

Exploratory Study of Obstacles in Safety Culture Development in the Construction Industry: A Grounded Theory Approach

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Abstract: The aim of this paper is to analyse the obstacles that prevent the development of a safety culture in Thailand's large construction industry from various managerial points of view. Qualitative research methods were used by performing a series of semi-structured interviews of eight case studies selected from six prominent construction firms to investigate the obstacles they face. Glaser's keyword coding from Grounded Theory (GT) was used to reduce the information load after the interviews. Our findings revealed that the factors influencing the successful development of a safety culture in the construction industry are the workers, the characteristics of construction, the subcontractors, the supervisors, and external factors. Based on the frequency analysis, the main obstacles in developing a safety culture result from problems related to the workers themselves. The three most frequently discussed problems are unskilled workers, unsafe worker habits, and high worker turnover. Our results also suggest that managers should encourage engagement from their workers to optimise the successful implementation of safety programs and their long-term improvement.

Keywords: Thailand construction industry, Safety culture, Keyword quoting, Grounded Theory, Worker engagement

INTRODUCTION

Among all industries, the construction industry is considered to have one of the highest rates of work-related injuries and deaths. It accounts for the largest number of fatal occupational injuries in many countries, especially in developing countries. In Thailand, the safety statistics

of the construction industry is grim. Table 1 gives the number of deaths and injuries from 2002 to 2005 in the construction industry of Thailand and shows increasing trends in the number of deaths and injuries; more importantly, the construction industry's increasing share of accidents is demonstrated.

Moreover, the accident rate in the construction industry of Thailand is reportedly the highest when compared to other industries (see Table 2), which illustrates the fact that an accident in a construction business is more

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likely to cause a fatal injury to a worker than in any other industry.

Table 1. Number of Deaths and Injuries in the Construction Industry and All Industries Between 2002 and 2005

Year	No. of deaths in the construction industry	No. of injuries in the construction industry	Total deaths and injuries in the construction industry	Total deaths and injuries in all industries	% of construction deaths and injuries
2002	98	12,274	12,372	190,979	6.43
2003	106	14,060	14,166	210,673	6.67
2004	109	17,050	17,159	215,534	7.91
2005	207	18,516	18,723	214,235	8.64

Source: Occupational Safety and Health Bureau of Thailand

From the table above, it is evident that the construction safety situation in Thailand is very poor, judging by the number of accidents that occur on work sites. To eliminate this problem, a strong safety culture is needed (Gillen et al., 2002; Zohar, 1980; Arboleda et al., 2003). Cooper (2000) also emphasised safety culture by declaring that many industries around the world are increasingly interested in the concept of "safety culture" as the means to reduce the potential for large-scale disasters and accidents associated with routine tasks. Moreover, in the United Kingdom, the Health and Safety Commission (HSC) has

suggested that firms can prevent accidents and maintain a good safety record through the development of a "positive safety culture" (Clarke, 2003).

Table 2. Five Most Common Occupational Injuries Classified by Degree of Loss and Type of Industry in Thailand in 2005

Business	Degree of loss in 2005					Fatalities/total injuries (%)
	Deaths	Permanent disability	Loss of an organ	Temporary disability		
				> 3 days	< 3 days	
Construction	207	6	151	3,861	14,291	1.12
Electrical appliances and vehicles	88	1	93	2,595	7,883	0.83
Food and beverages	24	-	156	3,615	7,969	0.20
Metal casting and shaping with a lathe	7	3	188	2,062	8,105	0.07
Manufacture of plastic	6	-	188	2,168	6,816	0.09
Body and device vehicle manufacturing	5	-	187	1,534	6,533	0.08

Source: Occupational Safety and Health Bureau of Thailand

Because the safety culture problems in the Thai construction industry have not been clearly explored, this research decided to use a qualitative method, which is particularly useful when researchers lack a clear idea of

the problems (Cooper and Schindler, 2003). The objective of this study was "to investigate the current obstacles to the development of a safety culture in the construction industry in Thailand."

OBSTACLES IN SAFETY CULTURE DEVELOPMENT

The development of a strong safety culture is difficult to implement in the construction industry due to numerous restrictions:

1. Problems related to unique characteristics of the construction industry: decentralisation, mobility, unskilled labour, and high turnover. Because of decentralisation (the employees are on separate sites and must make their own decisions when facing specific problems) and mobility (employees in the construction industry move between firms, sites, and positions more frequently than in other industries) in the construction industry, safety culture is highly important (Fang et al., 2006). Generally, in Thailand, most labourers migrate from the north and north-eastern regions of the country. Most of them (81.2%) have not undergone formal schooling beyond the age of 15, and therefore can seek only low-skilled, low-paying jobs at home and abroad (Abdul-Aziz, 2001; Damrianant, 2004). Lack of education can be attributed to low income and the relatively lower educational facilities available in rural areas. In essence, they are working in agricultural industries

with the lowest average income in the country (NESDB, 2002). Agricultural industries are seasonally based, so workers move into big cities to work in the construction or manufacturing industry as labourers, mostly as unskilled labourers, and move back to their hometowns during harvesting seasons. This creates many temporary workers and high turnover in the construction industry.

2. Problems related to diversity of safety cultures. Due to decentralisation and mobility in the construction industry, different subcultures will emerge from or form around functional groups, hierarchical levels and corporate roles (Cooper, 2000; Fang et al., 2006). The diversity of safety cultures is due to the absence of a cohesive safety culture (Gadd, 2002). This has been recognised as a factor that contributes to accidents by several researchers (Clarke, 1999; Harvey et al., 1999; Mearns et al., 2001; Gadd, 2002). There are numerous causes of accidents in the construction industry, which include less attachment to co-workers, less commitment to their respective organisations, less communication with co-workers, high absenteeism, high turnover, more conflict, taking more time to reach decisions than homogeneous groups (Swann et al., 2004). Furthermore, increased ambiguity, complexity and confusion in group processes is potentially devastating for team effectiveness (Chevrier, 2003). In addition, work teams do not achieve their safety goals, which detracts from overall organisational

achievement, leads to misunderstandings between groups, and decreased overall safety performance (Suplido, 2006).

3. Problems related to the use of subcontractors. The construction industry has changed due to the influence of an uncertain environment, such as the Asian economic crisis, the international environment, legal and political factors, the labour market, and clients and competitors. Such changes affect every industry, especially the construction industry, which had resulted in the recent business trends toward subcontracting and outsourcing. Some potential impacts of outsourcing on safety are dual commitments, responsibility for training, quantity or quality of training, role ambiguity, loss of corporate memory of health and safety issues, no ownership of problems, diffusion of responsibility, contractor payment and schedule schemes, loss of commitment to training, and externalisation of risks (Horbury and Hope, 1999; Wright et al., 1999).

4. Problems related to supervisors and workers. Supervisors and frontline workers are considered important groups in creating safe work environments because they are closely involved in the construction process. However, there are still many obstacles hindering the successful implementation of a safety culture. OSHA (undated; cited in Roughton and Mercurio, 2002, p. 58) reveals obstacles that were identified by supervisors and employees, as

shown in Table 3. The columns list identified obstacles to a successful safety program that later can become safety culture obstacles.

Table 3. Supervisor- and Frontline Worker-identified Obstacles

Supervisor-identified obstacles	Frontline worker-identified obstacles
Fear of losing my job	Fear and lack of trust
No money for needed changes	Supervisor is not willing to listen and support
Risk in spending money for safety	Communication is one-way (top down)
"What's in it for me?" attitude	Organisation is not aligned on safety; production is number one at the line level
Many employees want change but are afraid to take responsibility for it	Supervisors are not willing to hear problems and receive feedback
No support from upper management	Intimidation tactics
No time or follow-through from top management	People are not willing to take personal responsibility; too easy to shift blame
Make it work or "can do" attitude	Production is number one
Competing priorities - production is number one	Lack of consistency and follow-through, past efforts fade away
Work orders not completed even when signed off	"Them versus us" attitude, win or lose scenario
Overwhelmed with workload	
Turnover too high	
Double standards	
Lack of trust, poor ethics in the organisation	
Lack of open communication and listening	

Source: Roughton and Mercurio (2002)

5. Problems related to communication. Communication is one of the general organisational factors that affect safety cultures. There is a need for frequent and effective communication to avoid misunderstanding and to facilitate teamwork (Wright et al., 1999). However, several factors affect effective communication: a lack of open and honest discussion on safety, a lack of local information and feedback, and insufficient emphasis on the impact of careless behaviour and unsafe acts (Guest et al., 1994).

6. Problems related to reporting. A positive safety culture requires effective reporting from the staff regarding frontline safety issues and problems. Eiff (1999) stated that "One of the foundations of a true safety culture is that it is a reporting culture." However, there are organisational factors that affect incident reporting, such as "The incident was just part of a day's work" (32%). This would suggest that the incidents were not reported because they are accepted as the norm, managers take no notice, and there are concerns about getting someone else in trouble (HSE, 2005).

7. Problems related to a blame culture. The presence of a culture that places blame on an individual following an accident or near miss has clear implications for the other indicators of a positive safety culture. A blame culture inhibits reporting, prevents thorough examination of

incidents, prevents learning, and has a negative effect on staff motivation (HSC, 2001). Whittingham (2004) identified the problems of a blame culture: staff tries to conceal errors, employees feel fearful and may report high stress levels, employees are not recognised or rewarded and thus lack motivation, errors are ignored or hidden, and management decisions tend to be made without consulting employees.

The problems stated are factors typically found in safety culture development in countries worldwide; thus, there is the need to underpin some distinctive obstacles that could be unique to Thailand.

METHODS

To investigate the obstacles to developing safety cultures, qualitative research methods were used by performing a series of semi-structured interviews of eight large-scale projects selected from six construction firms. For inclusion in this study these projects must have: (a) a project value greater than 100 million baht (approx. USD 2.85 million), (b) more than 200 employees, and (c) implemented the 17 safety programs that were identified by Aksorn and Hadikusumo (2008) for implementation in large-scale projects. These programs include: (1) safety policies; (2) safety committees; (3) safety inductions; (4) safety training;

(5) safety inspections; (6) accident investigations; (7) first aid programs; (8) in-house safety rules; (9) safety incentives; (10) control of subcontractors; (11) selection of employees; (12) personal protection programs; (13) emergency preparedness planning; (14) safety related promotions; (15) safety auditing; (16) safety record keeping; and (17) job hazard analysis. Examples of the questions used in the interviews were adopted from Weyman et al., (2005). The questions included: (a) "The phrase safety culture is much talked about, what is your understanding of the term"; and (b) "What are the obstacles that affect the development of safety culture?"

In terms of the targeted respondents, safety managers with at least 10 years of work experience in safety construction were selected, and we carried out in-depth interviews. All interview sessions were tape recorded and summarised in written text for evidence. This paper uses three logical design tests proposed by Yin (2003) to handle these eight case studies. Three sets of the tests are proven to have construct validity (have safety experts review draft case study report), external validity (use replication logic in eight case studies), and reliability (develop a case study database).

DATA ANALYSIS

Grounded Theory (GT) by Glaser, was used to analyse the data. GT investigates actualities in the real world and analyses the data with no preconceived hypothesis (Glaser and Strauss, 1967). This technique consists of searching out the concepts behind the actualities by open coding, axial coding, and selective coding:

- **Open coding:** spotting key points (rather than individual words) and allowing concepts to emerge.
- **Axial coding:** drawing out relationships between open codes for the purpose of developing core codes.
- **Selective coding:** selecting the central or core category and systematically relating it to other categories either directly or indirectly (Allan, 2003).

Consistent with GT analysis, the conclusions from key point coding are summarised in Table 4; axial coding is summarised in Table 5; and selective coding is shown in Figure 1.

Table 4: Key Points and Codes from the Data in Case Studies A to F

ID	Key point	Code
COMPANY A		
Pa1	Company A provides the same standards and rules for workers and their subcontractors. However, subcontractors show less cooperation.	Subcontractor participation
Pa2	They may not understand or they never worked with these standards or rules.	Inexperience of subcontractor
Pa3	Subcontractors work only a few periods of time; sometimes they cannot join in the training, but they frequently rotate new worker positions due to their internally high turnover rate.	Quantity or quality of subcontractor training
Pa4	New workers have no idea about how to do their work safely. Most of them come from agricultural backgrounds.	Unskilled worker
Pa5	Working in agricultural environments may require less attention to safety issues; most workers are likely to behave unsafely and sometimes against the safety rules or regulations.	Worker unsafe habits Worker resistance to safety
Pa6	Safety information board cannot communicate effectively to workers. Many workers cannot understand, while some workers do not care.	Worker communication difficulty
Pa7	Safety culture problems mostly occur between the supervisor and worker levels.	Supervisor safety problem Worker safety problem
Pa8	Bad examples of supervisor always make their workers feel less admiration for safety rules.	Example of supervisor
Pa9	Supervisors ignore all safety liabilities because they have to speed up their own work.	Work speed Supervisor commitment
Pa10	Workers having no accident experience from unsafe behaviours will have less safety awareness.	Worker prior accident experience Worker awareness
Pa11	It is hard to communicate to workers on how to improve their safety culture.	Worker communication difficulty
Pa12	If workers have never had work accidents, then they never realise the importance of safety.	Worker prior accident experience
Pa13	In company A, most workers do not work long; this might be one obstacle impeding the development of a safety culture.	High worker turnover

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Table 4. (continued)

ID	Key point	Code
COMPANY B		
Pa14	Foremen and supervisors possess different safety awareness due to their different levels of education.	Supervisor education
Pb1	In most cases, Thai workers are not concerned about their own safety.	Worker needs
Pb2	Money is the only thing that workers are concerned about.	Worker needs
Pb3	Training can make them perform and cooperate only for a while; finally, they ignore it.	Lack of consistency and follow-through
Pb4	The Thai legislation liaison to labour is not forceful enough; minimum safety requirements can satisfy contractors.	Law enforcement
Pb5	Thai workers come from agricultural sectors; when they stop cultivating, they return to work for construction. Thus, they do not understand the importance of safety.	Unskilled worker Worker perception
Pb6	SME subcontractors do not care about safety, because the owner typically chooses the subcontractor that bids the lowest cost.	Owner commitment
Pb7	Workers have little education so they do not understand the importance of construction safety.	Unskilled worker Worker perception
Pb8	Regularly, engineers and foremen think that safety is not their responsibility.	Supervisor commitment
Pb9	If the company does not vigorously enforce the program and train their workers continuously, then the safety level will drop automatically.	Lack of consistency and follow-through
Pb10	Most construction projects are time-constrained. One worker may have to do multiple jobs at the same time. They reside on the site of construction; the unpleasant surroundings typically make them socio-culturally pressured.	Construction period Work speed Various activities Unskilled worker Work environment Worker stress
Pb11	Sub-subcontractors have lots of problems with safety.	Multilevel subcontracting

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Table 4. (continued)

ID	Key point	Code
Pb12	Some foremen have no idea about safety and do not perceive the benefits of a safety program because they were never involved in an accident.	Prior accident experience of supervisor
Pb13	Workers cannot follow up the safety plans, because their jobs rotate frequently, and the period of work in a project is too short.	Construction period High worker turnover
Pb14	Time frame is a factor that makes the safety program imperfect.	Construction period
Pb15	Engineers and foremen believe that safety officers attempt to monitor their way of working, and sometimes intend to interrupt their work.	Supervisor attitude
Pb16	Engineers and foremen do not participate in activities related to safety matters because they believe that they are not necessary.	Supervisor participation
Pb17	Some workers do not abide by the safety rules because they think that they would slow down their work.	Workers' attitude
Pb18	Some workers are reluctant to wear PPE because they claim they are uncomfortable.	Workers' attitude Friendly equipment technology
Pb19	Engineers and foremen perceive that morning talk and toolbox talk are not important.	Supervisor participation
Pb20	Limited working time makes engineers feel negligent about safety.	Construction period
Pb21	Subcontractors can work only for a few periods of time; thus it is hard to develop safety awareness.	Quantity or quality of subcontractor training
Pb22	Subcontractors employ outside subcontractors who may not be aware of safety rules and protocols.	Multilevel subcontracting
Pb23	There is no budget provided by subcontractors to do activities related to safety.	Subcontractors' commitment

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Table 4. (continued)

ID	Key point	Code
COMPANY C		
Pc1	Workers avoid wearing PPE because they feel uncomfortable.	Workers' attitude Friendly equipment technology
Pc2	Company C has a high turnover rate; this is an obstacle to implementing a long-term safety program.	High turnover
Pc3	Workers come from an agricultural background.	Unskilled workers
Pc4	The perception of danger in the workplace depends on the level of maturity possessed by individual workers. Young workers are likely to show off and do not recognize potential accidents that might occur during their work.	Age of workers Worker awareness
Pc5	Workers cannot predict accidents as the result of their unsafe behaviours.	Worker responsibility
Pc6	Young workers who have no experience are prone to be less aware of dangers in their workplace.	Age of workers Worker awareness
Pc7	Unsafe practices by a group of workers and overlooked by the safety supervisor may cause unsafe practices in another.	Worker imitation
Pc8	Engineers, foremen, and workers all are involved in safety-related problems.	Supervisor problem Worker problem
Pc9	Workers are not acquainted with wearing PPE because they do not see the need.	Worker perception
Pc10	Workers need to be notified about good safety practices all the time.	Worker attention
Pc11	It is hard to develop a sustainable safety culture. As a result of the departures of trained workers, the new hirees need to be retrained about safety.	High worker turnover
Pc12	Even though workers are well trained, they still perform their work based on their previous habits. It is not easy to change their ways.	Worker unsafe habits

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Table 4. (continued)

ID	Key point	Code
Pc13	Workers acquire little knowledge about safety; most of them used to work on small construction projects that have low safety awareness.	Unskilled worker Worker unsafe habits
Pc14	Workers cannot picture accidents without visual examples.	Worker communication difficulty
Pc15	It is difficult to train workers due to their high turnover.	High turnover
Pc16	Working under the pressure of time, lack of sleep and alcohol causes accidents.	Work speed Drinking culture
Pc17	Overtime fee attracts worker to leave their site of construction late.	Worker needs
Pc18	Job completion pressure makes workers overlook safety issues.	Work speed
COMPANY D		
Pd1	Firms encourage safety culture in the workplace. However, when workers are less stimulated, the importance of safety culture is consequently diminished.	Lack of consistency and follow-through
Pd2	Good communication between supervisors and their workers brings a positive attitude towards safety.	Communication difficulty
Pd3	The government does not pay enough attention to safety initiatives, and the budget to support such initiatives is scarce.	Government attention
Pd4	Workers cannot perform safe acts because most of them are inexperienced and lack knowledge.	Unskilled workers
Pd5	The restricted time-frame makes supervisors and their workers pay less attention to safety.	Construction period Supervisor problems Worker problems
COMPANY E		
Pe1	Problems of safety culture occur mostly among workers because they are familiar with unsafe acts and their own habits.	Worker problems Worker unsafe habits

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Table 4. (continued)

ID	Key point	Code
Pe2	Workers feel resistant to changes, and they feel uncomfortable with safety equipment.	Worker unsafe habits
Pe3	Legislation on is not strong enough to enforce contractors to follow all safety standards.	Law enforcement
Pe4	Working skills among Thai workers are poor.	Unskilled workers
Pe5	A high turnover rate strongly affects the expansion of a safety culture. Therefore, it is hard to develop a safety culture if constant training is always required for newcomers.	High turnover
Pe6	Workers have their personal habits of work. These influence the way they work, and in most cases, they overlook the unsafe behaviours without noticing. They seem to believe that long-time work experiences without the occurrence of severe accidents are typical, so they keep working in their own way without any significant changes.	Worker unsafe habits Workers' prior accident experience
Pe7	Differences in education sometimes make communication a difficult issue.	Worker education Worker communication
COMPANY F		
Pf1	Because of a high turnover rate of workers, it is not easy to develop a long-term safety culture and initiatives.	High turnover
Pf2	Individual communication skills are required to make workers understand the importance of safety.	Worker communication difficulty
Pf3	Workers are always known to go by their own habits.	Worker unsafe habits
Pf4	Workers care about money.	Worker needs
Pf5	Safety is viewed as an unnecessary cost for the subcontractor.	Subcontractor commitment
Pf6	Experienced workers who are familiar with unsafe acts are likely to be resistant to change.	Worker unsafe habits

Note: 'P' indicates 'key point,' 'a, b, c, d, e, and f' indicates 'companies,' 'No' indicates 'subsequent interviews'

Source: Research

Table 5. Categories of Concepts Coding from Case Studies A–F

Categories	Explanation	ID
PROBLEMS RELATED TO EXTERNAL FACTORS		
Law enforcement	Labour legislation in Thailand is not strong. It has produced several safety standards levels for contractors and the minimum safety requirement is adequate.	Pb4, Pe3
Friendly equipment technology	PPE equipment is not comfortable for the workers.	Pb18, Pc1
Owner commitment	SME contractors do not care about safety because the owner chooses a contractor with the lowest bid.	Pb6
Government attention	The government does not pay enough attention to safety issues and is unaware of the benefit of providing a budget for safety initiatives.	Pd3
PROBLEMS RELATED TO CONSTRUCTION CHARACTERISTICS		
Work speed	Due to the short construction period and improper planning, work speed can cause problems.	Pa9, Pb10, Pc16, Pc18
Construction period	Construction projects have limited time frames.	Pb10, Pb14, Pb20, Pd5
Work environment	The construction work environment is congested.	Pb10
Various activities	Construction projects usually have various activities.	Pb10
PROBLEMS RELATED TO SUPERVISORS		
Supervisor commitment	Safety is not the first priority. Supervisors do not think safety is their responsibility.	Pa9, Pb8
Supervisor participation	Supervisors do not perceive any usefulness in cooperating with safety activities.	Pb16, Pb19
Example of supervisor	Bad examples of supervisors make workers faithless in safety rules.	Pa8
Supervisor education	Supervisors have differing awareness due to their education.	Pa14

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Table 5. (continued)

Categories	Explanation	ID
Prior accident experience of supervisor	Supervisors do not understand safety initiatives and do not see the benefits of work safety because they never see the outcomes of accidents.	Pb12
Supervisor attitude	Engineers and foremen think that safety officers are consistently trying to identify their mistakes all the time without letting them get on with their work, thereby causing detrimental effects.	Pb15
PROBLEMS RELATED TO WORKERS		
Unskilled workers	Most workers come from an agricultural work sector. They do not have enough construction and safe working skills.	Pa4, Pb5, Pb7, Pb10, Pc3, Pc13, Pd4, Pe4
Workers' unsafe habits	Unsafe habits make workers resistant to safety work.	Pa5, Pc12, Pc13, Pe1, Pe2, Pe6, Pf3, Pf6
High worker turnover	High turnover rate of workers causes difficulties in training and safety culture development.	Pa13, Pb13, Pc2, Pc11, Pc15, Pe5, Pf1
Worker communication difficulty	Effective and attractive communication with workers is still questionable due to their education and interests. Miscommunication results in bad attitudes.	Pa6, Pa11, Pc14, Pd2, Pe7, Pf2
Worker needs	Money is the most important need of the workers.	Pb1, Pb2, Pc17, Pf4
Lack of consistency and follow	Training and education can make them perform and cooperate for a while; however, soon they will forget and not perform.	Pb3, Pb9, Pd1, Pc10
Workers' prior accident experiences	Workers without prior accident experience will have less safety awareness.	Pa10, Pa12, Pe6
Worker awareness	Workers with no prior accident experience, including young workers, will have less safety awareness.	Pa10, Pc4, Pc6
Worker perception	Thai workers have a low perception of safety because they come from agricultural work and low education.	Pb5, Pb7, Pc9

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Table 5. (continued)

Categories	Explanation	ID
Workers' attitudes	Workers think safety activities and PPE slow down their work.	Pb17, Pb18, Pc1
Age of worker	The perception of danger is dependent on age. Young workers have a hero attitude, and do not understand the danger of the work.	Pc4, Pc6
Worker resistance to safety	Workers resist work safety due to their unsafe habits.	Pa5
Worker responsibility	Workers do not realise the consequence of their unsafe work because they do not think about other people.	Pc5
Worker imitation	A bad practice of one group without correction by a supervisor will become the bad culture of another group.	Pc7
Worker stress	Work speed and congested environments make work stressful.	Pb10
Worker education	Education of workers makes communication harder.	Pe7
Drinking culture	Workers usually drink when they get together after work.	Pc16
PROBLEMS RELATED TO SUBCONTRACTORS		
Quantity or quality of subcontractor training	Subcontractors, who only work for a short time, do not see the benefits in attending safety training, and they change new workers quite often.	Pa3, Pb21
Multilevel subcontracting	Sub-subcontractors have a lot of problems related to safety.	Pb11, Pb22
Subcontractors' commitment	Subcontractors do not allocate a budget for safety initiatives because safety is not viewed as a cost for subcontractors.	Pb23, Pf5
Subcontractor participation	Subcontractors give less cooperation in safety activities compared with workers because they are working for a short period.	Pa1
Inexperienced subcontractors	Subcontractors may not understand or have never worked with these standards or rules before.	Pa2

Source: Research.

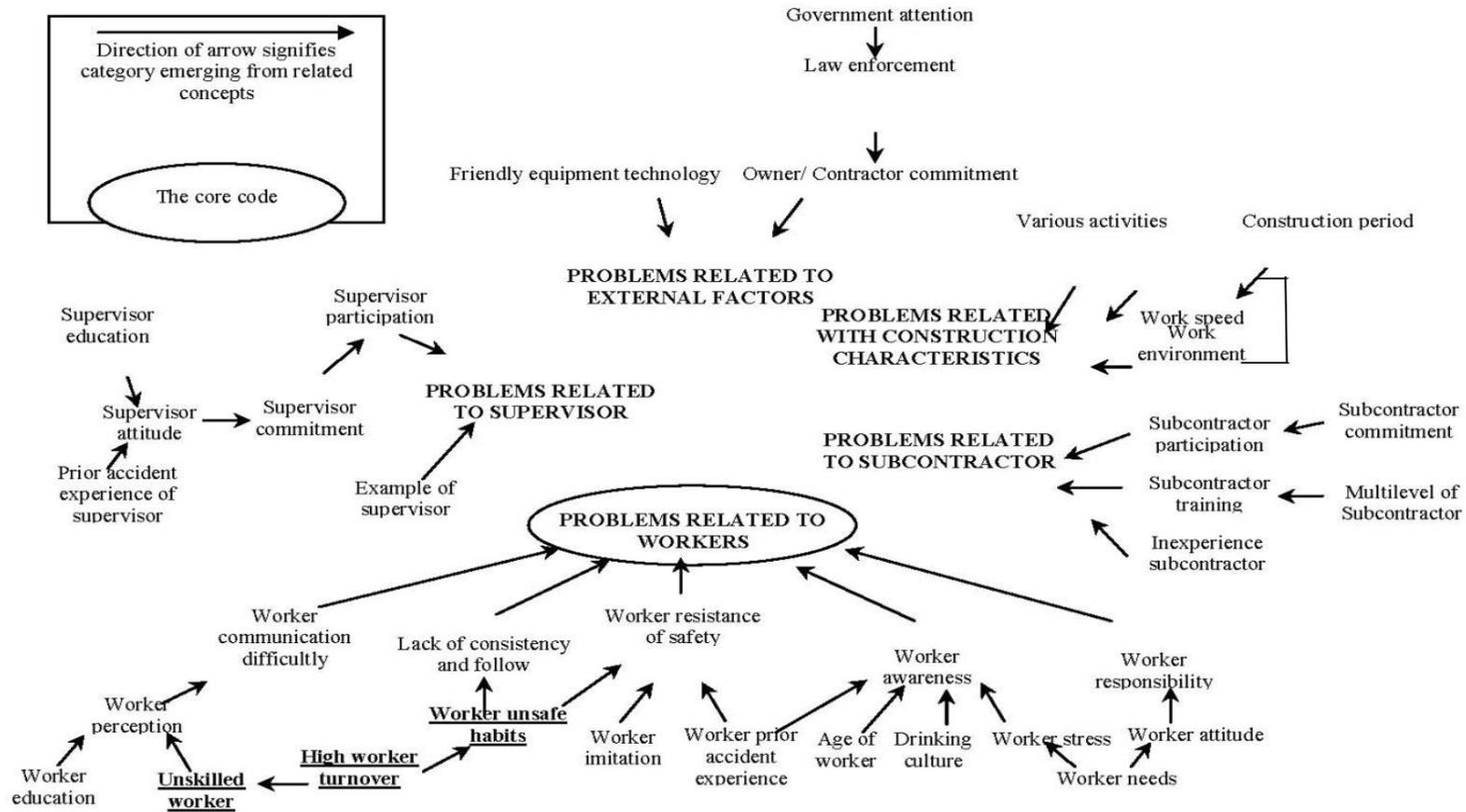


Figure 1. The Relationships between Codes Derived from Grounded Theory

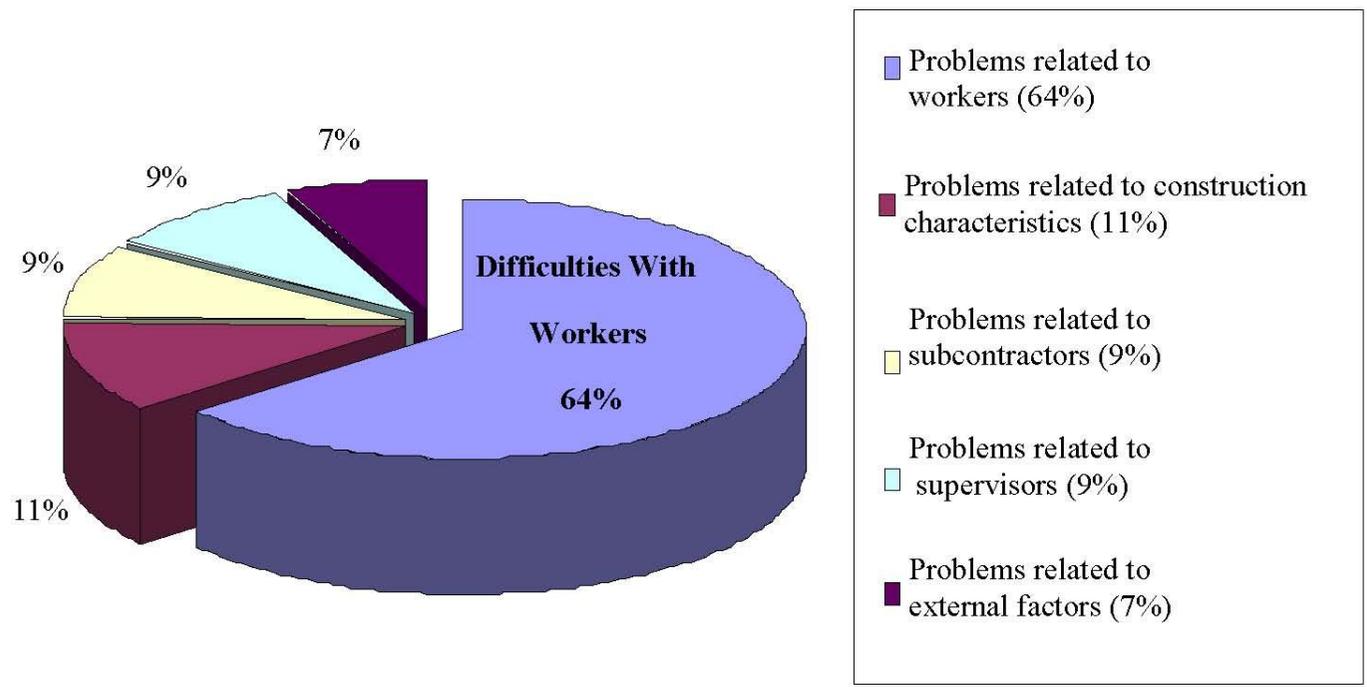


Figure 2. The Problems of Safety Culture Development in Thai Construction Companies
 Source: Research

Open coding in Table 4 involves the analysis of data that is interpreted and given names or labels by the researchers. This initial coding applied Glaser's key point coding technique, which identifies key points rather than individual words. The key point identifiers are shown in the first column of Table 4, in which 'P' indicates 'Key point,' a suffix (a, b, c, d, e, and f) indicates a company, and the 'No' indicates subsequent to the interview. For example, 'Pf3' means the third key point made by the respondent in Company F. The text of the key point is shown in the middle column, and the code is shown in the last column.

After initial open coding has been completed, it is followed with the axial coding process by analysing and regrouping the data. Those related to a common area are grouped together to develop core codes, as shown in Table 5. Then, selective coding is done using the core code, which appears most frequently in the data, followed by investigating the connections between codes either directly or indirectly, as shown in Figure 1.

DISCUSSION

As a result of the interviews, obstacles in safety culture development were systematically identified. These can be grouped into five groups: (1) workers, (2) construction

characteristics, (3) subcontractors, (4) supervisors, and (5) external factors (Table 5).

The findings show that (1) the diversity of safety culture affects the increase of worker's turnover rate and their resistance to safety, and (2) communication is not a major obstacle compared to the unique characteristics of the construction industry, subcontractors, and supervisors and workers (see Figure 1). In terms of a reporting and blame culture, the two were not mentioned by respondents. In Thailand, workers do not openly communicate their complaints or blame others, especially to their supervisors, because they are afraid of losing their jobs.

Based on code frequency of data analysis, as shown in Figure 2, problems related to workers are the main concern of most management levels in charge of developing a safety culture, and the three most frequent problems related to workers are unskilled workers, unsafe worker habits, and high worker turnover.

From the most significant obstacles identified in Figure 1, unskilled workers, high worker turnover, and worker unsafe habits are the fundamental factors most interrelated to one another. These factors turned out to be the most frequently recognised obstacles to the development of a safety culture, as identified by case studies. Findings from this study are somewhat linked to the

view of Maloney et al., (2007), who stated that workers are currently the only group without an opportunity to participate in the health and safety planning process, although they are the ones most likely to be affected by safety failures:

“...most workers come from the northern and north-eastern parts of Thailand; they work mostly in farming, which is based on seasons. During the off season, they come to earn money from the construction industry, part of which they will invest in their farm. This results in high turnover and unskilled workers...” stated a 52-year-old respondent who is a safety manager with more than 20 years of experience.

“...workers from agricultural families work without safety rules and regulations, e.g. always work wearing slippers and never use PPE; these practices are repeated in their daily work life and have become their habits. Once they come to work which requires implementing a well-defined safety program, they tend to be resistant...” stated by 54-year-old respondent who is a safety manager with more than 20 years of experience.

Given the above obstacles, identifying the degree of worker engagement by managers is highly advised. This means the ability to measure (1) the cognitive domain, including workers' knowledge and understanding; (2) the

affective domain, which defines workers' feelings and emotional issues; and (3) workers' skills. As long as managers are able to recognise different degrees of engagement in their workers, it is feasible that they can take the appropriate actions to effectively overcome the aforementioned difficulties. Several empirical studies have found that workers' involvement (previous level of worker engagement) is the factor most important in achieving a positive safety climate (Mohamed, 2002; Fang et al., 2006). In addition, involvement is one of the important factors in safety program implementation to reduce worker risk (Harper and Koehn, 1998).

CONCLUSIONS

The purpose of this study was to explore the current problems in safety culture development faced by Thailand's construction industry. A series of interviews were performed to investigate the safety barriers observed by eight interviewees who worked at the managerial level. Data analysis from Glaser's Grounded Theory was used to collect only keywords frequently mentioned by these case studies. As a result of these interviews, the obstacles in safety culture development were grouped into five problem areas: problems related to workers, problems related to construction characteristics, problems related to

subcontractors, problems related to supervisors, and problems related to external factors.

Of these five, the most significant obstacle is found to be problems related to workers, which can be further divided into 10 sub-factors. Of these sub-factors, the most significant are unskilled workers, unsafe worker habits, and high worker turnover.

RECOMMENDATIONS AND FUTURE DIRECTIONS

The next stage of the study is to develop a reliable assessment tool to measure worker engagement in safety program implementation in construction projects, and to find the factors that affect worker engagement. The results should enable construction firms to identify gaps in worker engagement in safety program implementation and to facilitate actions to improve the situation, thereby optimising safety program implementation for continuous safety performance improvement.

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