The Response of the Auckland Construction Industry to Recent Technological Changes

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Aim of the research

To determine:

• The types of technologies that are being used in the Auckland construction industry

• The challenges that construction firms face as they adapt to technology

• The impact of technology on the construction workforce
The New Zealand construction industry is characterised by an ageing workforce and skill shortages (Lobo & Wilkinson, 2008; Tipper, 2012).

The overall trend of an increasingly ageing and decreasingly young workforce presents serious challenges, especially in terms of technology uptake.
Technology uptake in industry

- BIM (Building Information Modelling), Cost-X, VR (Virtual Reality), RFID (Radio Frequency Identification), etc.

Technology Acceptance Model (Davis, 1989).

- Important role of age in perception of technology and willingness to adapt to new technology.
- If an older adult perceives a technology to be difficult then they are unlikely to adopt the technology compared to an adult who is willing to accept the challenges offered by new technology (Charness & Boot, 2016).
Using the Technology Acceptance Model (TAM) as a theoretical framework, the key interrelated factors (perceived usefulness, perceived ease of use, and attitude toward use) were evaluated within a construction context.

**Research questions**

How does the Auckland construction industry respond to recent technological changes?

- What are the types of technologies in Auckland construction firms?
- What are the benefits and challenges of adaptation to technology for construction firms?
- What are the benefits and challenges of adaptation to technology for the construction industry workforce?
Research design

Research approach
Face-to-face surveys

Data collection methods
Questionnaires, followed by Face-to-face, semi-structured interviews

Research sample
Questionnaires: 20 construction workers and 12 managers (M) or people in managerial roles (M/PMRs).
Interviews: 10 managers from different construction firms
Demographic data: Construction Workers

- Site manager: 2
- Site engineer: 4
- Project controls: 1
- Carpenter: 5
- Welder / Fitter: 5
- Crane operator: 1
- Equipment operator: 1

Demographic data: Managers

- Project manager: 4
- Project administrator: 1
- Quantity surveyor: 6
- Mechanical engineer: 1

Area of expertise
Construction workers’ years of experience in the industry

M/PMR’s years of experience in the industry

Research findings
Questionnaire results
Research findings
Questionnaire results

Technologies used by M/PMRs in Auckland construction firms

- BIM
- Virtual Reality
- E-Learning
- PMS
- 3D Scanning
- Aconex
- Auto CAD
- Pipe Stress Modelling
- Procor
- CostX
- SketchUp
- 3D Visual Packages
- Bluebeam
- Co-Construct
- Candy
- Lenture

Number of responses
Research findings
Questionnaire results

Construction workers and corresponding rating of technology adaptation

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Rating (1 - Easy, 5 - Difficult)</th>
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<tbody>
<tr>
<td>18 - 30</td>
<td>2</td>
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<tr>
<td>31 - 44</td>
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</tr>
<tr>
<td>45 - 64</td>
<td>4</td>
</tr>
<tr>
<td>64+</td>
<td>5</td>
</tr>
</tbody>
</table>
Research findings
Questionnaire results

Benefits of adapting to technology for construction workers

- Projects are completed within time
- Improved communication
- Easy access to design information
- Improved accuracy
- Decreased workload

Number of responses
Challenges faced by workers when adapting to technology:

- Need skills to learn how to use the technologies
- Some softwares are hard to learn
- Access and price
- Lack of materials and equipment
- Lack of skilled staff
- Resistance from staff
- Lack of motivation to accept the new technologies
- Affects the interaction of workers in the industry
- Face stereotypes of not being flexible
- Face difficulties adapting to computers

Number of responses:

- Need skills to learn how to use the technologies: 2
- Some softwares are hard to learn: 2
- Access and price: 1
- Lack of materials and equipment: 3
- Lack of skilled staff: 2
- Resistance from staff: 1
- Lack of motivation to accept the new technologies: 9
- Affects the interaction of workers in the industry: 8
- Face stereotypes of not being flexible: 5
- Face difficulties adapting to computers: 8
Research findings
Questionnaire results

Benefits of adapting to technology rated by Managers

- Offset skill shortages
- Easy access to design information
- Decreased workload
- Projects are completed within budget and deadline
- Record of emails, RFI, notices and the subject threads and email types
- Better traceability
- Improves visualisation
- Minimised risk associated with document control (using the correct document)
- Easy planning
- Problem identification
- Easy access to contract information
- Calculators are good
- All communications between client/subcontractors/suppliers are documented
- Contractors kept informed of changes to programme and scope of work
- Better workload management with technologies
Research findings
Questionnaire results

Challenges of adapting to technology as rated by Managers

- Poor attitude towards technology
- Unable to use all the properties of the software
- Resistance from staff
- Face stereotypes of not being flexible
- Lack of motivation to accept new technology
- Training workers and contractors takes time
- Back-up/trouble-shooting help with issue
- Time taken to learn new technology
- Budget for technology
- IT back-up and investment in hardware
- Ability of technology to keep pace old computers/laptops on site
- The tech is inappropriate for task
- Cost of having technology customised to our specific use
- Disagreement on the best use of technologies available
- Lack of resources
- Challenges of adapting to technology as rated by Managers

0 2 4 6
Companies adaptation to technology

**Challenges:** “it will be difficult for people who work in different departments, for example, we do not have access to Candy. It is only available to estimators” (M01). “Finding good software that integrates with other software ... we are still having to repeat data entry in multiple pieces of software without them all managing to integrate” (M06).

**Benefits:** “a project management tool that sends out regular construction updates to all of our subcontractors. When the project manager updates the Gantt chart to reset his days, it notifies all of the subcontractors that the date has been adjusted and gives them a new target date to be on site. Also, a health and safety technology where we have a barcode on our hazard boards at the site entry and subcontractors can sign in using their phones, to scan like a QR code, and that can log onto the site, so we know for health and safety reasons who is on-site at each time” (M07).
Workers’ attitudes towards technology

“the workers are keen to learn and use new technologies as long as the technologies work.”

“I think that people get frustrated when the technology does not do what they expect it to do.”

“Younger workers take less time to adapt to technologies and they usually pick up new technology very quickly. However, old/senior workers may be resistant to using new technologies because they are used to the old way that they usually do things ... they are not comfortable in learning new things” (M02). “The older workers take time to adapt to, but the younger workers can easily adapt to technology” (M08).
Main challenges for workers

**Availability of time to train/practice:** “...need to take time off...it is difficult because projects usually have limited time to be completed, so taking time off from work to do training may have a negative impact on project completion” (M10).

“the lack of practice [is another concern] ... because if you learn the new technologies and do not practise, you can forget easily” (M04).

**Technical obstacles:** “we have ordered software from the United States and so one challenge with that is the time zone. Are we getting the right level of customer support?” (M01).

“The workers are usually used to emails, but now when they have to send emails through another technology or application like Aconex, it becomes really difficult coz you have to focus on two different criteria to send emails” (M08). This is mainly challenging when “some people, particularly the older people in the workforce who have a lot of construction experience, are not so quick to adapt to technology” (M07).
Strategies to overcome, reduce and eliminate challenges

Providing training would help immensely.
“I think the way to equip me with new technology is to do more training ... firms need to invest in more resources such as booking training for employees and allowing them to take time out to do training. I think the company should give incentives to workers learn new technology” (M01).

Running in-house training sessions in an attempt to address ongoing problems.
“Probably not universally or coherently, but we as a business try and support people when they have the challenges with the technology in terms of running small training sessions within the business and trying to use as much of the customer support from the technology inventors to get their assistance whenever we need it” (M06).

Other quick solutions involved getting extra support.
“we usually contact the person who is responsible for the technology and if anything goes wrong, we just have that contact person within New Zealand whom we can keep in touch with and he comes and helps us on where we have gone wrong” (M09).
Conclusions

The Auckland Construction Industry (ACI) is capable of adapting to technology. Benefits include increased efficiency and communication.

Training & Development: Professional development time is crucial to ensure employees’ upskilling in these technologies.

ACI’s Response to Technology

Technology Divide: Older construction workers’ pre-existing perception that learning new technology is difficult acts as a barrier to technology adaptation.

Challenges: The lack of available time and resources and software support could have an impact on companies’ growth.


