

# Knowledge and skills gaps of young workers in port engineering and operations: a case study of Makassar New Port

## Introduction

The Makassar New Port was built in 2015 as a national strategic project to improve the maritime capabilities of Indonesia. It is designed to become the largest port facility outside of the island of Java and represents a great opportunity to provide job opportunities for young people in the province of South Sulawesi.

The port is located in an area with a large agricultural base and an industrial zone with huge potential to drive economic growth and encourage more efficient trade of goods. It needs to be supported by good infrastructure and significant investment in human resources. This study examines the education, skills and training needs in two specific areas - port engineering and port operations.

These are two highly specialised professions. Operational workers work in the port operations, while engineering workers work in the construction and port facilities section, such as civil engineers. The study does not consider mechanical or electrical engineers who maintain operational equipment.

Young people already make up the majority of the workforce at the Makassar New Port with more than 12 percent of port workers between 15 and 24 years of age. It increases to half for those aged between 25

and 40 years old. This study explores the knowledge and skills gaps of young workers' in both areas and compares them with the industry's expectations.

The research team surveyed port workers who mentor entry-level graduates, fresh graduates, port entry-level employees and stakeholders - particularly senior managers from MNP, Biringkassi Port in Pangkep (a smaller port north of Makassar) and cement company PT. Semen Tonasa. The mentors provided insights into what knowledge and skills they expected from their young port engineering and operations workers.



Image: [Indonesia Shipping Gazette](#)

## Findings

Employers felt that graduates generally have the basic knowledge acquired from degree programs such as a Bachelor of Mechanical Engineering. Current port capabilities and technical knowledge were considered fair. But young workers needed to gain the necessary specialist skills that required further training and certification.

Local vocational education and higher education institutions should update and internationalise their port operations and management curriculum. They should incorporate relevant topics into existing programs, create new subjects to respond to new areas of need or create streams to allow students to specialise in port engineering and operation. The curriculum should also embed soft skills like problem-solving, critical thinking, leadership skills, software and programming and ethics.

For port operations, employers are interested in professional certification in port operational management, logistics and supply chain. They identified specific skills for operating equipment,

operational maintenance, container terminal operations, occupational health and safety, information technology, data analysis and entrepreneurship.

For port engineering, employers are interested in professional certification in Building Information Modelling, construction modelling, port construction and construction management, digital-based multimedia, automation, mechatronics, port operational tools and Safety, Health & Environment.

Managers identified a range of 'soft' or intelligent skills in foreign language proficiency, knowledge of regulations, work ethics, adapting technology, problem-solving, leadership, negotiation skills, presentation skills, time management and communications.

## Challenge

The industry is dominated by men and this can be seen in the survey respondents with 75 percent of workers in port operations and 89 percent in engineering identifying as male. Although the port industry provides equal opportunity it remains male dominated, which raises questions about how to create an inclusive learning and working environment for women and people with disabilities. Under representation of women or minority groups perpetuates the notion that they are not suited for careers in the industry.

There needs to be increased visibility of the profession and its different work roles to attract people and also signal the kinds of skills required to have a career in the industry. Hearing from leaders and people in port operations and engineering, and explaining the important role that the port industry has in the national economy needs to start from the early stages of education.

Overall there is the perception that young workers skills are reasonable,

however gaps occur in many levels of specific knowledge. As an example the study found that for port engineering these are areas such as ships, hydro oceanography, port layouts and dock facilities. For port operations the special competencies or hard skills considered to be lacking include capabilities around the ability to calculate optimal port capacity, operational capabilities such as Reach Stacker (RS), a driver's licence (SIM) type B1 and B2, ship guiding, equipment maintenance and practical skills in the field.

Aside from the specific technical skills required, there is also a need to develop emotional skills and critical thinking, for example, in communication, leadership, discipline, responsibility, work ethics, teamwork, innovation and self-development. The need to develop self-confidence was identified by both managers and young workers to be important but lacking.

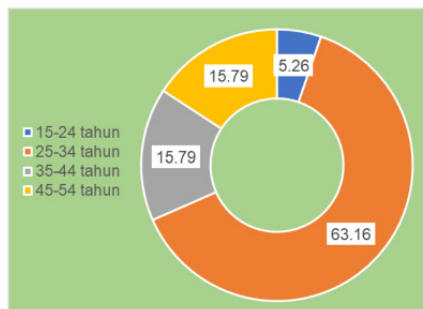


Figure: Age range of engineering workers respondents

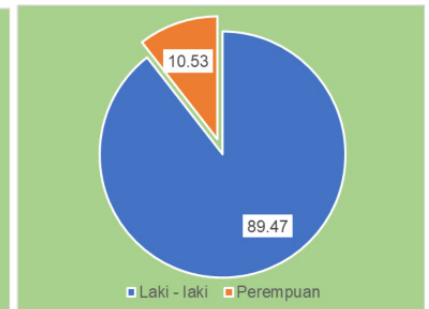


Figure: Gender distribution of engineering workers respondents

## Recommendation

Develop short courses in vocational education and update existing curricula to meet the training needs of young people and the skills requirements of port operators. Provide facilities and course schedules and tools that support women and minority groups to pursue careers in port operations and port engineering.

## A way forward for policymakers

Introduce certified short course training in vocational education and higher education to address the port operation and engineering skill gaps in the following areas:

Port operations - training on equipment, including equipment knowledge, loading-unloading equipment operation, operational capabilities, and equipment maintenance (requiring certification). Ship operating procedures and navigation. Port management and operation: container terminal operation, calculation of demand and capacity of port services, pier berth occupancy ratio, market knowledge (supply chain), and logistics. Maritime regulations: including safety regulations, safety and health work environment and regulations for protecting the marine environment.

Port engineering - Port construction and management: including port development master plan, port construction and construction modelling, construction management, project management, port business venture, international ports, port services, Safety, Health and Environment, building information methodology and lean construction.

Port operation: operational tools, automation, mechatronics, crane machinery, container handling skills. ships and ship navigation.

Port design: hydrographic and bathymetric survey, hydro oceanography, port layouts, breakwaters, shipping lanes, harbour pools, jetty construction and dock facilities, fenders. Port structural design: foundation engineering, land and topography survey, structural design.

The Ministry of Education, Culture, Research & Technology encourages internship programs in port operations and port engineering, both in the office and in port facility development projects, through its “Merdeka Belajar Kampus Merdeka” (MBKM) program. Universities also partner with ports to develop internship opportunities.

## A way forward for education institutions

Higher education institutions and polytechnics can update the curriculum in the following areas.

Port operations - Operation of loading-unloading equipment, knowledge of equipment for operational permit (Surat Izin Operasi), operational capabilities (such as reach stacker), equipment maintenance, and container terminal operation. Ship guiding, ship operating procedures and navigation. Port management and operation, estimation of Pier Berth Occupancy Ratio, demand and capacity of port services, market knowledge (supply chain), logistics. Maritime regulations, including safety regulations, safety and health work environment, environmental protection

Port engineering - Port development master plan. Port construction modelling, project management, port business venture, international ports, port services, Safety, Health and Environment. Port operational tools, automation, mechatronics, crane machinery, and container handling skills. Ships, ship navigation, mooring. Hydrography and bathymetric survey, Hydro oceanography, port layouts, breakwaters, shipping lanes, harbour pools, jetty construction and dock facilities, fenders. Foundation engineering, structural design, land survey, topography. Building Information Modelling and lean construction, artificial intelligence. Advanced port engineering.

Update the curriculum by adding topics such as design problems in port structures into existing civil and environmental engineering courses. New subjects should be created if the knowledge gap in specific areas is significant. Create new specialisations that allow students to complete relevant subjects in port engineering and operation.

Embed soft skills into the curriculum. Priority areas identified by the industry include English Language proficiency, presentations, problem-solving skills, critical thinking, interpersonal skills, leadership skills, software and programming, and adapting to technology and ethics.

Universities and polytechnics should consider partnerships with Australian education providers to enhance their offerings and internationalise their student experience through joint or double degree arrangements.

## Project team | Authors | Partners

Prof Alexander Babanin (University of Melbourne), Prof Muhammad Arsyad (Universitas Hasanuddin), Dr Elisa Lumantarna (University of Melbourne), Prof Abbas Rajabifard (University of Melbourne), Dr Agustinus Ribal (Universitas Hasanuddin), Dr Ilham Alimuddin (Universitas Hasanuddin), Dr Georgina M Tinungki (Universitas Hasanuddin), Dr A Ildha Dwi Puspita (Universitas Hasanuddin), Hedi Kuswanto (Universitas Hasanuddin), Rafika Nurul Hamdani Ramli (Universitas Hasanuddin), Dr Eugene Sebastian (Australia-Indonesia Centre), Helen Brown (Australia-Indonesia Centre), Kevin Evans (Australia-Indonesia Centre), Febi Trihermanto (Australia-Indonesia Centre), Steve Wright (Australia-Indonesia Centre)



### POLICY PARTNERS:

