects, and other technical staff of the firms by the face-to-face interview technique in order to assure the validity and reliability of the survey. Only 10 firms that could not be contacted were interviewed by e-mail. The telephone interviews explaining the content of this study were conducted with the general directors of 187 firms, and it is positively responded by 82 of them (43.85%). The remaining ones refused the survey request with various reasons. Nevertheless, this relatively high approval rate can conveniently represent the sampling whole.

Two statistical methods were used to analyze the data provided by the questionnaire. The first was to acquire percentage values through frequencies of the answers received. The other was to calculate a Relative Importance Index (RII). For this purpose, a rating scale of 1 to 5 was adopted with 1 representing the lowest level of effect and 5 representing the highest level of effect. The RII was evaluated using the following expression (1):

$$RII = \frac{\sum_{i=1}^{5} W_i X_i}{\sum_{i=1}^{5} X_i}, \quad (1 \le RII \le 5), \qquad \textbf{(1)}$$

W_i, is the rating given to each factor by the respondents ranging from 1 to 5, with 1 representing 'not significant' and 5 representing 'extremely significant'; X_i, is the percentage of respondents scoring; and '*i*', is the order number of respondents. The numerical values calculated by the above formula were then differently classified because a single point or number changing from 1 to 5 in questions no longer symbolizes each verbal scaling expression in the evaluation phase. These five expressions are defined by the intervals of 0.8 as the following,

1.00 ≤ not significant (NS) ≤ 1.80

1.80 < somewhat significant (SS) ≤ 2.60

2.60 < significant (S) ≤ 3.40

3.40 < very significant (VS) ≤ 4.20

4.20 < extremely significant (ES) ≤ 5.00

In addition to calculating the relative index scale, the percentages of respondents scoring 2 or fewer, 3, and 4 or more, on the significance scale were also evaluated for each of the factors. These were used to rank the factors in which relative importance indices were the same.

RESULTS

In this survey, ten organizational factors were examined: site management, material management, systematic flow of work, supervision, site layout, occupational education and training, crew size and efficiency, firm reputation, camping conditions, and relaxation allowances. These are clarified in descending order in the text below. Statistical results of the relative importance index method can be seen in Table 1.

Table 1: Relative importance index results

Rank	Organizational factors	RII	Effect level	Percentage of respondents scoring		
				≥ 4	3	≤ 2
1	Site management	4.53	ES	96.20	3.80	0.00
2	Material management	4.50	ES	96.16	3.85	0.00
3	Systematic flow of work	4.40	ES	89.61	9.09	1.30
4	Supervision	4.20	VS	88.15	10.53	1.32
5	Site layout	4.18	VS	83.12	12.99	3.90
6	Occupational education and training	4.06	VS	79.22	19.48	1.30
7	Crew size and efficiency	3.92	VS	72.73	23.38	3.90
8	Firm reputation	3.87	VS	71.79	17.95	10.26
9	Camping conditions	3.74	VS	62.82	29.49	7.69
10	Relaxation allowances	3.15	S	34.67	44.00	21.34
	Average	4.06	VS			

The survey results showed that ‘site management’, ‘material management’, and ‘systematic flow of work’ were ranked by the participants as the three most effective factors with the ‘extremely significant’ effect while the ‘relaxation allowances’ factor was determined as the least predominant factor with the index of 3.15, indicating a ‘significant’ impact. The other six factors have ‘very significant’ impacts upon efficiency. The mean index of the ten factors was evaluated as 4.06. This level of effect indicates that worker productivity is ‘very significantly’ affected by organizational factors in the industry.

DISCUSSION

Site management

Improving productivity could be best carried out by means of development in management quality. It means that the principle difference in construction productivity is the management influence. Stages of estimating construction time and cost reliably, where the knowledge of labour productivity takes a considerable part, are the main items of successful management understanding. Four primary ways of increasing worker productivity through management can be cited as planning, resource supply and control, supply of information and feedback, and selection of the right people to control certain functions. The planning topic will be examined in the systematic work flow issue in detail. The second way of rising productivity is to procure and control equipment and materials. Lack of available resources has a significant degrading effect on labour performance. Under inadequate working facilities, no employer can expect that labour satisfactorily work. Even highly

motivated and skilled operators working with poor conditions will not continue to produce quality work.

Another means of increasing productivity is the supply of information. In the construction industry, a strong relationship between labour and contractor can not be set up due to temporary employment. To attain high project performance, however, it has a great importance to get a worker-manager relationship based on mutual trust and respect. For this objective, a flexible management style and a simple organizational structure should be established in construction. Central management, lack of confidence in employees, and formalities are the obstacles to this type of management. On the other hand, conflict is predictably preponderant in industries such as construction with its proliferation of human relationships, and it is impossible to keep motivation high continually. In such cases, the role of foremen, who constitute communication between construction workers and managers, becomes more important. There is no doubt that some sorts of communication in which hesitation and pressure exist are not beneficial in this regard. Especially in developing countries such as Turkey, if the low education level of construction operatives, who come from patriarchal regions of the society, is considered, they will be very pleased with the verbal and behavioural appreciation and recognition of their contributions and efforts on the project. To this aim, the management staff in site should act appropriate to the social and cultural structures of workers. However, it does not mean that hierarchy will not be preserved. In this point, it is inevitable to consider that labour may misuse the sincere interest.

The last choice that can be applied to get productivity boom is the selection of the right people. Particularly in international bids, it is paid attention to the qualification of management personnel rather than labour. Some senior engineers in this study have claimed that labour is highly critical of the inspection personnel and questions their competency. Upper management should therefore clearly determine task definitions of lower management personnel such as site engineers. Otherwise, these staff will be demotivated, and more importantly, not want to take any responsibility in a work environment where dictated instructions are dominant, authorities are maximally limited, and any motivation tool is not used for them.

Material management

Effective material management practices can be determined as taking measures against fluctuations in material prices, informing vendors precisely concerning the desired material features, and suitable material planning and organization. However, problems with adverse material management conditions that consist of supplying and shipping are among major causes of productivity loss. For instance, when an adequate supply of materials is not available, workers try to not exhaust their current stockpile of supplies, so they may slow down their pace in anticipation of a delivery, resulting in idle times and cost overruns. The other potential problems are the following,

- running out of materials,
- extensive multiple-handling of materials,
- improperly marked materials, which makes to define them difficult,
- damaged materials that exceed acceptable specification tolerances, or production errors pointing poor quality out,
- unsystematic flow of materials, and

- production rates of materials in plant incongruous with those in site.

In addition to these factors, distributing materials to the desired places when they are needed becomes too harder if the project, e.g. a high rise building, is located in a densely populated urban area. This type of sites possesses more traffic and on-site transportation difficulties owing to the storing problem, where materials may not be ready to use just in time even if supplied. Short planning and design change durations leaving management with little time to order the necessary materials are the other common problems encountered in the procurement process.

Systematic flow of work (planning)

It is almost axiomatic of construction management that a project may be regarded as successful if the building is completed on time, within budget, to the specified quality standards and overall client satisfaction. Poor planning can adversely affect labour productivity through the need for rework and can result in lost time for workers. Most workers take considerable pride in the work they have accomplished that can be seen from the very start of construction through completion. For workers to go back again and take apart what has been completed can be extremely frustrating and can cause them to put forth less effort for the remainder of the work.

Resource levelling is of paramount importance in planning. Labour inefficiencies occur when both larger and smaller amounts of work than estimated or planned are made available. In this context, changes in the number of labour during project should follow a gradual move since rapid changes can cause organizational mistakes and make adaptation process difficult among workforce and management staff.

Construction labour efficiency is also affected by deviations from the normal flow of work, and can be estimated by analyzing how the work flow deviates from which has been planned. Government possesses a share of about 50% of the construction investments made in Turkey (SIS 2005), and most of the construction companies are dependent on these investments. However, the sector has been in a stagnant period since last 5 or 6 years, and payment claims are neither regular nor on time. In such a business and economic environment, it is not possible that firms evaluate labour productivity in a robust manner, as emphasized by many of the participants. For example, a member of board of directors in a firm which specializes in hydraulic structures has notified that 94 dam constructions in Turkey do not continue owing to lack of appropriation. Moreover, a planning engineer in this survey has quantified that the difference between the real and estimated time-cost data of public projects they undertook usually stayed at the levels of approximately 1% in developed countries such as Belgium while it went up to about 20% in Turkey.

Supervision

Labour-only subcontracting makes some aspects of site management more difficult. The supervision level of labour-only gangs tends to be lower than that of directly employed workers, and the general contractor has little control, at best, over subcontractors' workforces. The lump poses the problem of which lump workers can not be controlled whereas firms possessing employed workforce have their own effect on labour relations.

The number of site engineers whose primary function is to supervise, changes in proportion to site area, quantity of workers to be inspected, and other project characteristics. Proverbs *et al.* (1999a) proved that the UK contractors deploy on average 1 supervisor for every 6 workers, the French 1 supervisor for every 8 workers,

and German firms 1 supervisor for every 10 workers. It is a fact that workers feel embarrassed and pressed with the existence of tight audits. Multiple tiers of field supervision reduce overall crew efficiency. On the contrary, a smaller span of control has been shown to foster worker interference (Thomas *et al.* 1990) and to impair construction productivity (Horner and Talhouni 1990). On the other hand, piece-work or task basis supervision can be the norm. In the present survey, it was revealed that 59.76% of the participants control their labour uninterruptedly (see Figure 1). To control workers periodically by making them aware of the existence of inspectors rather than to wait close to them without leaving is indeed the most favourable method of supervision, as was specified by 30.49% of the respondents. Meanwhile, 9.76% of the companies nearly ignore control mechanism and supervise workforce at random.

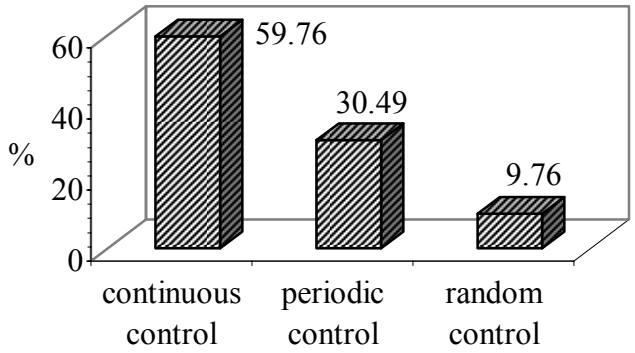

Figure 1: Types of worker supervision

Site layout

Layout can influence productivity and enhance space management capability. It defines the location of facilities, the tools and supporting utilities for optimum product flow, and thus, has a direct impact on the activities' time and cost of construction. In this context, the location of worker dormitories has a strategic importance in site especially where there are many shifts.

Occupational education and training

Vocational education in developing countries is the total of activities which enable the reasonable employment of unskilled labour by directing them to vacant fields of labour market to regulate and control those who come from farming and do not have any continuous working habit. Lack of occupational education in construction is a reality in many of the countries around the world. For instance, there is currently a lack of formal training in construction in the US – the lowest of any major sector of the economy (CPWR 1997). According to Allmon *et al.* (2000), this lack of job training is due to the increased percentage of non-union work. In the same way, an educational problem created by migrant labour coming from abroad does exist in Germany where to be trained as a qualified worker one must first complete at least a three year training course and then take a professional association examination (Syben 1998). On the other hand, construction workers in Turkey are composed of uneducated individuals in general. In a business environment where little educated people are employed as a craftsman, workers are mostly educated only by the apprentice-craftsman relationship on-site, but this type of relation which is in fact essential under ideal conditions becomes meaningless since craftsmen are also uneducated. Shortage of foremen who are intermediate employees as both top-level workers and first-level managers is the other problem concerning occupational education in Turkey, as stated by the respondents. The most sensible way of finding a

permanent solution to these problems may be occasional short training programs or day release courses and seminars in educational establishments. However, whether construction companies undertake the financial loan of their current labour is a big question mark because the work force in construction is generally highly mobile. Contractors are often reticent to invest capital to train those who may soon be someone else's employees, which may result in a decrease in the construction workforce's average capability level. The answer in this phase is that governments should accept all of the educational expenses incurred by the firms in proportion to their scales and financial structures as an input in improving productivity, and in this way, as a tax deduction on money spent for training.

The relationship between labour productivity and training measure in a profession does not possess a regular increasing trend, and the inclination is fixed at a certain value called maximum productivity. That is, the impact of formal training on productivity alleviates exponentially as training continued until its optimum level. The training that will be given after this point can not contribute towards productivity.

Crew size and efficiency

Construction tasks do not happen in isolation, but always as parts of an ongoing process. It is quite indispensable to coordinate workers and crews with the others to finish projects successfully. Robust cooperation, interaction, and communication both inside and between gangs are the functions of competent management system. In this regard, a labour-only subcontract may lead to more cohesive teamwork, in which the sanctions for poor work are much greater than those against a directly employed worker.

Construction is arguably a largely collectivist activity, and the industry's well-known assertion is that it is a team-spirit based industry. Otherwise, project team actually becomes a group rather than a true team. Work teams need to interact effectively with other teams in completing the project successfully without interfering with each others' work. As site management and coordination of subcontractors evolves, engineering of the construction phase improves. Moreover, crew interfacing becomes much smoother as experience and mutual trust are built up especially at the last periods of the project. In a similar manner, if workmates or sub-contractors work together for a long time, the number of errors will be minimized. Dynamics in a crew contribute towards labour productivity positively, and offer better worker performance by self-control mechanism rather than management control. The main agent behind this suggestion is the feeling of workmates, stressing responsibility to contractor as a member of this small group rather than an individual. Furthermore, the crew concept gives workers the right to choose their workmates. The other issue that should be examined is to optimize the crew size. Noyce and Hanna (1998) suggested that utilizing smaller gang forms was one of the methods appealed with the aim of preventing labour productivity from diminishing when schedule was compressed. According to Thomas *et al.* (2002), using larger gangs, however, can achieve further simplification of work.

Firm reputation

Labour first takes the advantages of working in a reliable construction firm into account. The basic ones of these conditions are enumerated below,

- physical conditions: accommodation, nourishment, safety, and health,
- economic conditions: amount of pay, on-time payment, and social insurance,

- social conditions: social activity opportunities and holidays,
- testimonial: a rising chance of getting new jobs, and
- training conditions: an opportunity for learning recent developments about the trade thanks to original projects.

Camping conditions

Accommodation and nourishment conditions are among the factors that have to be primarily considered by management. Some of the respondents have admitted that they could not adequately fulfil even these basic human requirements in some projects. There is no doubt that the productivity level obtained while workers live in own houses with their families will be higher than while staying at dormitories in site. To select workers from native residents, if possible, has a great advantage that the people and local authorities strongly support the construction because of creating employment. In addition, it is more convenient to solve the food matter with a refectory. Payments for food are also a method applied in the sector, but it is an unknown if workers spend the whole payments to be nourished as is due. A construction worker requires taking on average 3000 calories a day, and thus, the menu in site refectory should be arranged by relevant experts according to this limitation.

Relaxation allowances

Recess is composed of two components, i.e. lunchtime and non-midday breaks. In this factor, breaks except lunchtime are considered because of that midday intervals are also in the status of lunch interludes. Namely, the direct intention of relaxation is much more limited in lunchtime breaks than non-midday allowances. Proverbs and Holt (2000) found that labour relaxation did not have any statistically significant effect on project duration while Horner and Talhouni (1995), on the contrary, demonstrated that longer construction times were unexpectedly associated with shorter relaxation allowances. In addition, significant differences in the lengths of break times and daily working times of contractors from Germany, France, and the UK were determined by Proverbs *et al.* (1999b).

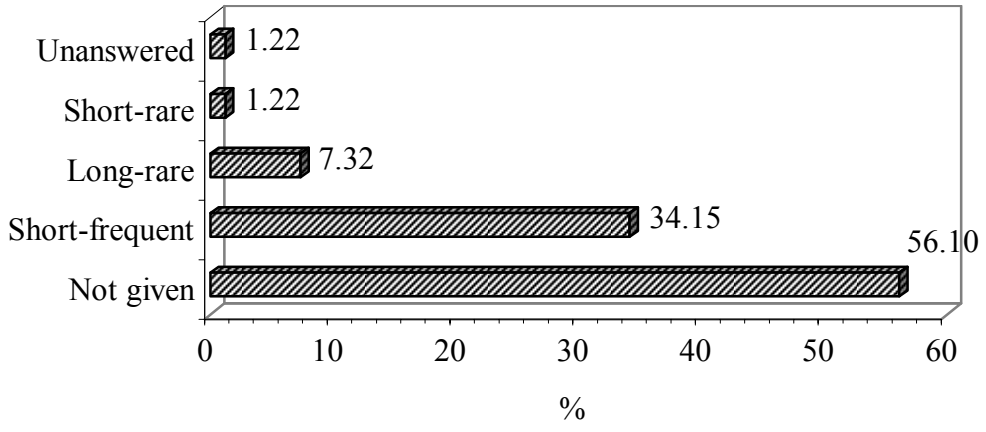

Figure 2: Break types

Frequency and style of interludes are a very considerable part of this subject. In the present study, a great portion (56.10%) of the firms never gives this kind of a break (see Figure 2). The general reason of the situation pointed out by the respondents is that this sort of allowances has an adverse effect on workers. However, even if no

break except lunchtime is given, workers themselves have some breaks. Otherwise, workers' productivity will undoubtedly be lowered due to long working periods. There are two kinds of the allowance strategy. One of them is to leave the breaks to worker's own initiative to keep the performance stable. The other is to give formal allowances with the volition of managers according to the conditions of current tasks at that moment. The first alternative has superiority since workers absolutely know more about their own tiredness, but also it is possible to be misused this tolerance. In the second alternative, there is no chance of having arbitrary breaks as may occur in the first alternative, and the most suitable moments of the work are waited for the rest. On the other hand, it is never paid attention to the time workers get tired. Too long allowances produce some troubles in scheduling while too short breaks can not remove the feeling of tiredness. Meanwhile, short and frequent rests better eliminate the feeling of fatigue than long and rare rests. 34.15% of the participants agree with this thought while 7.32% of them do not. Short and rare rests also indicate a small value (1.22%) due to their weak effect on removing tiredness.

CONCLUSIONS

With the present research, organizational factors affecting construction labour productivity was formed and evaluated by taking the sectoral conditions of a developing economy into consideration. The detailed explanations concerning the factors can be accepted both as a step that may cause further studies for academicians and as a different viewpoint for industry practitioners. Although all of the factors determined here should be examined extensively, the survey results revealed that the participants ranked the followings as the three most effective organizational factors on labour performance,

- site management,
- material management, and
- systematic flow of work.

As a managerial perspective, it was found that worker productivity is on an average 'very significantly' affected by organizational factors in Turkey. This finding indicates an unexpected pattern of developing countries since each of the factors investigated here is an indicator of management understanding. Thus, it is evident that the importance of organizational quality required to obtain high construction productivity is very well comprehended by the professionals in the industry.

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