Scheduling Decisions and their Dynamic Consequences on Construction Performance

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Abstract

Construction practitioners often experience unexpected results of their scheduling-related decisions. This is mainly due to lack of understanding of the dynamic nature of construction system. However, very little attention has been given to its significant importance and few empirical studies have been undertaken on this issue. This paper, therefore, analyzes the effect of aggressive scheduling, overtime, resource adding, and schedule slippage on construction performance, focusing on workers' reactions to those scheduling decisions. Survey data from 102 construction practitioners in 38 construction sites are used for the analysis. The results indicate that efforts to increase work rate by working overtime, resource adding, and aggressive scheduling can be offset due to losses in productivity and quality. Based on the research findings, practical guidelines are then discussed to help site managers to effectively deal with the dynamics of scheduling and improve construction performance.

Keywords: Construction sites, Dynamics, Productivity, Resources, Scheduling

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INTRODUCTION

Parkinson's Law on 'Schedule Expansion'—work expands to fill the time available for its completion—can be also applied to construction scheduling. When project schedule is loose (that is, the time available to complete an activity is perceived to be more than what is normally required), workers tend to have low level of arousal, which in turn reduces labor productivity (Roberts and Alfred 1974; Wickens and Hollands 2000). The pertinent question then is: can aggressive scheduling enhance productivity? The answer is that it may or may not. When the time available is far shorter than what is reasonably required, productivity can also suffer (Cooper 1994; Horner and Talhouni 1995; Thomas and Raynar 1997; Eden et al. 2000). Despite this potential risk, when schedule is delayed, site managers tend to schedule the remaining activities aggressively with over-optimism (Neil 1989; Hopp and Spearman 1996).

This kind of tradeoff also exists in other scheduling-related decisions such as whether to increase resources, use overtime, or let the schedule slip. However, construction practitioners lack understanding of tradeoffs associated with their decisions. Productivity and quality are often sacrificed for the sake of schedule and actual schedule benefits are hardly achieved (Ballard and Howell 1998). Since construction is labor-intensive, inefficiency in construction scheduling can cause significant losses to a company, client, and the industry as a whole. Hence, it is imperative to identify inefficient practices arising from scheduling-related decisions and address them properly. However, little attention has been given to their significant importance and few empirical studies have been undertaken.

In an effort to address this issue, this paper analyzes the effect of aggressive scheduling, overtime, resource adding, and schedule slippage on construction performance, focusing on workers' reactions to those scheduling decisions. To do this, survey data from 102 construction practitioners in 38 construction sites in Singapore were used. The analysis results suggest that efforts to increase work rate by working overtime, resource adding, and aggressive scheduling can be offset due to losses in productivity and quality. Based on the research findings, policy implications are drawn and practical guidelines are suggested to help site managers to effectively deal with the dynamics of scheduling and improve construction performance.

RESEARCH FRAMEWORK

The dynamics of scheduling-related decisions as represented with the causal loop diagram in Fig.1 can be used as a framework for this research. The premise of the framework is: a site manager makes various scheduling-related decisions in order to complete activities by a given deadline. As a result, several direct or indirect consequences, as shown, can be apparent.

<<Insert Fig. 1 about here>>

The arrows in the diagram indicate the direction of causality, while the signs on arrowheads ('+' or '-') indicate the polarity of relationships. A '+' sign indicates that the increase (decrease) in one variable causes a corresponding increase (decrease) in the dependent variable; and a '-' sign indicates that the increase (decrease) in independent variable causes a corresponding decrease (increase) in the dependent variable (Sterman 2000).

The causal loop diagram systematically maps the effects and consequences of scheduling-related decisions. Consider that construction is now delayed and construction activity schedule cannot be simply extended due to time constraints. Some of the possible actions would be to accelerate the project by managerial actions such as aggressively scheduling the activities, working overtime, and adding resources. In a certain case, letting the schedule slip would be inevitable. The dynamic effects of each measure are briefly analyzed below.

Effects of Overtime

In order to face a schedule delay, one of the most common steps that site managers undertake is to schedule work overtime. While occasional overtime as an emergency measure to address an immediate problem or opportunity can have a moderate positive effect on productivity, scheduled and prolonged overtime working can adversely affect construction performance (Hanna and Heale 1994; Horner and Talhouni 1995). Overtime can certainly increase work rate by increasing physical work hours, but it can also have negative effects on productivity and quality. Possible reasons for the latter include disruptions in work (Thomas and Raynar 1997), overtime-induced fatigue, and subsequent increases in error rate (Cooper 1994; Thomas and Raynar 1997; Pena-Mora and Park 2001).

Effects of Resource Adding

Another common strategy in dealing with schedule delay is accelerating work by adding more resources (limited to human resources in this paper), thereby completing more work within the remaining period. However, it is a well-known fact that work rate does not increase in proportion to the corresponding resource added. This is especially true, when the resources have been

already utilized at the optimum capacity. In addition, contractors often fail to provide sufficient resources (e.g., materials, equipment, and information) in a timely manner, when they are required by construction crews (Thomas et al. 2002). Moreover, adding new staff to supplement the existing ones (especially by short-term hiring) can cause job bumping, dilution of the average experience, and the learning curve effect, leading to loss of productivity (Cass 1992; Eden et al. 2000; Piper and Vachon 2001).

Aggressive Scheduling

Aggressive scheduling may be also exercised in order to meet the deadline. A requirement to complete certain activities by the given deadline acts as a stressor for site managers and workers, thus introducing changes in workers' perception about the work and behaviors on site. When workers perceive that the available time is insufficient but the imposition of the time limit is obligatory, they feel pressured (Bronner 1982). The perceived schedule pressure intensifies as the required time increasingly exceeds the available time (Rastegary and Landy 1991). As discussed, schedule pressure has both merits and demerits. For instance, appropriate schedule pressure can increase work rate, while too much pressure can be detrimental to productivity (Rastegary and Landy 1991; Eden et al. 2000).

Previous studies show that the relationship between schedule pressure and productivity is not linear, but curvilinear. That is, it is best represented by a curvilinear model in which, the optimum level of performance is obtained at an intermediate level of pressure (Wickens and Hollands 2000; Bertrand and Van Ooijen 2002). The relationship is explained through using physiological measures of arousal (low and high) mediated by activities such as adaptation,

perseveration, attentional or memory difficulties (Wickens and Hollands 2000). The construction workers' behaviors such as cutting corners, losing incentive to finish the work on time, doing out-of-sequence work, and increasing work defects can be thought of as examples of adaptation, perseveration, and attentional difficulty respectively. As a result of these mediating variables, expected performance is hardly achieved.

Schedule Slippage

Schedule slippage is allowable in some circumstances. First, site managers may decide to let the schedule slip when there are constraints pertaining to the availability of resources and overtime work. Second, site managers can opt to slip a schedule in the hope of covering it up later or as a result of resource allocation. Regardless of the reasons for schedule slippage, productivity enhancement through the increased schedule pressure can not be expected with this scheduling measure. However, it could be beneficial to the schedule performance if schedule pressure is lowered, thus preventing the possible reduction in productivity and quality disruption that might be caused by aggressive scheduling.

In summary, this section has presented a research framework, which explains the site manager's reactive actions in response to schedule delays and mapped their dynamic effects on project processes into a causal loop diagram. In an effort to empirically analyze the notion as hypothesized in the framework, the next section presents an empirical investigation of survey data.

EMPIRICAL INVESTIGATIONS

Data Collection

We used survey questionnaires as a means of collecting data to analyze dynamics of scheduling, as explained in the research framework. The use of survey questionnaires allowed us to obtain a large number of samples. Also, the survey enabled us many qualitative attributes in the framework to be assessed subjectively.

We identified a list of 38 construction projects in Singapore through our vigilance, networking, and personal contacts. We visited all of the identified project sites and hand-delivered the survey questionnaires to 194 construction practitioners that included site/project managers, site/project engineers, project coordinators, and site supervisors representing the general contractor, subcontractors, or trades. In the questionnaire we did not ask respondents for any personal information, such as their sex, age, or experience/background, and maintained the respondents' anonymity. We sought additional research-related information and comments by providing open-ended questions in the questionnaire and also through face-to-face discussion during our site visits. Altogether, 102 practitioners, with representatives from all 38 projects, responded to our survey. Table 1 summarizes the profiles of the surveyed projects and the distribution of the responses.

<<Insert Table 1 about here>>

Definition of Common Terminologies

On each survey form distributed to the respondents, definition of some common terms was provided so as to establish a common basis for the research. We used perceived schedule pressure by the respondents as a proxy for workload. As explained in Table 2, schedule pressure

was categorized into four types – low, normal, high and very high. The respondents were asked to choose the one that best described their work. Establishing a common basis for our research required that we define a number of other variables. The "work rate" is analogous to the production rate; it determines the speed or pace at which work is being performed. Thus, we defined the work rate as the ratio between output and time. We defined "productivity" as the ratio between the output (number of units installed or quantity of work performed) and the input, i.e., the labor hours used (Halligan et al. 1994). We considered the target work quality to have been achieved if the finished work did not require rework and conformed to the original plans, specifications, code requirements, and the accepted industry standards (Alfeld 1988). The respondents rated these variables—i.e., the work rate, productivity, and quality—on a scale from 1 to 5 (where 1 = "very low" and 5 = "very high").

<<Insert Table 2 about here>>

Perceived Schedule Pressure

Schedule pressure is an indication of workload, which in one way or other, can be related to scheduling decisions and their consequences. Therefore, it is important to identify the perceived level of schedule pressure in study sites. This was measured by asking survey respondents to indicate the level of schedule pressure—low, normal, high, and very high — perceived in their on-going projects. As shown in Table 3, 59.1%, 21.5%, 18.3%, and 1.1% of the respondents perceived 'high', 'very high', 'normal' and 'low' schedule pressure respectively. It indicates that the majority of the project is executed under schedule pressure. Many site managers felt that their job was stressful as they had been given unreasonably short time.

<<Insert Table 3 about here>>

Adoption of Scheduling Strategies

In the research framework we have hypothesized that four scheduling strategies, namely overtime, resource adding, aggressive scheduling or schedule slippage can be exercised by site managers. In this section, this hypothesis is tested. However, adoption of these strategies is likely to increase, as schedule pressure increases (from 'high' to 'very high' in our case). It is therefore worthwhile to delineate the extent to which the strategies are adopted in the construction sites under study. The calculated mean values for each strategy are shown in Fig. 2 where 1 means 'never' and 5 means 'always'.

The survey results suggest that as schedule pressure is increased, there is an increase in overtime, resources, and aggressive scheduling. However, schedule slippage seldom occurs as indicated from the study sites. This is probably due to the fact that site managers would not generally allow the schedule to slip, as they believe this could cause delay in the project schedule and possibly incur high liquidated damages and/or penalties to the party involved in the work.

<<Insert Fig. 2 about here>>

A paired-sample t-test (Norušis 2002) was conducted to evaluate significant difference, if any, in the use of strategies for the corresponding 'high' and 'very high' schedule pressure situations. The results of the paired-sample t-test are tabulated in Table 4. Using the scores under 'high' and 'very high' schedule pressure as the first and second pair respectively, it was found that there is a

significant increase in overtime work, resource adding, and aggressive scheduling when the schedule pressure increases from 'high' to 'very high'. However, no significant change in schedule slippage was observed.

<<Insert Table 4 about here>>

Scheduling Decisions and their Influence on Workers

Having analyzed the site managers' scheduling tendency, we now explore the effects of scheduling decisions, focusing on their influence on the performance and behaviors of workers. The respondents rated the effects of overtime, resource adding, and schedule pressure on a five-point scale, in which 1 and 5 refer to 'no effect' and 'very high effect' respectively. Only the 'high' and 'very high' schedule pressure cases were used in the analysis for the aforesaid reason.

The one-sample t-test (Norušis 2002) was chosen to investigate whether the hypothesized effects were significant. In so doing, we chose 3.5 as a test value against which the comparison was made. We believed that our criterion would possibly rule out the tendency of the respondents to lean toward a more neutral score (3 in this case). Table 5 shows the results of one-sample t-test along with a descriptive statistics.

<<Insert Table 5 about here>>

Impact of adding resources

The analysis results in Table 5 indicate that adding resources can cause site congestion, quality deterioration, dilution of team's average experience and interference of the existing crews' work. However, as indicated by the non-significant value in Column 7 of Table 5, there was no evidence to suggest that adding resources increases productivity. Previous studies have suggested that adding resources can in fact lead to reduction in the expected productivity level as new workers take time to become acquainted with the project and organizational environments (Eden et al. 2000). In addition, existing crews need to spend time to give instructions to the new workers, thus distracting the former from attaining planned production targets (Cass 1992). Respondents strongly admitted that adding resources could increase work completion rate, but this would be offset by the lowered productivity to some extent.

Majority of the respondents also noted that resource adding could create safety problems and often call for increase in the number of supervisors. It was also mentioned that site congestion pertaining to resource adding has less negative effects on large-scale civil projects compared to building projects that are located in downtown areas. Some respondents pointed that the quality and experience of new workers, the nature of the work along with an availability of equipment, tools or plants also determine the effects of adding resources.

Impact of overtime

The significant negative effects of overtime on workers were also confirmed from the analysis results in Table 5. Our findings lend support to the view that overtime can cause fatigue among workers, produce work disruption, and lower the quality of work. The respondents admitted that working overtime helps site management to meet short-term targets by increasing work rate.

Nevertheless, they revealed that in most cases the product is not satisfactory. Our analysis also confirmed that working overtime can lower quality of work. However, as indicated by the non-significant value in Column 7 of Table 5, there was no evidence to suggest that working overtime increases productivity.

Many respondents expressed the view that that working overtime affected the effectiveness of regular work on subsequent days, as workers would not have had sufficient sleep or rest. As a result, workmanship would not be as expected as they often generated more defects. In addition, there was a consensus among the practitioners that working overtime could trigger a higher number of potential accidents on site. These observations indicate an adverse effect of overtime on site productivity. Vollmann et al. (1997) report that overtime affects productivity indirectly through increased defects and rework, and workplace injuries. Some participants in the current study also noted that working overtime could help boost the morale of workers, when the site management decides to work overtime for immediate 'catch-up' and workers receive additional pay. However, as noted by a few respondents, it was customary for workers to work at a slower work rate in order to obtain more overtime pay.

Impact of schedule pressure

Generally, respondents agreed that schedule pressure to a certain extent could increase productivity, but under 'very high' schedule pressure conditions labor productivity tends to decrease. The significant negative effect of schedule pressure, as indicated by the practitioners, is the increase in out-of-sequence work and defects. As hypothesized in the research framework, the analysis results in Table 5 also confirm that workers try to cut corners to meet deadlines

when they feel high schedule pressure. Admittedly, all these factors contribute to slowing down the construction progress. The practitioners also believed that, in a highly pressured condition, workers tend to lose incentives to complete work on time. This normally happens, when workers feel that the schedule is not attainable by any available means.

We also explored the effect of 'low' schedule pressure on workers' behaviors. The cases for this purpose were however grouped into two, one with 'low' and 'normal' schedule pressure and another with 'high' and 'very high' schedule pressure. This is because the two groups can have different perception regarding the effect as the cases in the first group were not pressured, whereas the cases in the second group were pressured. The one-sample t-test results along with descriptive statistics results for the two groups are presented in Table 6.

<<Insert Table 6 about here>>

The results suggest an agreement between the two groups regarding the effect of low schedule pressure, as indicated by significant and non-significant values for the corresponding variables in Column 7 of Table 6. As evident, the results suggest that 'low' schedule pressure leads to slow work rate, deferral of work, and engagement in unnecessary movements and unproductive activities, each of which hinders on-site productivity. However, contrary to our expectation, there was no evidence to support the hypothesis that low schedule pressure would cause idling among the workers, as indicated by the non-significant value in Table 6. It is possible that workers may engage in lingering the work rather than idling for fear that they would be laid off.

Synthesis of Empirical Results

The results from the empirical investigation can be summarized as follows:

1. The use of overtime, resource adding, and aggressive scheduling are frequently used strategies, the adoption of which, increases for corresponding increase in schedule pressure in construction sites.
2. Majority of construction sites have been observed as working under schedule pressure.
3. While overtime helps to increase work rate by providing more physical hours, it also causes fatigue among workers, work disruptions, and losses in productivity.
4. The positive effect of increase in work rate through resource adding is offset by decrease in productivity and quality deterioration as it can cause site congestion, dilution of average experience of workers, and work interference.
5. Moderate schedule pressure helps to increase workers' effectiveness; high schedule pressure, however, reduces labor productivity by increasing out-of-sequence work, defects, and workers' temptation to cut corners to meet the deadline. Also, workers tend to lose incentives when there is excessive schedule pressure.
6. Workers respond to 'low' schedule pressure by deferring work, working slowly, making unnecessary movement, and engaging in unproductive activities.

IMPLICATIONS FOR SCHEDULING

The survey results provide a deeper understanding of how scheduling-related decisions are implemented on site and in what ways they influence the project and construction workers. In this section, we discuss the practical implications of this research.

Managing Overtime and Resource Adding

Many construction sites work overtime and increase resources to expedite work. This is also apparent from the fact that most construction activities are manual, requiring simple tools to be used in accomplishing them. Also, work culture, industry and labor environment influence overtime and labor practices. For example, in Singapore, foreign construction workers are normally paid on an hourly basis, even for the regular work hours. In this labor structure workers are willing to earn more by working overtime. However, as indicated by the survey results, overtime can cause fatigue of workers, produce work disruption and negatively affect quality of work. Thus it is challenging for the site manager to deliver the products on time and in a cost-effective manner and also to satisfy the expectation of the workers.

In an attempt to address the above paradox, methods such as a goal-setting technique tied to a certain benefit could be established to increase labor productivity. Furthermore, the site manager must consider the existing number of supervisors, site constraints, and other on-site conditions before increasing the number of workers. Skilled and experienced workers can be hired to relieve the regular workers working under intense pressure. In addition, when there is a need to work overtime, management should ensure that it is for a short period of time, and that materials, adequate supervision, and information are readily available up-front. These would ensure that work is done correctly and smoothly from the onset, thus obviating unnecessary rework.

Managing Schedule Pressure

Many managers believe that “if you don’t set the target high enough, workers won’t deliver their best efforts” (Hopp and Spearman 1996); this notion is also common in construction sites. As

indicated from the survey, schedule pressure, to some extent, can increase productivity. This can be attributed to the imposition of external pressure. Crises, dissatisfaction, tension, or significant external stresses usually stimulate people to act (Van de Ven 1986). Also, the motivational effect of goal-setting (e.g., setting specific deadlines) provides directions for people and increases the motivational force to achieve goals (Locke and Latham 1984).

However, as discussed, schedule pressure would invite many negative rippling effects on workers. It is therefore important to set a schedule that is attainable and realistic. Adequate time for various activities would ensure that the specified quality standards are achieved optimally. Owners and developers also need to realize that by setting unrealistic project duration they will not get what they expect. Instead, they will be compromising quality or accepting hidden defects on a product.

Motivating Construction Workers

Motivating workers intrinsically or extrinsically can arguably be an effective means in dealing with working under schedule pressure. Much work has been done on implication of motivation for construction workers (e.g., Maloney and McFillen 1986). Goal-setting, as mentioned above, is one of the strongest extrinsic motivational forces. But care should also be taken while setting goals as previous research has shown that short-term goals are more effective than long-term goals (Hadavi and Krizek 1992). Moreover, in fairness to all workers, cooperation from both site supervisors and workers must be sought. This ensures that people are not penalized for not attaining unrealistic targets. Also, the active participation of site staff and workers in site-related decision-making process can increase work effectiveness. Equal attention should also be given to

the expectation, basic needs, personal values, and the capacity of workers in line with existing managerial and project constraints.

Site Coordination

On-time project completion requires extensive coordination and communication with suppliers, subcontractors, and designers. The construction practitioners in this survey have raised this issue as a key to minimizing the possible negative effects of scheduling-related decisions. A number of site engineers and supervisors working for subcontractors under schedule pressure have criticized the main contractor for failing to provide up-to date detailed information and approval of submittals on time. Many of them also argue that the lack of coordination and design changes affect their normal schedule. Since teamwork, effective coordination and communication are decisive factors in construction (Howes 2000), it is essential for different entities involved in the project to have a win-win attitude rather than an opportunistic behavior. Project manager should always strive to maintain a good working relationship between the main contractor and subcontractors or trades.

Effective Site Planning and Monitoring

Careful consideration should also be given to the overall work schedule and its integration with individual trades. The proper planning of site activities in terms of material availability and inspection, workspace design, site planning and layout, safety auditing, and quality work assignments can eliminate negative effects of scheduling-related decisions. In fact, the time spent on rigorous planning and constant monitoring of site work, while ensuring smooth flow of work, would ultimately increase labor efficiency. This also provides a basis for schedule control.

CONCLUSIONS

Construction practitioners lack the understanding of tradeoffs and the dynamic nature of scheduling-related decisions. As a result, productivity and quality are often sacrificed in a quest to meet deadlines. However, little attention has been given to its significant importance and few empirical researches have been undertaken on this matter. We analyzed this issue by specifically examining the effect of aggressive scheduling, overtime, resource adding, and schedule slippage on construction performance, focusing on workers' reaction to those scheduling decisions. The analysis results identified a speed-accuracy tradeoff, in which strategy of acceleration provides faster but more error-prone performance.

The primary contribution of this research is the insights it provides to site managers on how scheduling-related decisions can induce dynamic effects on construction performance. In particular, the research provides greater understanding into the tradeoffs of scheduling decisions, and thus can assist practitioners in the selection and implementation of appropriate policies. Moreover, the research provides an empirical investigation of the effects of overtime, adding resources, and schedule pressure on construction workers. Further, it provides an examination of influence of scheduling decisions on construction site performance. The additional benefits of the research for practitioners are proper strategies it provides on how they can minimize negative effects of scheduling-related decisions on construction sites. The research findings and insights will be useful for site managers as a step toward improving labor efficiency, on-site productivity and product quality.

Given that the present research is limited to Singapore further research can be carried out in diverse work settings and environment with the view to validating findings. Also, analysis of scheduling dynamics when there is interaction effects of scheduling-related decisions needs further study. The current work can also be extended by investigating the relationship of scheduling decisions and project performance measures. In addition, experimental studies investigating workers' behaviors pertaining to schedule pressure, overtime or resource adding also deserve attention. This research provides a basis for further studies.

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2. Fig. 2: Mean value plots of the scheduling decisions

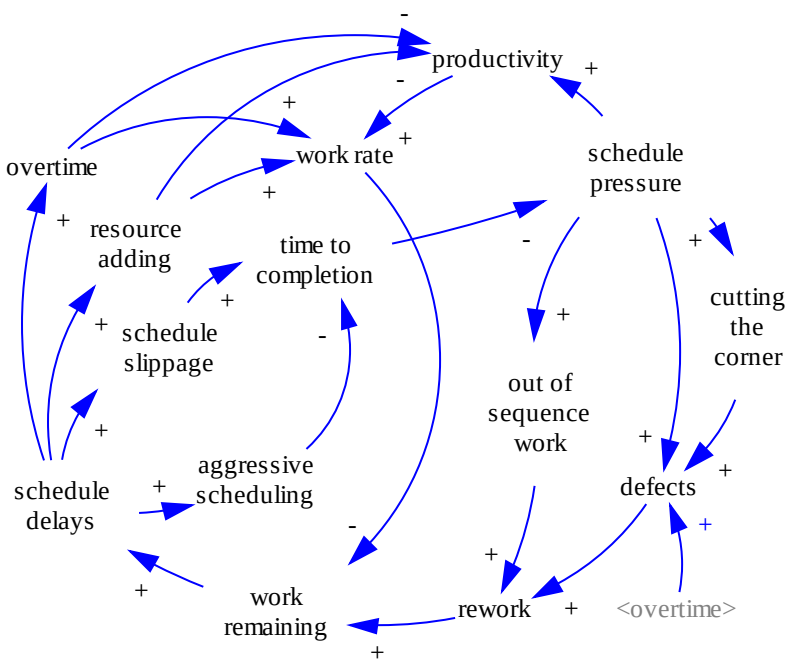

Fig. 1: Dynamics of Scheduling-Related Decisions

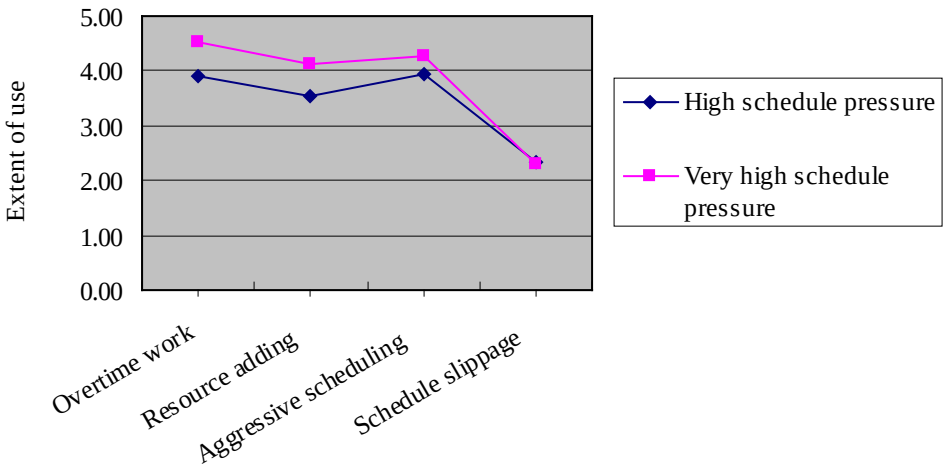

Fig. 2: Mean Value Plots of the Scheduling Decisions

Table 1 Summary of Project Profiles and Survey Responses

Project type	No. of projects	No. of questionnaires delivered	No. of final respondents
(1)	(2)	(3)	(4)
Infrastructure *	12	35	17
Institutional building	6	20	15
Condominium	10	76	31
Commercial/Office building	7	57	36
Industrial	3	6	3
Total	**38**	**194**	**102**

* Includes projects such as roads/highways, mass rapid transit, airports, and depots.

Table 2: Categories of Schedule Pressure

Schedule pressure (1)	Definition (2)
Low	A perceived situation pertaining to the time available to the site staff in completing activities when the project is ahead of the schedule.
Normal	A perceived situation pertaining to the time available by site staff when the project is on schedule.
High	The resulting time pressure when a project is behind a schedule or when management decides to revise the deadline to an earlier date.
Very high	A perceived time pressure by the site staff when the project is very behind schedule or, when the project duration is drastically reduced.

Table 3: Frequency of Perceived Schedule Pressure

Perceived schedule pressure	Frequency	Percent	Valid percent	Cumulative percent	Mean	Standard deviation
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low	1	1.0	1.1	1.1	3.01	0.67
Normal	17	16.7	18.3	19.4		
High	55	53.9	59.1	78.5		
Very high	20	19.6	21.5	100.0		
Total	93	91.2	100.0			
Missing	9	8.8				
Grand Total	102	100.0				

Table 4: Paired Sample t-Test for the Scheduling Strategies

Measures	Paired Differences			t-value	Degrees of freedom	Significance
	Mean	Standard deviation	Standard error of the mean			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overtime	-0.57	0.81	0.10	-5.56	60	0.000
Resource adding	-0.46	0.73	0.09	-4.84	58	0.000
Aggressive scheduling	-0.29	0.62	0.08	-3.59	58	0.001
Schedule slippage	0.02	0.71	0.09	0.18	58	0.855

Table 5: Effects of Schedule Pressure, Overtime, and Resource Adding

Factor	Effects	Mean	Standard deviation	Test Value = 3.5		
				t value	Degrees of freedom	Significance
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Resource adding	Site congestion	2.78	1.09	-5.62	71	0.000
	Quality deterioration	2.89	0.85	-6.11	71	0.000
	Dilution of experience	3.06	0.91	-4.11	70	0.000
	Work interference	3.01	1.11	-3.73	71	0.000
	Increase in productivity	3.39	0.93	-1.02	71	0.313
	Increase in work rate	3.70	0.74	2.30	72	0.025
Overtime	Worker's fatigue	3.87	0.83	3.80	70	0.000
	Work disruptions	3.21	0.90	-2.66	69	0.010
	Lower quality of work	3.19	0.87	-2.93	67	0.005
	Increase in work rate	3.70	0.95	1.82	70	0.074
	Increase in productivity	3.56	0.94	0.51	69	0.614
Schedule pressure (SP)	Productivity increase with moderate SP	3.79	0.74	3.38	72	0.001
	Productivity loss with increased SP	3.10	1.02	-3.34	71	0.001
	Out-of-sequence of work	3.72	0.92	2.04	71	0.045
	Increase in defects	3.89	0.83	3.97	71	0.000
	Cutting the corner	2.81	1.16	-5.09	71	0.000
	Lose incentives	2.85	0.99	-5.55	70	0.000

Table 6: Perceived Effects of Low Schedule Pressure

Group	Effects	Mean	Standard deviation	Test Value = 3.5		
				t value	Degrees of freedom	Significance
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low & normal schedule pressure	Slow work rate	3.00	0.91	-2.34	17	0.032
	Work deferral	2.72	1.02	-3.24	17	0.005
	Unnecessary movement	2.83	0.92	-3.06	17	0.007
	Doing unproductive things	2.61	0.85	-4.44	17	0.000
	Idling	3.33	1.08	-0.65	17	0.523
High & very high schedule pressure	Slow work rate	2.96	1.14	-4.07	72	0.000
	Work deferral	2.79	1.33	-4.51	71	0.000
	Unnecessary movement	2.82	1.13	-5.12	70	0.000
	Doing unproductive things	2.73	1.15	-5.64	70	0.000
	Idling	3.60	1.13	0.73	71	0.469