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Whitepaper

Labor Transformation in the Engineering and Construction Sector through Digital

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The Engineering & Construction sector has always been complex and labor-intensive. A lot of manual work continues to be involved, especially in the construction space in developing countries, adding a factor of uncertainty to this already dynamic sector characterized by volatile returns. In an industry where labor costs account for nearly 12-15% of the total costs (up to 25-30% for construction of residential and commercial buildings), growth in global labor productivity over the years has been among the lowest compared to other industries. Being characterized by a predominantly contracted, immigrant workforce and seasonal work, retention of workers proves to be a tough job. Hiring a skilled workforce, setting up a robust management structure, and keeping them motivated poses huge challenges. In this paper, we discuss how digital initiatives can enable better planning, management and performance of labor in the context of the construction industry.

Digital in the Labor Front

We shall discuss how digital interventions can help improve three major aspects of labor – productivity, hiring & people management, and safety & retention of the workforce.

1. Productivity

Digitization can go a long way in deriving productivity norms and baselining performance metrics for future projects. The multitude of data gathered over the years (via paperwork)-worker skill databases, labor contracts in Contract Management Systems, etc. can be a rich source of data to analyze past performance trends and facilitate forecasting for labor allocation. Rationalization of norms for labor productivity can be done by taking into account actual, on-ground conditions and constraints which affect site performance. For example, low workforce availability can be predicted for specific times of the year based on how factors like weather conditions, seasonality of work demand, and festivals have affected work in the past years. Advanced analytics based on inputs like geography, skill, and experience can help determine optimal skill ratios, which can be incorporated during the finalization of tendering norms.

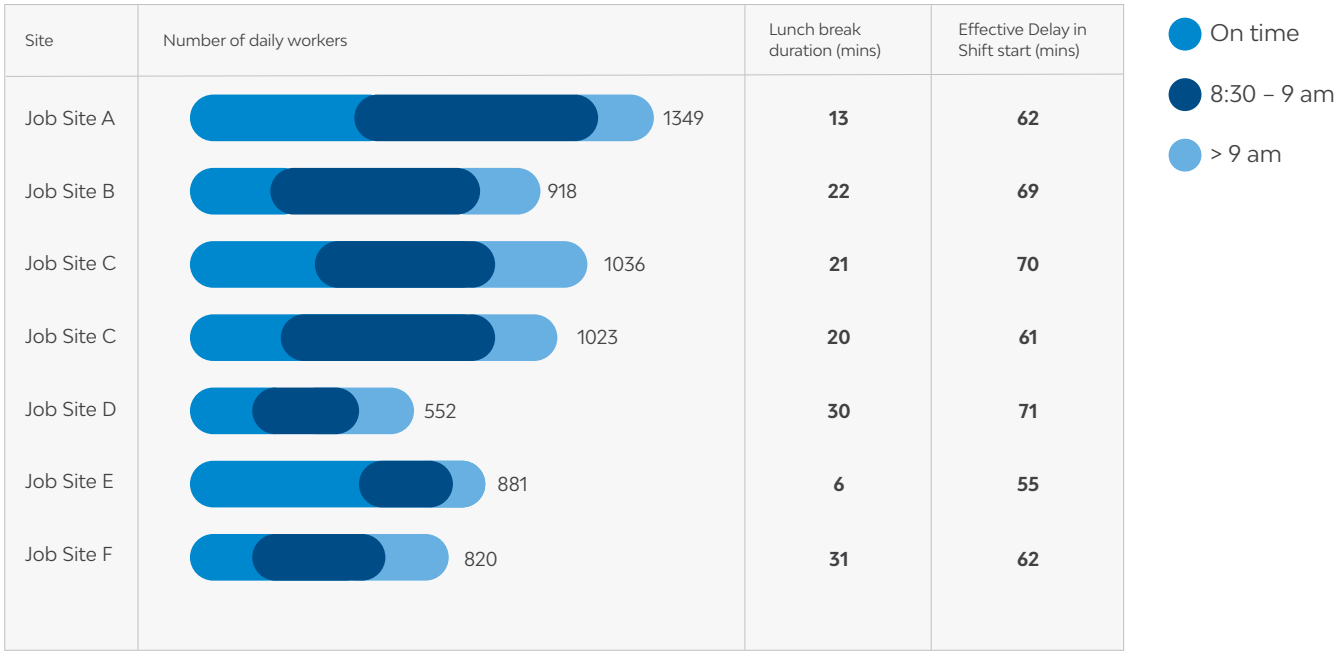
A prerequisite for such mechanisms to work, is the availability of well-captured data on historical work done such as quantities, schedules, and progress – along with worker attendance data. Many project management software and tools have played an important role in scheduling, progress tracking, and execution of various onsite activities. Building Information Modeling (BIM) is a sophisticated tool customized to the construction industry, generating digital models of building plans in 3D. A 4th dimension allows time to be factored in, i.e. schedules and onsite progress, while a 5th dimension permits cost entries which together could be used to predict schedule delays and costs overshoots likely in projects. These tools are usually integrated with the respective firms' ERP databases which house labor deployment data. Labor data is usually in the form of workmen attendance data which can be captured in multiple ways – biometric attendance via thumbprint punching, retina scanning, or RFID.

Advanced technology usage like facial recognition for attendance allows greater efficiency and transparency by preventing 'buddy punching' that is typical of traditional ID card systems.

Workmen attendance data, once incorporated along with progress and schedule, can be used for real-time productivity computation. At a project level, this can provide rich insights to aid better planning, decision-making, and resource allocation for projects, helping revise schedules to target timely completion of projects. If tracked at more granular levels like specific building/tower levels or even specific floors, individual productivity of site engineers or subcontractors could be tracked and corrective action taken if their performance is observed to be subpar. Possible interventions would be to provide specialized training to such workers, probably eliminate vendors that are consistently underperforming, and incentivize site engineers by providing them high-volume structures if they showed good performance.

Biometric data can also be used to maintain punctuality and prevent wasteful manhour losses due to logistical inefficiencies, eventually leading to greater productivity. Biometric punching can allow tracking delays in entry while RFID can help track long breaks or idling. In an industry where maximization of daylight hours is crucial, this data can be very useful for taking action and maximizing productive hours on site.

For example, a construction major used this data to derive insights and implement certain changes on site. It was observed that many workers were arriving late and taking long lunch breaks (Figure 1). On investigating, it was discovered that two reasons for this were long commute distances to canteen and labor colony from work zones and overcrowding at biometric stations at the time of attendance punching.



Site	Number of daily workers	Lunch break duration (mins)	Effective Delay in Shift start (mins)
Job Site A	1349	13	62
Job Site B	918	22	69
Job Site C	1036	21	70
Job Site C	1023	20	61
Job Site D	552	30	71
Job Site E	881	6	55
Job Site F	820	31	62

Figure 1 : Analysis showing delays in entry affecting shift start time

Steps were then taken to have the canteens and labor colonies shifted closer to the work sites; also, bus timings were adjusted to prevent overcrowding, with plans to have a greater number of entry points and biometric stations for some sites. (Figures 2 & 3)

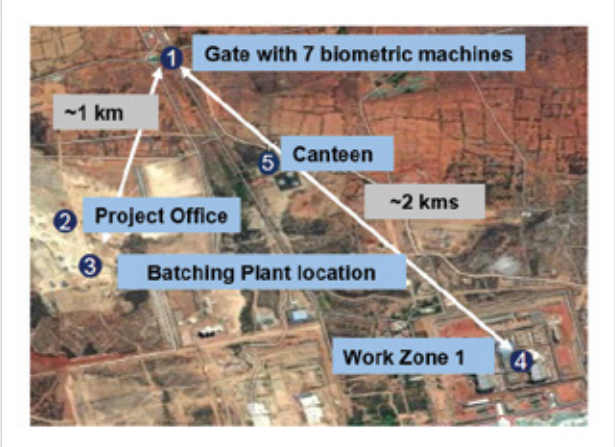


Figure 2: Geo-mapping of site locations to plan for prevention of overcrowding at punch-time

Worker biometrics sign-in time

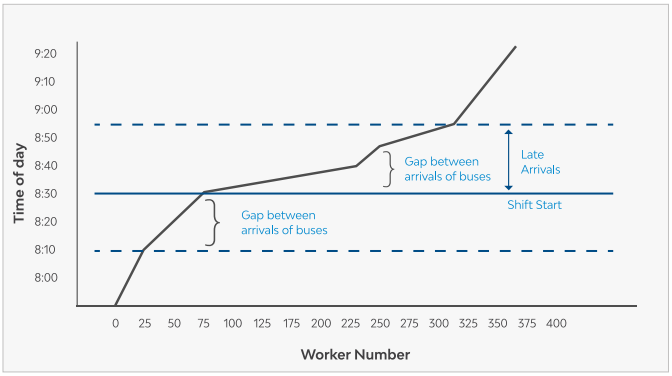


Figure 3: Analysis of biometric attendance data showing bus arrival timing & punch-times

Worker idling (workers on site but not in productive work zones) was also detected using RFID at certain sites. Shift times of workers were staggered at these sites, so that the relevant skilled workmen arrive at site based on when front and material is expected to be available, optimizing their time on site. At times when these constraints prevented them for engaging in productive work, these workers were engaged in ancillary activities like material shifting and housekeeping, thereby engaging in non-core work without much productive value.

2. Hiring & Labor Management

A subcontractor database, if captured and analyzed in a structured manner, can be used as a basis for evaluation of future subcontractor bids and for benchmarking cost estimations. These data-backed figures can place the company in a better bargaining position to negotiate and finalize payment rates. Logging of relevant vendor details like specialization, gang size, work feedback, productivity achieved, rates, etc. by project managers can provide reference points for hiring skilled and quality vendors in future, as per project requirements. This helps create a one-stop portal of collated and relevant vendor information of otherwise dispersed data that existed in the traditional system.

Onboarding vendors can be made more seamless through search engine-based mobile apps, allowing project managers to refer to the HR repository of all vendors hired in historical/existing projects and send out requests for engaging with preferred vendors via the app.

Advanced analytics can help correlate factors like productivity, gang size, core/non-core work

percentages, ratio of skilled to unskilled labor, enabling better decision making. For instance, it may seem intuitive that fragmented and small, specialized laborers bring down the overall productivity because they require more investment of time and resources for their onboarding, management, payments processing, and retention. (Figure 4) Data analytics can not only provide proof of this hypothesis but also helps pinpoint problem areas to work on.

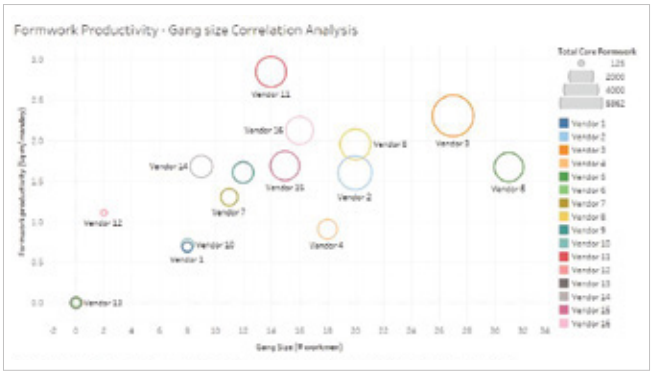


Figure 4: Analysis depicting correlation between gang size, productivity & quantity of work done by vendors

One of our construction industry clients used such data (as shown in Figure 4) to come with an action plan as follows –

i) Started eliminating small gang sizes with low productivity
ii) Incentivized better-performing subcontractors to scale up
iii) Consolidated small subcontractors so they have a common supervisor
iv) Maintained a company-wide mandate to hire vendors only if they can fulfill minimum workmen count, especially for major activities like Concreting, Shuttering, Reinforcement (CSR).

Further, subcontractors with a larger capacity of workers can be pushed to allot larger groups to a few projects rather than having them fragmented over multiple projects. Hiring unit rate subcontractors i.e. one vendor having workmen that specialize in each of CSR activities – can be useful for certain kind of projects where centralized control of large number of workmen is a must. For example, construction of commercial projects often requires fast execution of activities over a vast expanse of space, for which such control can be crucial.

3. Safety & Retention

The ADP Workforce Vitality Index 2017 reported that one of the major but unnoticed problems that affect construction contractors is the high turnover among workers. A large chunk of the workforce comprises of immigrant workers who head back to their places of origin for extended periods and might never return because they have found better opportunities elsewhere. Some structural interventions like preventing extensive payment delays, giving non-monetary incentives like mid-day meals and mid-month token amount payments can prove as incentives for them to stay longer. However, for more sustained impact, it is imperative to address their more intangible needs of safety and conducive work conditions on site, in which digital technology can play a role.

Active RFID technologies with tags installed on the helmets of workers can prevent worker entry into No-Go Zones by real-time presence detection. LoRa is a sophisticated, cost-effective

technology which offers long-range connectivity, allowing larger coverage of even the non-permissible higher-level structures like multistoried towers. Alerts on the project supervisors' mobile apps or portal notify them if any worker enters restricted zones. Bluetooth Low Energy (BLE) beacon is another technology that generates micro location positional data which can be used for ensuring safety of laborers at sites.

However, the construction industry is subject to extensive regulations, especially in developed nations. This makes it necessary to implement tracking solutions and data collection with care, taking into consideration privacy-related rules.

Data from IoT installations (in the form of barcodes on full body harnesses) makes their periodic inspection certain and more efficient. Sensors and beacons on workmen can reveal undesirable fluctuations in heartbeat, pulse rate, and blood pressure that can alert supervisors to take corrective action and thereby prevent incidents. Fatigue and gas detectors, connected to jackets or helmets, provide data on conditions during near misses and safety incidents that might have taken place. New processes could be institutionalized and trainings held, based on this data to ensure such incidents do not happen again, thereby creating safer working zones and improving the safety quotient immeasurably.

Safety apps can be developed and used to record safety compliance processes like Safe to Start checklists and checklists on Occupational Safety and Health Administration (OSHA) standards.

(Figure 5) They can also include health and safety e-training modules, as well as incident videos and guidelines on safety to sensitize workers on possible hazards at the workplace and necessary courses of action.

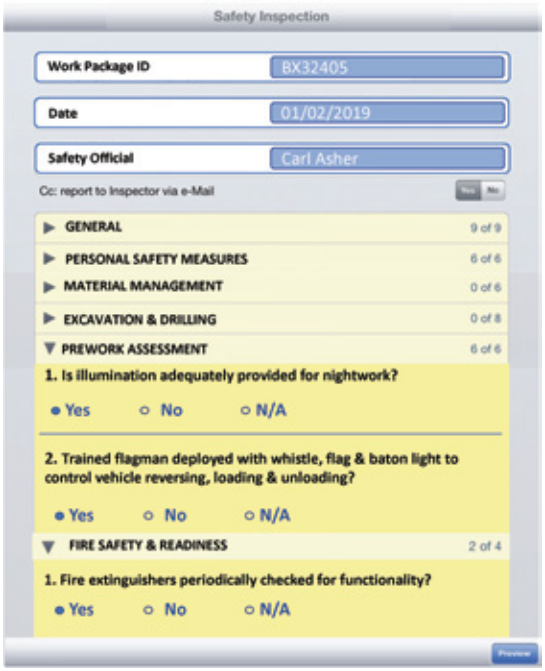


Figure 5: Safety app checklist template

Challenges

For sophisticated and integrated digital systems to provide reliable data, a certain level of digital maturity of the solutions is a prerequisite. A 'digital culture' in the organization should be embedded in its people at all levels, so that they zealously adopt these solutions. A continuous process for improving digital solutions and increasing adoption must be put into place until the data churned out is deemed accurate and stable. A dedicated digital team should be set up to act as a change agent that facilitates a seamless digital transformation process.

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Worker digital solutions, particularly, have their own share of inherent challenges. These digital solutions are highly contingent on human behavior. For example, sharing of helmets with RFID tags or intentionally leaving tags in work zones when away from site can result in misrepresentation of worker availability. Similarly, a good number of onsite activities are categorized as non-core work i.e. activities like shifting, housekeeping, grinding etc., and are not easily captured by productivity tracking solutions. This can result in distortion of data around true subcontractor productivity making it difficult to track overall performance accurately.

The nature of work and the large immigrant worker population often imply that many laborers are on project sites for a few months at best. Employing digital solutions like biometrics, VR based trainings, mobile applications etc. which involve high setup costs to onboard worker information can then prove to be futile, given the scenario of high turnover.

Upkeep of sensors and prevention of their loss is an additional issue as it becomes difficult to track missing tags and sensors with such an ever-changing, contracted labor base. A major firm dealt with this issue by shifting the responsibility of tag management to the subcontractor in-charges and keeping a refundable caution deposit in return for sensors given out to their workmen.

Also, as tracking systems get smarter and more transparent, workers often tend to get smarter and try to find loopholes or tamper with the system in place. The digital team and officers must be wary of this and continually test for solutions to be foolproof, attempting to always stay ahead of the game.

Conclusion

In a sector where cost savings are a priority, many firms may question the cost-effectiveness of investing in technology. What they do not realize is that a one-time investment of money and time can result in sustained benefits for the organization in the long term. Investment in digitization leading to increased labor productivity could help reduce project schedule delays and cost overruns, translating into money in the bank for these firms. Reducing labor costs by 5-10% can lead to a 2-3% increase in the net profits of the company. Though digital solutions in labor may have some limitations, coupled with the right ecosystem and robust tools it can go a long way in bringing about sustained improvements in safety, cost optimization, and project cycle time reduction.

About the Author

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Swati is an Associate Consultant in the Consulting & Thought Partnering (CSTG) BU at LTIMindtree, specializing in Value Realization from Digital . She has worked predominantly in the construction domain, helping clients realize sustained excellence and performance through their Digital Transformation journeys. Swati has done her Masters in Business Administration from IIM, Bangalore.