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# The realities of applying total quality management in the construction industry

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## Abstract

Japanese contractors have been successful in adopting total quality management (TQM) practices in their domestic operations. By examining Japanese contractors in a foreign country, the research presented in this paper shows that the implementation of TQM in the construction industry is constrained by national markets where the clients, subcontractors and site operatives are not imbued with the same quality culture. The location-bound nature of the production process, competitive bidding which emphasises cost, dependence on subcontractors and the non-direct link between the main contractors and site operatives are some of the constraining factors. Nonetheless, as demonstrated by the Japanese contractors, TQM routines can still be implemented, provided local norms and contracting practices are accommodated.

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## Introduction

There is a consensus among observers (e.g. Andrews, 1973; Paulson and Aki, 1980; Bennett *et al.*, 1987; Hasegawa, 1988; Levy, 1990, 1993) that the major Japanese contractors in Japan have led the way in implementing total quality management domestically, thus setting the benchmark for others to follow. While the operating environment unique to Japan does allow for quality to be the central focus of the construction process, the same cannot be said of other countries. Construction contracting elsewhere is characterised by a confrontational and adversarial atmosphere with time and money being the prime concern (McCabe, 1996). The competitive bidding arrangement subscribed to by most countries intrinsically eschews long-term owner-contractor relationships while at the same time attaching an overbearing importance to low bids (Burati *et al.*, 1992). It is not surprising that those delegated to implement TQM in their construction companies face an uphill challenge (McCabe *et al.*, 1998) in the midst of continuing intellectual discourse and prescriptive advice (Seymour and Low, 1990; Burati *et al.*, 1992; Low and Peh, 1996; Arditi and Gunaydin, 1997; Shammas-Toma *et al.*, 1998; Winch *et al.*, 1998).

This paper describes a study of Japanese contractors operating in a foreign market with the intention of gauging the viability of adopting TQM principles in less conducive markets. A two-stage approach was adopted. The first was a questionnaire survey to all known Japanese contractors in Malaysia (26 forms were sent out of which eight were returned completed). The second involved locating research assistants for three months continuously at four construction sites that were handled by different Japanese contractors. In the interests of anonymity the four Japanese companies whose projects were observed are referred to as Company A, B, C and D. Several points about the projects have to be mentioned from the outset. Those that came under observation and were handled by Companies A, B and C can be categorized as complex/large, while the project undertaken by Company D was awarded by a Japanese multinational (and hence had greater emphasis on the customary Japanese practices to be adopted). While this project had the traits of being normal/conventional, the



contract was procured with a strong inclination towards Japanese practices. The description of projects as either complex/large or normal/conventional is significant as it has a bearing on how the clients and main contractors treat them. The more prestigious the project, the greater is the importance to all parties concerned. Hence greater care and attention is given to quality matters.

This paper is divided into two parts: the first describes the processes and the second the parties. The processes section dwells on the four major areas of: work routine, cost control, time control and safety control. Practices in Japan are described under each subsection so that the degree of divergence with overseas practice can be gauged. The parties section focuses on those whose involvement in the construction process has a bearing on quality. By concentrating on the clients, subcontractors and site operatives, the impediments to TQM become clearer.

## The processes

Up until 1973, construction quality in Japan was so abysmal that there was outcry from owners and public alike (Bennett *et al.*, 1987; Levy, 1990). The industry responded positively by introducing formal quality assurance programmes such as Kajima's Companywide Quality Control (CWQC) and Obayashi's SK. Defying sceptics such as Hippoh (1983) who predicted that the movement was transient, Japanese contractors' commitment to quality has remained undiminished. Taisei still subscribes to the maxim: Quality is remembered long after the name is forgotten (*Building*, 1991).

Levy (1993) points out that quality is maintained even on overseas projects. In fact 75 percent of the companies that participated in the questionnaire survey indicated that they have project management manuals for worldwide application. A document of one of the companies formulated its "total quality control system" for overseas use in the departments of planning (which deals with design drawings), construction (which oversees actual construction work) and quantity surveying (see Figure 1). The manual on construction methods for example is distributed to every project manager overseas, who in turn prepares supplementary

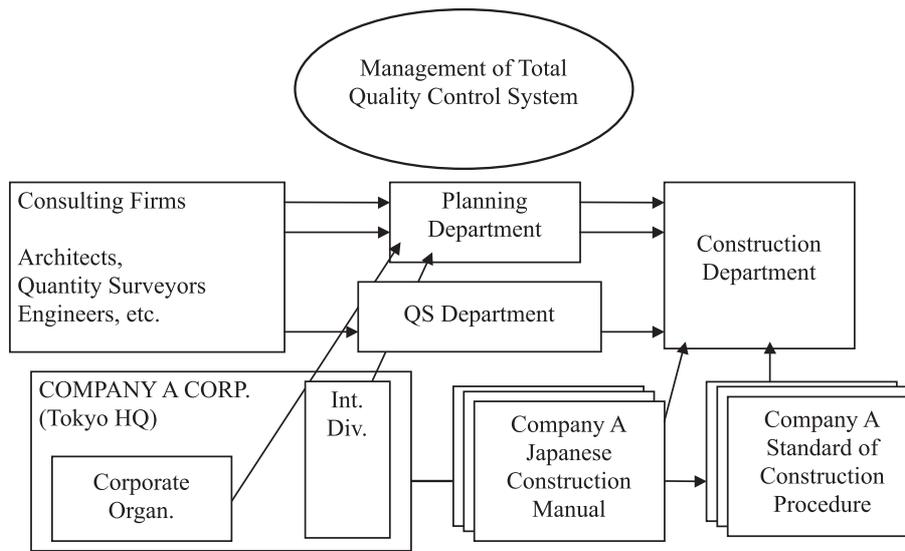
technical manuals for supervisors and building engineers. The aspects emphasised include recommended construction practices, check points and the parties responsible for these check points. It is also spelt out that quality control meetings with sub-contractors should be periodically conducted. The international division located at head office in Tokyo provides necessary technical back-up assistance. But as Figure 2 shows, the TQM practices that are applied in Japan were adapted to suit local context. Furthermore, the adaptation is more pronounced for normal/conventional than complex/large projects. The subsections below elaborate salient field observations that correlate well with the questionnaire responses graphically presented in Figure 2.

## Work routine

Commitment to quality by Japanese contractors results in meticulous attention to detail and a structured approach to work (Levy, 1990). Drawings prepared by consultant architects are checked by the Japanese contractor, and if necessary corrected (Hasegawa, 1988). Management focus may even be shifted from head office to site in advance of actual construction work (Andrews, 1973; Paulson and Aki, 1980; Bennett *et al.*, 1987; Levy, 1990). Once work commences, all tasks including material purchasing, payments, labour engagement and design work are carried out on site. Every activity undergoes the same plan, check, double-check and record regime. Moreover, almost every level of site management is by consensus, with plans and policies being agreed by the various parties (client, designers, engineers, supervisors, subcontractors, etc.) during meetings before implementation.

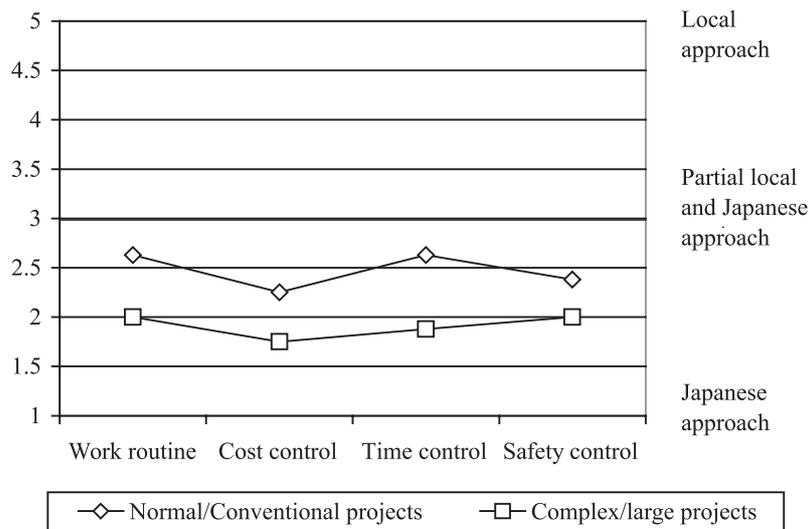
High quality work output also stems from the placement of a greater number of field management staff who, it is important to note, are well experienced senior people (Andrews, 1973; Hasegawa, 1988; Levy, 1990). Higher overhead costs are more than compensated by averted delays and re-workings. *Kaizen* (continual incremental improvement) is practised on site (Bennett *et al.*, 1987; Bennett, 1993). Quality is measured and maintained through detailed, rigorous and carefully planned tests. The most interesting ideas are taken up and discussed during company-wide presentation

Figure 1 Diagram showing the Total Quality Control System as implemented by Company A



Source: Company A

Figure 2 Aggregated average response from eight Japanese contractors who participated in the postal questionnaire



meetings and may even set new company standards.

All four sample sites possessed a relatively high number of site staff, which to local observers seemed superfluous but in fact was necessary to perform activities with rigour, such as scrutinising and amending design drawings produced by independent consultants and subcontractors – a practice rarely done by local main contractors. Company A’s site even had separate sections (construction, planning, accounts, and mechanical and electrical) headed by qualified and experienced construction professionals. Consensus decision making prevailed on all four sites. On Company D’s

site, the assistant project manager’s submission on project scheduling and budget underwent several rounds of discussion on location, then at the main office before being faxed to Japan. The emphasis on collective decisions and wisdom translated to seemingly endless meetings. These meetings at different levels provided formal avenues for quality matters to be discussed.

All project managers in Company D were expected to prepare reports on matters as diverse as the weather, labour, machinery and raw materials. Such meticulous documentation is connected to TQM’s requirement for decisions to be based on data and facts. Company D practises *kaizen* on

site. Material quality and construction activities were constantly monitored. It has been known to remove installed defective building material (e.g. marble pieces) for what may seem petty reasons (e.g. colour variation). With such assiduous quality control, Company D was able to confidently provide to its Japanese clients a ten-year guarantee for building structure and a two-year free maintenance service. Collective obligation which transcends ostensible job and project demarcations was also observable: at Company A, a senior project manager assigned to a nearby project periodically visited the sample site to assist his junior counterpart in certain duties such as chairing quality control meetings.

Equally important to note is that Company B's site differed from the rest. There, quality control was worse than local standards with protruding reinforcements from a concrete slab and a bulging reinforced concrete basement retaining wall among the tangible manifestations.

#### **Cost control**

In Japan, contracts are normally awarded on a lump sum basis (Hasegawa, 1988). Bennett *et al.* (1987) opine that the Japanese operate on the premise that if the quality and time criteria are fulfilled, costs will then look after themselves. In other words cost is subjugated to other more important priorities. Even when there is design variation leading to cost escalation, the contractor would hesitate to claim for additional expenses from the client (Levy, 1990). Petition, not claim, is presented to the client for consideration (*New Civil Engineer*, 1984; Bennett *et al.*, 1987).

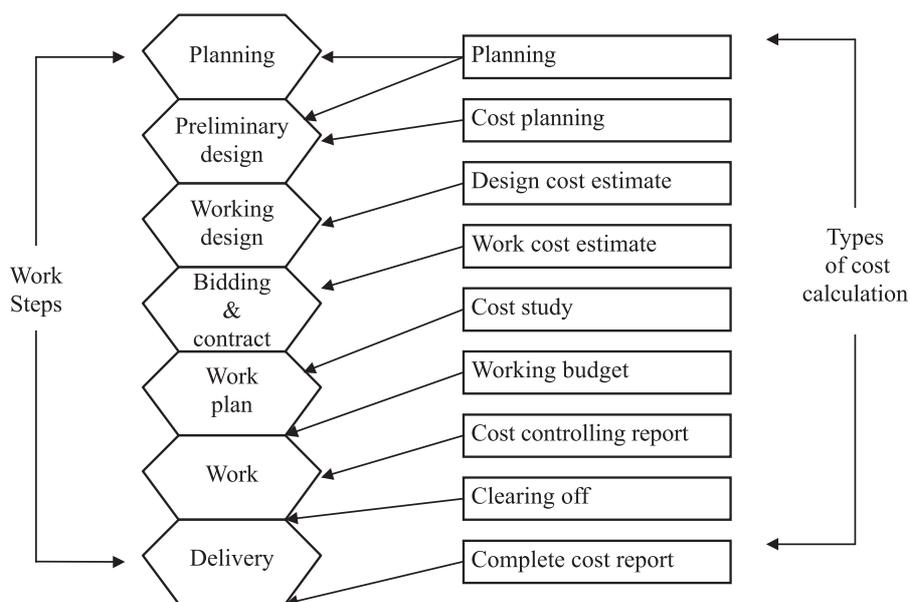
“Adjustments” to contract sum is through gentlemanly negotiations based on reasonableness and relative bargaining strengths. Alternatively the contractor would have to diligently find “trade-offs” to counter these extra costs (Levy, 1990). As contracts tend to be lump sum and scope for claims limited, cost control is as tight as it can be (Hasegawa, 1988; Levy, 1990). Various types of techniques are employed throughout the project life cycle (Figure 3). As indicated above, once work shifts to site, the management there takes charge of cost control. Monitoring from head office is also done with the help of monthly cost control reports submitted by the site management team.

All four Japanese companies employed locally-trained estimators. There was nothing unusual in the techniques utilised by these professionals in the Japanese organisation. What was striking however was the rigour with which they were applied. The observations at Company D's branch office when it was designing a project for a Japanese client brought into clarity this impression. As design evolved from the earliest conceptual stage, the estimating personnel were expected to continually revise their estimates. Tedious as this may be, the cyclical process typifies the PDCA cycle and the concern for early detection and elimination of complications. Cost control in the context of an all-Japanese working relationship is different from a multinational setting. While, in the former situation, losses for a particular project may be absorbed for the sake of long-term gains, local clients do not exhibit the same one-to-one relationship with contractors (see below). Therefore making sure that every project is profitable becomes paramount, for survivability if not for anything else.

#### **Time control**

In Japan, because of client expectation, meeting delivery datelines becomes almost sacrosanct (Levy, 1990). Hence the preoccupation with meticulous work programming using bar charts and network techniques for varying time-frames, i.e. total, monthly, and ten-day breakdown (Hasegawa, 1988). Time control (as with cost and safety) is achieved through a consistent series of daily meetings with subcontractors who in turn hold their own toolbox meetings with their workers to discuss the work for the day (Bennett *et al.*, 1987; Bennett, 1993). Later in the day, the site management team conducts its own internal meeting to discuss whatever problems may have arisen during the day.

True to the Japanese spirit, for Company D, which only deals with Japanese multinational corporations, meeting the project schedule is indeed very crucial. On one delayed project, the company absorbed RM2 million losses (i.e. equivalent to 10 percent of total project value) to avoid time overrun. However, Company A's manager pointed out that the same preoccupation for time cannot possibly be extended to local clients as the understandings with them are different. Be that as it may, as Figure 2 shows,

**Figure 3** Cost control techniques adopted by Japanese contractors at the various work stages

Source: Adapted from Hasegawa (1988, p. 59)

time is predominantly managed in typical Japanese style.

At all four sites, while the concern for deadlines was comparatively high, the utilisation of meetings to manage project schedule (as well as quality, safety and cost aspects) varied according to the differing perception of their effectiveness for the situation in hand. Nowhere else is this made clearer than at Company D's site which adopted a simple routine of bi-weekly meetings with subcontractors. Early morning briefings were dispensed with – and this from a company which as mentioned earlier absorbed substantial losses so as to bring back another project on schedule. Company C's site was the most diligent in implementing all types of meetings: daily morning meetings, daily afternoon coordination meetings, weekly coordination meetings with M & E subcontractors, weekly coordination meetings with nominated subcontractors, weekly management meetings with section managers, weekly design coordination meetings, weekly supervisor meetings and bi-weekly logistic meetings. Company A's site also had its own set of meetings, including early morning briefings followed by toolbox meetings. It even had a Planning Manager to monitor work progress. At one time, a materials supplier was replaced simply due to late delivery.

Company B's site displayed a marked divergence in conduct from the rest. As with

the other sample sites, linked bar charts and meeting timetables were profusely pinned on the walls of the site office. The reality was that the thrice-weekly subcontractors' meetings were sometimes cancelled and "discussion meetings" never took place at all during the observed period. Only the internal coordination meetings attended by section managers were held every week.

### Safety control

Prompted by a poor safety record of the construction industry, the Japanese government dramatically restructured its safety education in 1971 and enacted several safety-related laws (Bennett *et al.*, 1987; Levy, 1990). Safety policy has been made mandatory on all sites. Workers suffering from injury due to non-usage of hard hats are deprived of insurance coverage. Government-appointed inspectors empowered to stop work investigate all serious construction accidents. Contractors with a poor safety record are blacklisted by public and private clients. As a consequence of all these measures, construction safety is taken seriously in Japan. It is taken into account as early as the planning stage and continuously stressed during daily toolbox, weekly and monthly meetings. Buildings under construction are wrapped cocoon-like with safety netting. The ubiquitous slogans and posters on site remind workers to use protective gear and to lift loads properly.

Safety standards adopted by the Japanese contractors on the sample projects were found to be higher than local standards. Company A's safety philosophy is encapsulated in the five "Ss": *seiri* (separate), *seiton* (arrange), *seiso* (clean), *seiketsu* (tidy) and *shitsuko* (discipline). At its site, the usual safety routines found in Japan were evident: safety talks during morning assembly, toolbox and afternoon meetings; fines for failure to wear safety gear (serious offenders were sent off the site); and clearing up by sub-contractors and workers when work ceased at the end of the day. A schedule of the entire project highlighting potential disasters for every work activity, the respective preventive measures, and main checkpoints for safety inspection were pinned on the notice board. A detailed month-by-month breakdown of the same information was also displayed. A fine was imposed on subcontractors for not attending monthly occupational safety and health committee meetings. It was found that Company A might even establish a Safety Administration Department for exceptionally prestigious projects. The safety procedures at the sample sites which belonged to Company C and D were broadly similar to the above description.

Company B's sample site had all the tangible signs of being safety conscious. Enshrouded in netting with safety posters and banners everywhere, the building under construction was well-fenced all around it. A thick company manual on occupational health and safety could be found in the site office. On the office wall was a chart displaying the emergency procedures in the event of accidents. Short weekly meetings were held by the occupational safety and health committee. Again, the real situation however was different beneath this exterior. Monthly safety campaigns were not promptly conducted, the fortnightly safety patrol never made its round, and workers habitually went about their work without hard hats and boots (only six months into the project did the site management consider penalising errant workers). Company B's site was just as disorderly as most sites in Malaysia – except when Japanese superiors from Kuala Lumpur main office arrived for inspection. At one time, as a result of an accident, Safety Instructions were diabolically faked, backdated and signed by the subcontractor

concerned as proof of receipt to exonerate site management of any blame.

## The parties

### Client

Contractor-client relationships in Japan are normally long term (Andrews, 1973). Contracts are generally secured on a negotiated basis. For this reason, maintaining relations with established clients is more important than securing orders from new ones (Kajima, 1973). Client-contractor relationships are not dictated by the contract but rather social norms. Japanese contractors unilaterally guarantee the end product to their clients (Ono, 1967). Even for those outside the nucleus of steady clients, the Japanese clients are likely to stick to their corporate policies, even if it means losing money on a project (Levy, 1990). Even though construction disputes are common in Japan (Hippoh, 1983), differences are settled through amicable negotiations (Bennett *et al.*, 1987). The party that gets its own way often reciprocates favourably to the other party in future dealings. One western construction professional working with a Japanese company noted that construction negotiations can be "very, very tough" (Abdul-Aziz, 1987). The bargaining process is often merely to establish mutual trust and confidence (Richardson and Ueda, 1981). Abroad, the Japanese contractors have come to realise that familiarity with contractual formalities is crucial (Hippoh, 1983; Bennett *et al.*, 1987). When dealing with non-Japanese clients overseas, the Japanese contractors take on a more adversarial outlook typical of other contractors. "In Japan words alone are enough but overseas you must have a contract because it seems we cannot trust each other", quipped a Shimizu senior managing director (NCE International, 1984). The Japanese contractors have learnt that working relationships with foreign clients are governed by the fine prints of the contract rather than trust (Paulson and Aki, 1980).

Indeed all four sample projects had a contract administration section which served to protect the interest of the contractors *vis-à-vis* the clients. At Company B's site, this section was headed by an Australian expatriate. Quality workmanship was conditional upon the client's willingness to

pay for it. When the client for Company A's project reduced the originally agreed contract sum from RM79 to 71 million, the company was forced to take drastic measures including using lower quality building materials and doing away with the safety officer. In general, local clients do not emphasise quality to the same extent as Japanese clients, and therefore are not willing to pay for it, particularly if the projects are conventional. Faced with such a situation, main contractors would find implementing TQM to their disadvantage.

### Sub-contractors

In Japan, Japanese main contractors form long lasting relationships with subcontractors who provide the main input to the production process (Bennett *et al.*, 1987; Levy, 1993). The main contractors go to great lengths to provide continuous work and fair compensation. Deals are often struck through bargaining rather than competition. The paternalistic main contractors monitor the work performance of their subcontractors on quality, time and cost. Because of the main contractor-subcontractor bond, the level of concentrated effort yields high work quality to the required schedule and safety level.

The field study found all four Japanese companies to be provident in their relationships with capable and reliable subcontractors. As in Japan, the subcontractor's performance was continually monitored. On Company A's site, site managers guided the subcontractors to perform work economically, explaining along the way the likely effects of actions taken. Company D was found to strike a fair deal with its subcontractor rather than trying to get the most out of it. The added benefit of having a nucleus of subcontractors was that the performance expectations of the Japanese contractors were understood by all. Still, it was found in general that many local practices still prevailed. Just as in Japan (Furusaka, 1990), actual productive activities on site are mainly done by subcontractors. Main contractors often take on the role of coordinating the disparate activities carried out by the many trades and specialist subcontractors. The paternalistic attitude towards subcontractors was not uniquely Japanese but a common trait among local main contractors who fundamentally draw their operational strength from the subcontractors (Navamukundan, 1992). The

non-contractual duties undertaken include extending loans in times of need and attending to their other needs. Moreover, not all subcontractors reciprocated the treatment accorded by Japanese contractors. A Japanese manager quipped that local subcontractors attach much importance to profit with little regard to oral agreements. There had been instances when he experienced the walk-out of local subcontractors from projects on the excuse of poor profitability.

### Site operatives

In Japan everyone on site, including site operatives, takes collective responsibility for quality (Bennett *et al.*, 1987; Bennett, 1993). They are expected to improve their work through quality circles or *kaizen* (continual incremental improvement), and to report their ideas and results. Quality is measured and maintained through detailed, rigorous and carefully planned tests. The most interesting ideas are taken up and discussed during company-wide presentation meetings and may even set new company standards.

On all surveyed sites, shared responsibility towards quality was not fully subscribed to by site operatives. Not all site operatives were committed towards construction safety unless coerced into doing so with heavy penalties. On one occasion at Company B's site, one construction executive who told a site operative off for not obeying safety precautions was himself challenged by the worker. Morning calisthenics were not received well by all site operatives. Among the factors which can be ascribed to the lack of a quality culture among local site operatives are the high mobility of site operatives from site to site and the absence of direct relationship with the Japanese contractors. Instructions from main contractors reach the site operatives via the subcontractors and head of work gangs, by which time the original message may have lost some of its true meaning.

The situation is different for the Japanese contractors' directly employed staff. The implementation of TQM practices was made possible through the acculturation of local employees to Japanese work ethics (Table I). Three-quarters of the companies that returned the postal questionnaires indicated the policy of regularly sending key local people to Japan as part of the socialisation process, while an even greater proportion

**Table I** The TQM concept as applied by one Japanese company that participated in the postal questionnaire

Important items	Supplementary or related important ideas
1. Market-in concept	A. Quality first B. Degree of client's satisfaction: attractive quality C. Any work at a certain stage must be performed in full consideration of the work at successive stages
2. Turn the PDCA cycle (control cycle)	A. Problems can turn to be mountains of treasures B. Objectives-orientation (determination of quality of design) C. Priority-orientation D. Give heed to abnormalities (whether good or bad) E. Put emphasis on the process; remove the fundamental cause F. Upstream control: prevention is the best cure G. Standardisation; recurrence prevention
3. Thinking based on data and facts	A. Stratification B. Utilisation of scientific techniques such as SQC C. Abnormality and normality (recognition of dispersion) D. Outspoken discussions based on true facts (atmosphere to allow honest and frank talks) E. Candid and unbiased observations (to learn from facts); actual things at actual places
4. Participation by all members	A. Combination of everyone's wisdom B. Respect of humanity and spontaneity C. Cooperated or coordinated play between different departments, etc.

**Note:** Total quality management comprises the above four important items, but they do not explain the TQM concept in full, and some supplementary or related important ideas are added in the right-hand column

**Source:** Company document

(i.e. 87.5 percent) transfer Japanese construction executives overseas either on a project or term basis. One manager of Company A who happened to be a local pointed out that a highly disciplined work regime differentiates Japanese contractors from local contracting groups. Even then, the acculturation process may not be foolproof as demonstrated by the laxity on quality at Company B's site which comes through recurrently throughout this paper.

## Conclusion

The operating environment plays a primary role in determining the feasibility of implementing TQM practices in the construction industry. In national construction industries where the clients award contracts based on competition between contractors often on cost, any construction company keen to adopt TQM principles will find the task daunting. The other actors to the construction process – the subcontractors and site operatives – may also not be sufficiently imbued with a quality culture. Being location-bound, the

construction process must inevitably reconcile with local contracting norms and customs. Even the TQM-oriented Japanese contractors have had to modify their *modus operandi* when operating overseas under such circumstances.

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