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CAPACITY BUILDING: LEARNING FROM CORPORATE SUCCESSES OUTSIDE CONSTRUCTION

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ABSTRACT

Industrialization is a response to low productivity and shortage of skilled labour. Advancement in technology is associated with the growing trend. Thus, industrialisation requires upskilling the whole workforce – literacy, numeracy, technical and trade skills. This crisis is exacerbated by the casualization of construction labor over the last ~60 years which means construction companies do not see it as in their interest to upskill those they do not employ. Even though "*with every pair of hands comes a free brain*" (Henry Ford), the construction sector seems to find it acceptable to do little or nothing to use and develop those brains, to tap into this unused talent. Motivated by these insights, we ask, *what can we learn from corporate success outside construction that might help improve industrialised project delivery in construction?* This qualitative exploratory analysis of successful major transformations in other sectors uses selective literature review, categorical aggregation of case studies and inductive reasoning. The findings underscore the importance of leaders with 'constancy of purpose' driving system change in order to build the capacity and competence of workers. In construction this may mean decasualising labour which will require the creation of pipelines of work to ensure a steady workload. The paper concludes with suggestions for further research and validation in the field.

KEYWORDS

Organization, Culture, Industrialisation, Collaboration, Capacity building.

INTRODUCTION

Industrialisation seems to have advanced rapidly in the last 2-3 years. In the construction sector, industrialization is in part a response to low productivity and shortage of skilled labour, a global phenomenon. Advancement in technology is associated with the growing trend which in turn requires workers to upskill at a faster pace. What is our industry doing to address these concerns? What are the criteria for capacity building of workers? What are some if the existent issues? These intriguing questions, propelled us to explore further.

A preliminary literature review shows that shortage of skilled labor in construction was a 'crisis' for at least the last 20 years. Many construction workers have short careers brought on by the hard physical labour involved and the physical conditions of the work.

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Construction workers, and particularly unskilled labourers, join the sector with little education, low literacy and poor numeracy skills (Kahn, Alam and Ahmed 2015).

In practice, construction workers are generally *told* what to do by middle managers based on a Critical Path (CPM) schedule prepared by other people (Mossman and Sarhan 2021). With CPM, the sector is, as the late Greg Howell frequenly said "*a commitment free zone*". It is as if construction workers are speechless. In certain parts of the world they are certainly not expected to speak up, to say 'no' or to object in any other way to the instructions they are given by trade crew leaders, supervisors or managers. This can even be true when they don't understand the instructions they have received – because, for example, they do not share the instructor's mother tongue (Mossman & Ramalingam 2021a). Extreme examples of construction workers who are not expected to speak up include those who are engaged in forced labour, bonded labour or debt bondage (Von Elgg 2016). Often referred to as *Modern Slavery*, this happens in Europe, North America as well as in other parts of the world and is often associated with trafficking of individuals. All this contributes to rework, cost and delay. Taken together these conditions make it easy to treat these construction workers as an exploitable and expendable commodity and may help to explain the poor quality of much work done in construction. The cost of that poor quality is significant (Mossman & Ramalingam 2021b).

Even with significant industrialisation, to enable work to flow smoothly through the system, construction will still be a people business. Many in the construction sector appear to operate as if the workers only bring a pair of hands to work. These hands are told what to do by managers and supervisors, a very passive activity (Marquet 2012, 138). Changing that requires mutual respect of managers and workers. Yet as Henry Ford quotes, *"with every pair of hands comes a free brain"*. Few acknowledge those brains, let alone engage them. In some cultures and in some markets (e.g. parts of India, in Gulf states, as well as in the parts of the United States and Europe) workers are sourced from distant places where education is limited and, often, where languages are different.

Intereventions in other sectors over the last century have sought to capitalise on those brains. As in other sectors, it is the workers (operatives, laborers) who create the value that has been promised to customers by senior leaders. Some leaders have created significant success for organisations as well as developing the skills of individual workers. Holistically, we need a capacity building process. Capacity building is a systematic process to improve worker's knowledge, skills, understanding, values, attitude, motivation, and capability necessary to perform well at work. We feel that now is time to learn from successful labor development programs in other sectors so that the construction workforce are able to use their brains confidently — and ensure that '*One bad apple* does not spoil the barrel' (Mossman & Ramalingam 2021b).

Motivated by these insights, the aim of this paper is to understand the ways in which construction leaders might enable capacity building to *build* their workers (as Toyota do) so as to improve worker effectiveness as they adapt to industrialised construction and delivering ever better quality and productivity. Specifically, we explore, *what can we learn from corporate success outside construction that might help improve industrialised project delivery in construction?*.

METHOD

Many project learning reviews focus on learning from mistakes. Learning from mistakes is the norm on most projects and particularly following project failures – like the Chernobyl nuclear tragedy, the NASA Challenger space shuttle explosion or the time and

cost overrun issues in the Sydney Opera House project. This paper focuses on learning from project success stories. These are limited in construction (e.g: Delhi Metro project and Alandur PPP project in India) and often ignored. Following Creswell (1998) and Stake (1995) this is an exploratory case-study analysis of 7 success stories from other sectors with data from multiple sources including white paper reports and news articles as well as literary evidences. The cases were then categorically aggregated and thematically analysed using an inductive reasoning approach to interpret the findings in the context of construction. The learnings from this paper are thus based on a method of inquiry, inductive reasoning and interpretive analysis of success stories from all domains supplemented with the experiential insights of the first author. This is a conceptual paper and the findings will have to be validated on construction projects in future.

The length of the paper means that only the briefest of information about each case is presented. Each is much more complex than we may suggest. Find more in an appendix at https://bit.ly/3a25nwi .

THE CASES: SEVEN SUCCESS STORIES

1. TRAINING WITHIN INDUSTRIES — E.G. BOEING, AMAZON FULFILLMENT

The Training within Industry (TWI) program standardises training programmes and assists frontline managers in quickly and effectively teach new operations to workers. It is sometimes referred to as *the foundation of lean* (Dinero 2005). Founded in 1940 in the US during World War 2 (WW2), TWI built on Charles Allen's experience in US shipyards during WW1. In both wars it was necessary to ramp up both civil and military production quickly using workers with little or no previous relevant experience. The TWI program covered 1. How to train workers so as to reduce defects, rejects, rework, accidents (all things of concern to constructors); 2. How to systematically improve the way work is done; 3. How supervisors can get the facts, weigh them carefully, make a decision, take action, and check results (Dinero 2005).

After WW2 TWI skills were taught in Japan to help rebuild the economy and Toyota and other companies have been using them ever since (Huntzinger 2006; 2001). TWI programs covered, among other things: Pre-employment and on-the-job training; Developing all-round craft worker skills through an accelerated apprenticeship; Problem solving skills; Safety; Preparing instructors to deliver effective training; Supervisor selection; Improving job relations; Plant training plans; Strengthening the managerial organisation to support whole company program (Dinero 2005).

One example of a WW2 TWI success was Boeing. In 1941 Boeing faced a challenge: a rush order for B-17 bombers using existing production facilities and 33,000 unskilled workers 50% of whom were Seattle area housewives and the rest cowboys, fishermen, farmers and lumberjacks. By 1944 these people had increased output from 75 planes a month to 364 – a 485% increase – while reducing labour hours per plane by 60% and costs by 43%.

The program continues to this day — the *TWI Institute* is working with Amazon Fulfillment among others. [https://www.twi-institute.com]

2. HARLEY DAVIDSON

Following a leveraged buyout in 1981, senior leaders visited Honda's motorcycle plant in the US. This visit helped them realise that they faced a crisis – Harley Davidson had to radically change their own operations if they were to survive. They developed a new

approach that focused on 1: Employee involvement; 2: Just-in-time inventory practices (they called it *Materials-as-Needed)* to reduce work-in-process inventory and make quality problems more apparent so that employees were more likely to take action; and 3: teaching employees Statistical Process Control (see e.g. Wheeler & Chambers 1992) to help them systemically investigate and improve product quality.

Kotha & Dutton (1996) reported that senior leaders came to understand that production line workers had a better idea of what worked and what did not than they did. When Rich Teerlink, formerly CFO, became CEO in 1989, he was aware that Maslow had suggested that people willingly commit to what they help create (Teerlink 2000). With these ideas in mind Teerlink reinforced the turnaround by *engaging* the whole workforce — both salaried and hourly paid — in developing a vision for the company. To make it safe for people to make suggestions *quality circles* of manufacturing workers were made directly responsible for improving product quality. These changes rapidly made a difference. Quality improved and so did productivity, market-share and profits while waste fell — and the company became more customer centred.

Subsequently, Teerlink reports (2000), senior leaders began working to create an environment where employees want to do better, care about the company on a personal level and work together to improve both individual and overall performance.

Ten years later, when Teerlink retired as CEO, Harley-Davidson were doing well, and the process was still improving. *Nothing is so good that it cannot be made better*.

3. FAVI

In the early 1980s Jean-François Zobrist, became CEO of Favi, a French bronze foundry producing specialised castings for the automotive, aeronautical, health and other sectors. He realised that he trusted the people who created the company's wealth (Carney & Getz 2016). He then gradually removed every impediment to the workers: no more inspections, no more time-clocks, and no more locked warehouses — and no more managers. FAVI became a collection of autonomous teams delivering great quality and service to their international customers. Believing that "*People always tend to act as they are considered"* Zobrist helped the organisation shift from structures that assumed 'humans are bad' to one based on 'humans are good' (Minnaar and de Morree 2017). By 2000 FAVI had 50% of the European automotive market and a substantial proportion of the global health market without exporting work to low cost manufacturing countries. Employee turnover was very low, they never delivered late and never increased the prices of their products.

Zobrist retired in 2003. A decade later he noted that humans are formatted for uncertainty. Both as hunters and as farmers, humans look for weak signals and listen to intuition – i.e. *tacit* knowledge (just as in construction). In hierarchies, those weak signals rarely make it to the senior leaders as they are focused on efforts to create certainty.

After Zobrist retired and after ownership of the company passed to the previous owner's grandson and others, the new shareholders forced the new CEO to destroy the unique culture based on freedom and trust and to outsource manufacturing to Asia. As a consequence product prices rose, many workers left the company and profit margins and net cash flow decreased quickly, leading to even tighter control. (Minnaar and de Morree 2017). Success was over when the system change and assumptions were reversed.

4. NUMMI

In 1962 General Motors opened a new production facility in Fremont, California. By the early 1980s that factory "had the worst record of management/labor conflict of any U.S.

automotive plant" (Ranney 2009). In 1984 GM was considering closing the plant and at the same time Toyota was looking for a place to experiment with production in the US. Toyota agreed a joint venture with GM and New United Motor Manufacturing Inc. (NUMMI) was born using 85% existing labour. Toyota started by taking employees to Japan to experience how Toyota produce vehicles with teamwork and collaborative problem solving and to think about the end users of the vehicles they produced. Everything focused on quality. This importantly included *management doing what they said they would do* (Ranney 2009). At NUMMI, Toyota produced their own vehicles and a GM small car in the same plant. Quality, productivity and employee pride in their work increased dramatically. Within a couple of years the number of defects per vehicle were on a par with a similar model produced in Japan! All this required that workers were willing and able to stop the line to fix problems rather than passing on defective product. There are excellent descriptions of how the transition happened in *The American Way* (2010) and in Shook (2009).

GM pulled out of the joint-venture in 2009 and Toyota closed NUMMI in 2010 – the only plant it has ever closed. Tesla bought the NUMMI site later in 2010 and it now produces the Tesla range. With learning from the NUMMI experiment, in 1986 Toyota successfully created its own plants in North America (in Kentucky and in Ontario, Canada), and later in other parts of the world.

5. ALCOA

In 1987, newly appointed CEO of Alcoa, Paul O'Neill chose to focus on safety. He wanted to make Alcoa the safest company in America. O'Neill announced his intention on an autumn day in 1987 in a speech to Wall Street investors and stock analysts. Profits, he said, didn't matter as much as safety. Back in Alcoa, O'Neill toured the plants with the same message. On the basis of what he said many of his audience sold their Alcoa stock or recommended that others did, yet, within a year, Alcoa's profits hit a record high and by the time he retired in 2000, the company's annual net income was five times larger than before he arrived, and its market capitalization had risen by $27 billion, a nine fold increase.

"The key to protecting Alcoa employees, O'Neill believed, was understanding *why* injuries happened in the first place. And to understand *why* injuries happened, you had to study *how* the manufacturing process was going wrong. To understand *how* things were going wrong, you had to … educate workers about quality control and the most efficient work processes, so that it would be easier to do everything right, since correct work is also safer work." (Duhigg 2012)

O'Neill shared his home phone number with plant managers and others across the business. Six months later, in the middle of the night, a plant manager called. An extrusion press had broken and an operator had been killed trying to fix it. The following day plant management and Alcoa senior leaders reviewed all the information they had and O'Neill concluded "*We killed this man, it's my failure of leadership. I caused his death. And it's the failure of all of you in the chain of command*." That shocked the room and that's when things started to change.

6. USS SANTA FE

In 1999 David Marquet became the commanding officer of the USS Santa Fe even though he had been trained over the previous 12 months to take command of a different class of submarine. He quickly discovered that commands that made sense on the submarine he'd

been trained for didn't work on the *Santa Fe*. That was his epiphany. He decided that there was only one order that he was qualified to give – the order to use lethal weapons. For all other actions he communicated his intent so that his crew could initiate action to realise that intent.

Marquet's epiphany led him to create a way to develop leaders. He describes his approach as **leader-leader**. He writes about how he focused on three things: 1. **Moving authority** to where the information is while (this in effect gave those with authority the power to say 'NO'); 2. using **certifying** – the person responsible for the delivery team asks them questions to assess their understanding of the intended outcomes and competence to perform. Unlike *briefing*, this is an active process, everyone has to prepare. 3. **Emancipating the team**. Working with a team to identify and remove the shackles and obstacles that prevent them from doing the good job that they want to do when they come to work (as Zobrist did in Favi). *This is much more than empowerment and, like briefing and moving authority to where the information is, it builds the competence of the organisation as a whole.* (Marquet 2012)

In this way he moved from the situation where he was a leader with 134 followers on the submarine he commanded, to one where there were 135 leaders. In the process he *turned his ship around* — it went from the worst rated submarine in the fleet to the **best** — and *USS Santa Fe* created significantly more future submarine commanders than others in the fleet (Marquet 2012).

7. ANGLO AMERICAN

In 2007 Cynthia Caroll was appointed CEO of Anglo American (AA) a diversified mining company based in South Africa. Over 200 employees had died while working in the company in the preceding 5 years and its safety performance was improving. Caroll chose to focus the company on zero harm. Just in South Africa worker engagement was difficult because of the 13 national languages and low literacy. **On top of that the workers didn't feel safe to speak up.** Amy Edmondson (2019, 138ff. & 165) Caroll (2012) and three Harvard Business School Case studies (Mukunda et al 2013) describe how Caroll worked to help employees at all levels feel safe so that they were willing to engage in the improvement process.

Soon after her appointment there was yet another death at Rustenburg, the largest platinum mine in the world. Caroll declared "I simply cannot support operations that are killing people" and, even though no-one knew if it was possible at such short notice, she decided to shut it down. The decision marked the start of a major change process within AA that had a significant impact on the mining sector across South Africa and beyond (Mukunda 2020).

Unlike many of her peers, Caroll refused to accept that fatalities were an inevitable by-product of mining and wanted an indefinite shutdown, during which the mine would fundamentally overhaul safety procedures with a top-to-bottom audit of processes and infrastructure followed by a complete retraining of the workforce. The costs would be enormous. This was not a popular decision.

Rustenburg produced ~US$8m *per day* revenue and it remained closed for 7 weeks (→ ~€350m lost revenue). It led to revised safety practices in mines across the world. In the short term, it prompted complaints and resistance within AA. Many employees were not prepared to change, and almost all the managers at that mine were replaced.

The review of safety procedures and issues, meant 30,000 workers needed retraining before production at Rustenburg could resume. Small-group meetings and face-to-face

communication between executives and individual employees were used to identify what had gone wrong in the past and **to instill personal and group responsibility**. Caroll (2012) goes on to describe how she worked with Government, the Unions in SA – and ultimately AA's competitors to raise the game for the mining sector as a whole.

WHAT DO WE LEARN FROM THESE EXAMPLES?

Many of the cases are examples of what David Burkus (2020) described as "*The whole industry finds this acceptable, and we refuse to accept that".* In short, aggregating the preliminary insights from these cases and performing a thematic analysis, it is observed that each of these successes feature a strong leader demonstrating '*constancy of purpose'* (Deming 1994, 51); many of them chose not to accept the way things were done elsewhere in their sector; all of them actively involved the workforce in the change so that the workers were able to become the change. As Deming makes clear, purpose defines the system. All required time and a crisis, to enable workers to understand that management really DID want to hear their ideas for improving the way work (i.e. creating value for customers) is done.

Each of these cases includes a significant system change that upskilled the workers and increased their sense of self-worth, pride in workmanship and the quality of the work delivered. Most of the system changes were stimulated by crisis or a 'burning platform'. WW2 created a production 'crisis' in the US and the 'Training within Industries' program helped unskilled recruits quickly get up to speed and then improve on the performance of the workers who volunteered for military service; in the 1990s in South Africa, Anglo American used a safety crisis to change the relationship with workers so that they felt able to improve much more than safety (much as was done in Alcoa a decade earlier); In Harley Davidson a financial crisis in the 1980s led to the company engaging workers in improving all aspects of the business (just as Toyota learnt to do following a financial crisis in the late 1940s); a leadership crisis on the worst performing US Navy submarine in 1999 enabled a very different approach to leadership and quickly 'turned the boat around'. All of these involved some sort of crisis and a consequent system change that gave workers much more authority and control. All had strong and focused leaders with unique leadership traits such as commitment, quick decision, leading by action, strong advocacy, strong will, perseverance etc. Each improved effectiveness, productivity (with the possible exception of USS *Santa Fe* – how do you measure the productivity of a nuclear submarine?) and reduced costs.

Among other things Harley Davidson shows the value of engaging the whole workforce and acknowledging that people at the workface have information that managers do not. Harley, NUMMI and Favi illustrate the value of pride in work and focusing on quality. NUMMI, Favi and USS *Santa Fe* all illustrate that workers can be trusted when they have the necessary skills and information. Alcoa and Anglo American show the value of worker safety as a starting point for a deeper quality intervention that quickly improves corporate productivity and profitability. Harley, NUMMI, Favi, and USS *Santa Fe* clearly illustrate the value of moving authority to where the information is (rather than the more normal moving information to where the authority is). Workers generally need to *feel* safe to speak up even when managers are actively encouraging it as can be seen in Harley, NUMMI, Alcoa and Anglo American particularly. Building the trust so that people feel safe takes time.

MOVING THESE IDEAS TO CONSTRUCTION

In India much unskilled construction labour travels hundreds of kilometers from communities in other states to work on projects for months at a time. In the Gulf, many unskilled workers travel from Southern Asia for long periods of work. *The whole industry* seems to *find it acceptable* to do little or nothing to improve the working conditions let alone the skills and knowledge of the workers employed. Russell Waugh, Managing Director, Leighton Contractors (India) Pvt Ltd noted in 2011, there are few, if any, companies training workers, "possibly owing to a lack of recognition that *an absence of skill contributes to escalating costs and delays among other things*" (our emphasis). For labour-only suppliers there may be no advantage to improving the literacy and numeracy of such workers, particularly if they are exploiting them using forms of forced labour, bonded labour or debt bondage.

Unless customers have required contractors to provide training, apprenticeships, etc. as part of the contract (as some, particularly public sector, customers do), the only people contractors and some specialist trade sub-contractors invest in are their own staff. Labour only contractors appear to have no interest in training the people they provide to projects, yet industrialisation will require upskilling the whole workforce – improving literacy, numeracy as well as technical and trade skills.

Combining basic education with on-the-job training in trade related skills could be of significant advantage to the general contractor and trades through improved quality of work leading to reduced delays and costs (Mossman and Ramalingam 2021b) – and when the workers return home there will be more that they can contribute in their family and home community. Much of the required basic learning for construction workers is tacit – that is why it is important that it is learnt on-the-job. TWI would be an excellent way to do this.

Why do so many constructors accept that casual, unskilled labour on a complex fast-moving construction site is both *acceptable and safe*? What stops senior leaders acting on the idea that improving skills helps improve quality (by reducing costs, delays, mistakes, etc.) and improve productivity?

DE-CASUALISATION

Green (2011, 60ff) was critical of the effects of casualisation of labor, the hollowing out of construction firms. He describes the outsourcing of functions and associated staff to specialist subcontractors beginning in the early 1970s. "*Especially stark*," he noted "*was the declining number of directly employed operatives in proportion to the number of administrative, professional, technical and clerical employees*." In time the new subcontractors themselves started to rely on labour only subcontractors. Originally intended to push costs down, as Deming (1985,3) predicted it is now pushing quality down and costs up as groups of poorly skilled workers are assembled afresh for each new project. This fragmentation in the sector makes it much more difficult to coordinate the work of people, let alone machines.

It would be easier for contractors and major sub-contractors to directly employ workers if those companies had a steady, 'level-loaded' pipeline of work to keep their employees busy. A level-loaded pipeline requires either a vertically integrated business (as Katera attempted to be) *or* both constructors and their customers to change the way they do business.

In the UK, Laing O'Rouke, a major contractor, believed that it had cracked this problem in the early 2000s and recruited workers from a number of trades. In the global

financial crisis this strategy came unstuck as work dried up. In the Netherlands a house building subsidiary of BAM created a pipeline of work building homes for developers. Developers had to agree to the houose builder's program if they wanted to join the pipeline.

DISCUSSION

Construction is a people business. The pandemic brought in a major crisis. Industrilization and automation exaberate the labour shortage and skilled worker issues. However, even as the sector becomes more industrialised, it will still be a social process. It is vital that machines, algorithms etc. are subservient to the intentions and preferences of people, so that they cannot become the boss (Russel 2021, lecture 4). When every job is automated it will still be necessary to coordinate the work the robots and other systems managed in many different ways to ensure that work is flowing smoothly through the site. At least initially it is likely that specialised robots will be managed by 'trade' specialists. The work of one robot may adversely affect the work of another and the "conflict" will need to be resolved by their handlers. As a number of authors have shown, when you change the technology within a system, you will change the system and, particularly, the social relations, the roles, within the system (e.g. Trist & Bamforth 1951).

What can we learn from corporate success outside construction that might help improve industrialised project delivery in construction? Through inductive reasoning and reflecting on experiential insights, it is clear that strong, committed leaders with a will to change and accept change, leaders with strong advocacy who take quick decisions will be instrumental in bringing a safer and conducive learning environment for the workers, for it is evident that: 1. Workers know more than managers about what needs to be improved in production processes; 2. People are more likely to commit to improvements that they have had a hand in designing; 3. Developing people so that they have the skills and knowledge to act on the information they have at the workface will help them solve problems; 4. Managers can help workers improve the way work works by removing obstacles and by helping them learn to solve problems (and this will help them take pride in their work); 5. TWI is a great way to help workers learn specific manual skills (tacit knowledge) so that they can operate effectively and safely; 6. Building trust, building respect and building the skills of people at all levels in the project team will help deliver construction projects more safely, more quickly, with fewer defects and at lower cost. Each of these is true for Toyota too.

In order to provide predictable production the ability to make reliable promises is critical (Flores 2013). You cannot trust the promise of someone who feels that they must say 'yes' to every request. Saying 'no' takes self-confidence and self-esteem. Education does not guarantee the ability to do that. It does help people understand why that is important and to speak up. And it is not just the unskilled workers who need to change, learn and develop. As the late Sven Bertelsen noted almost 20 years ago (at IGLC 2004), those with the most significant challenge are middle managers. They have to switch from directing workers (telling them what to do) to supporting their learning and improvement; removing whatever limits workers' ability to deliver quality work right-first-time; to helping workers improve their work processes; i.e. coaching, guiding and being consultants to the workers who create the value that the customers want to receive.

As construction projects become ever more complex and as customers want them delivered ever more rapidly with the aid of industrialisation, it is important that construction workers who create and shape the value that customers want from their

investment in the built environment have the skills and knowledge to work effectively "at the edge" (Alberts and Hayes 2002) with the ability to make decisions that support the delivery of the whole project. This is no different from what happens in the military, what happened on the USS *Santa Fe*.

Wherever they are in their organization**, managers can improve the system within which their people work.** What a middle manager can improve is often limited by the constraints imposed by more senior managers. As Prof Dr Myron Tribus wrote in 1988, "***People work in a system. The role of managers*** (and leaders) ***is to work on the system, to improve it — with the help of those who work in it****"* — i.e. emancipation.

In a very small way, in 2009, the first author saw what could be achieved on an enabling project for an opencast mine high on the veld to the east of Johannesburg, South Africa. None of the managers or foremen spoke one language that everyone understood. Three of the six foremen were functionally illiterate, yet together they were able to plan the project using Last Planner System (LPS), deliver it 2.5 months early (despite an extended wet season) and, correctly, tell the engineers that there was a mistake in the design. They planned and replanned collaboratively as a project team.

CONCLUSIONS

Construction is a people business, a social process. Industrialisation will not change this. Industrialisation is one of a number of responses to the global shortage of construction workers. Many workers currently have short careers in construction brought on by the hard labour and physical strength involved and the physical conditions of the work. Industrialisation has the potential to reduce the physical stress on construction workers and extend their construction careers. To build the capacity for unskilled workers to become full players in an industrialised construction sector, they need help to improve their literacy, numeracy and general educational achievement as the basis for equipping them to systematically improve the way construction work is done. This requires changes in the way workers are trained and supported; in the responsibilities they are given as well as the skill development necessary to take that responsibility will require strong willed champions able to lead with *constancy of purpose*, commit to change and act quickly, decisively so that, when appropriate, workers will feel confident to stop production rather than passing on defective product to later trades. This will support (and be supported by) a shift in the roles of middle managers from directing to listening, supporting and coaching. Learning from the cases, this study shows that a leader with 'constancy of purpose' can be instrumental in bringing in such a system change that builds both worker capability and capacity.

OPPORTUNITIES FOR FURTHER RESEARCH AND VALIDATION

To help the sector learn from success elsewhere, this paper is built around a number of challenging and successful cases from sectors other than construction. It is easy to present improvement ideas and claim they have an established theoretical base. We make no such claim. That is a topic for further research.

The opportunities for scholars to work with practitioners to study experiments in this field are significant. Such studies are likely to bring together the skills of ethnographers, anthropologists and other social scientists with construction management specialists to explore the cultural, social, managerial and technological dynamics of the construction sector to help understand how this capacity building can be beneficial to the industry.

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