ADVANCED FIBRE CLUSTER GEELONG

DEVELOPING A WORLD-CLASS WORKFORCE

Advanced Fibre Cluster Geelong: Towards 2025

CONTENTS

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EXECUTIVE SUMMARY

The vision for the Advanced Fibre Cluster Geelong (AFCG) is to accelerate the growth of its industry in a highly innovative engineering field of composites and advanced manufacturing technology. To meet this vision the AFCG is seeking to understand the workforce development requirements needed to meet technology advances to sustain and accelerate growth. The Gordon TAFE, together with Skilling the Bay, was engaged to support the Cluster to determine the workforce composition and training development needs including future workforce requirements.

Extrapolating on research undertaken by literature review, stakeholder interviews and an industry workshop, the report outlines key themes and emerging findings in relation to the AFCG workforce, including:

- areas of strength
- key gaps and challenges (opportunities)
- areas of commonality (overlap) and specialisation
- future training and workforce development needs
- attraction, recruitment and retention.

In order for the AFCG to realise its vision and for the region to build a capable and competitive workforce to sustain and grow the advanced fibre sector, the following strategies have been identified for consideration and action.

Cluster approach to develop a pipeline of talent and skills

- Awareness raising programs
- Pathways programs
- Graduate recruitment programs.

Collaboration and knowledge sharing

- Discovery or learning series programs.
- A cross cluster mentoring program towards leadership development or specialised technical roles.
- Multi-disciplinary approach to problem solving.

Micro-credentials to maximise learning and skills development

Recruitment strategies

- To support overseas recruitment campaigns for specialist skills.
- To better promote employment opportunities to women and increase female participation.

Pooling of resources for specific and highly skilled activities

- Shared quality and testing.
- Research and development.

Champion the principles of Life-long learning

In order to develop a world-class workforce the following recommendations have been developed for consideration by the AFCG to work with its members to take a staged approach to implementation and prioritise as necessary.

- Develop a sustainable local workforce to provide access to skilled and agile workers (talent).
- Support member industries to enhance their capacity to grow and thrive.
- Raising awareness of advanced manufacturing as an attractive career and business opportunity.

CONTEXT

The Advanced Fibre Cluster Geelong (AFCG) was formed by a group of highly innovative Geelong companies, with the goal of establishing the region as a global centre of excellence for advanced fibre and composites innovation. The vision for the AFCG is to accelerate the growth of industry in the highly innovative engineering field of composites and advanced manufacturing technology.

To meet this vision the AFCG is seeking to understand the skills required, and potential training needs for Cluster industry members. This will assist in understanding the workforce development requirements needed to meet technological advances and sustain and accelerate growth.

The Gordon TAFE, together with Skilling the Bay, was engaged to assist Cluster members to develop a deeper understanding of the current skills and training needs and future requirements of the industry in order to further build capability in the region.

This report provides an overview of workforce composition and development needs and the future workforce requirements of Cluster members. It provides recommendations and opportunities (actions and strategies) for developing a world-class workforce in advanced fibre and composites manufacturing in Geelong.

BACKGROUND

The AFCG is the evolution of the colocation of companies and research facilities in Geelong's carbon fibre and composites manufacturing precinct. The precinct, centred on Deakin University's Waurn Ponds campus, includes manufacturing operations for several companies who supply to a wide range of markets including automotive, aerospace, industrial, sporting goods, medical and defence.[1]

The Cluster was incorporated in 2018 and officially launched in early 2019. The appointment of a CEO in May 2019 demonstrates the local commitment to high value advanced manufacturing that is competitive, profitable and sustainable in the region.[2] The Cluster's founding members include Deakin University/Carbon Nexus, Geelong Manufacturing Council (GMC), the City of Greater Geelong, Carbon Revolution, Quickstep Holdings Ltd, Sykes Racing, Andritz, Austeng and the CSIRO. The membership also includes ACS Australia, GMS Composites, HeIQ, Sage Automation (formerly ICT), Partington AE, The Gordon TAFE and Urban Service Solutions. The Cluster also benefits from Victorian Government investment and support through the Department of Jobs, Regions and Precincts, and is estimated to generate $600 million in increased economic activity in the Geelong region and $741 million in Victoria overall.[3]

1 https://www.carbonnexus.com.au/industry-solutions/a-carbon-fibre-precinct, accessed 17 March 2020
2 https://www.deakin.edu.au/about-deakin/media-releases/articles/deakin-welcomes-new-advanced-fibre-cluster-geelong-ceo
3 https://www.deakin.edu.au/about-deakin/media-releases/articles/deakin-welcomes-government-support-for-advanced-fibre-cluster-geelong, accessed December 2019

PURPOSE

This report provides an overview of the current and future workforce development needs for the AFCG in order to sustain and accelerate growth of member organisations in the highly competitive composite and advanced manufacturing sector.

The report will be used to inform short, medium and long-term strategies to attract, retain and train (upskill) a world-class workforce capable of servicing a global centre of excellence for advanced fibre and composites manufacture.

Extrapolating on research undertaken by literature review, stakeholder interviews and an industry workshop, the report will outline key themes and emerging findings in relation to the AFCG workforce, including:

- areas of strength
- key gaps and challenges (opportunities)
- areas of commonality (overlap) and specialisation
- future training and workforce development needs
- attraction, recruitment and retention.

METHODOLOGY

A Literature review was undertaken to provide background and context regarding the Advanced Fibre Industry/Sector and key features of manufacturing using advanced fibres and composites.

Selected Cluster members were invited to provide input into the development of the report via semi-structured interview. Interviewees were asked a series of questions in order to understand their respective organisations' current and future workforce development needs. Interview questions were designed to gain an understanding of the workforce composition of Cluster organisations and the common and distinct workforce development needs.

Interviews were conducted in December 2019, and the emerging findings of these were tested and validated at a strategy workshop in February 2020. Stakeholder feedback, comments and observations have been incorporated into the findings and recommendations of this report.

THE BRIEF

- AFCG vision for the region to be a global centre of excellence.
- Accelerate growth of industry in the field of composites and advanced manufacturing technology.
- Gain a deeper understanding of members' current skills and training needs in order to build capability within the region.
- Gain industry input on emerging workforce development and training needs.
- Make recommendations as to the common and distinct workforce needs across the cluster.

UNDERSTANDING YOUR COMPANY

Interview Questions:

Please tell us a little bit about your company

1. How long has the company been operating?
2. What is the company's vision and purpose?
3. What are your products and services?
4. Who are your customers? And what is your market?

Workforce composition

5. How many staff do you currently have in Geelong? At other site operations?
6. What is the current composition of job roles? I.e. What are the types of jobs you currently have?
7. What are the typical skills and/or qualifications required for those job roles?

Recruitment and retention

8. How do you recruit staff now?
   a. Are there any positions which are difficult to fill? Why?
   b. Which skills are in most demand?
      i Technical?
      ii Soft Skills?
9. What are the general terms and conditions of employment for your staff?
   a. General hours of work – shift patterns?
   b. Breakdown of ongoing, part-time, contract and casual roles?
10. What type of training and development do you currently provide?

The Future

11. What are the short, medium and longer-term goals for your organisation?
12. To achieve those goals what skills and knowledge will your workforce require?
    a. What skills would add value to your future operations?
13. To ensure your business is viable and sustainable what are the business skills and acumen that will be required?
14. Thinking more broadly about the industry sector in Geelong.... What do you think will be necessary to reinforce the region as a global centre of excellence for advanced fibre and composites innovation?

ADVANCED FIBRE SECTOR

Geelong has a long history as a manufacturing hub for wool, textiles, clothing and footwear. Over a century, the city grew and evolved as textile manufacturers established themselves in the region, driving an enviable reputation as a world-leading Textile, Clothing, Footwear and Leather (TCFL) industry hub; with the likes of Godfrey Hirst, Huyck Wagner (now Andritz), Rip Curl, Quicksilver and Grosby Shoes becoming synonymous with the Geelong region.

In the early 2000s, Geelong's TCFL industry had an estimated turnover of $440 million, employed over 2,150 people directly by over 60 businesses and a further 2,838 indirectly. The industry contributed almost $70 million in wages and salaries annually to Geelong's economy and accounted for 14.2% of Geelong's total manufacturing workforce, in comparison to the Victorian figure of 8.9% and the national figure of 7%. During this time Geelong also became known for its heavy industry manufacturing base with Ford, Alcoa, Shell (now Viva) and numerous engineering firms, based here for many years, employing large numbers of local residents, directly and indirectly through their local supply chains.

In the years since, with increasing competition from overseas and the removal of high tariff walls, traditional fibre and textile manufacturing declined and, as a consequence, the Geelong economy has undergone significant transition.

However, with a significant focus on research and development, new manufacturing opportunities arose, particularly in the field of composites and advanced fibres. Building on regional capability and ingenuity, and in deep collaboration with Deakin University, this emerging industry has established a world-leading range of products, technologies and manufacturing techniques, new and old businesses are innovating, collaborating on projects, and challenging one another.

Cluster member companies and organisations are focused on growing the advanced fibre and composites centre of excellence that the Geelong region has come to represent. With unique capabilities, the Cluster members are a leading example of an advanced manufacturing ecosystem supported by "...a highly skilled workforce, stable and open government and a sophisticated research sector engaged with innovative companies with a global orientation."[4]

Today the Manufacturing sector makes the greatest contribution to economic output in the region, which at $7.1 billion accounts for 22.45% of total output.[5] The sector accounts for 8% of regional jobs, with 5.7% employed in traditional manufacturing and 2.3% in advanced manufacturing. Data also indicates that workers in this sector generate value add of $1.1 per worker, the highest contribution per worker of any sector in the region[6]. Advanced manufacturing also contributes significantly to Victoria's overall regional exports, providing 19.9% (or $22,688 million) of $114 million total exports[7].

4 https://www.aumanufacturing.com.au/weve-only-scratched-the-surface-of-the-opportunity
5 https://app.remplan.com.au/geelong/economy/summary?state=3J4oF3J7dSWv81oHek7Mq6FRhVh4I5)
6 REMPLAN Output Report - Productivity, Report 26, created 7 April 2020.
7 REMPLAN Regional Exports Report, Report 21, created 7 April 2020.

ADVANCED FIBRES EXPLAINED

The AFCG originally grew around carbon fibre and composite activities, and expanded to encompass broader advanced fibre and materials research, engineering, commercialisation and industrialisation. Significant opportunities exist to develop materials and products which are lightweight, highly durable and adaptable, and more environmentally sustainable.

> **"Advanced Fibres can be ultra strong, light weight and even intelligent, and they are an important part of the future for new modes of transport as well as new assistive and wearable technologies that augment the body's natural physical abilities.[8]"**

Carbon Fibre

Carbon fibre composite products are lightweight, and strong, and widely used in automotive, aerospace, high performance sports, oil and gas applications, in construction, and the renewable energy sector. The strongest carbon fibres are ten times stronger than steel and eight times that of aluminium, as well as being far lighter than both materials, 5 and 1.5 times respectively.

Carbon fibre can be defined as long, thin stranded material composed primarily of carbon atoms, specifically, any fibres with a carbon content of 90% or more fall into this category. Commercially carbon fibres are available in various forms and are easily manipulated, making them highly malleable and versatile for both the production and manufacturing sectors.[9]

When bonded together, typically using a resin polymer source, the result is a material stronger than both steel and aluminium yet lighter in weight and with superior fatigue properties. This combination of the carbon fibre with resin is referred to as a carbon fibre composite as is the typical medium used in manufacturing and production.[10]

Composites

When carbon fibre is paired with a resin it creates a highly malleable material that is both lighter in weight, vastly stronger and more corrosion resistant than typical metallic structures.[11]

Carbon-fibre composite materials are most suited for use in structures where high strength and light weight are preferable. Some common examples are air and spacecraft structures, automobile components, golf club shafts, fishing rods, bicycle frames and sailboat masts, however, carbon fibre use is growing in both the medical and sporting fields with the innovation of prosthetics and game equipment.[12] Composites and advanced fibre technology is in demand across various industries, such as aerospace, global mobility (electric vehicles and urban air mobility), medical, assistive technologies to support people with disability, even civil and commercial construction where carbon fibre reinforced concrete has potential to increase the life span of concrete and wooden structures (where concrete cancer is now a major issue).[13]

8 https://www.aumanufacturing.com.au/weve-only-scratched-the-surface-of-the-opportunity
9 https://www.sciencedirect.com/topics/materials-science/carbon-fiber
10 https://www.icis.com/explore/resources/news/2009/08/18/9240951/sports-is-a-key-market-for-carbon-fiber/
11 http://zoltek.com/carbon-fiber/what-is-carbon-fiber/
12 http://www.innovativecomposite.com/what-is-carbon-fiber/
13 https://www.aumanufacturing.com.au/weve-only-scratched-the-surface-of-the-opportunity

ADVANCED FIBRE CLUSTER ORGANISATION SUMMARIES

Andritz

The Andritz manufacturing plant Geelong has been operational for the past 50 years, previously operating as Huyck Wanger, with Andritz acquiring the company in 2018 as part of the formation of Andritz Fabrics and Rolls (as a result of a merger with Xerium).

The Geelong plant specialises in press felt production, supplying paper machine clothing (a consumable product for the papermaking industry) for Australian and International markets. Andritz (Geelong) is capable of manufacturing 140 felts per month, with supply to Asia accounting for 45% of sales. Andritz's main clients are Reflex Maryvale Mill located in Victoria's Latrobe Valley, ABC tissues and Orora Global a packaging company. In the year 2016, the profit grew by 20% earnings before interest and taxes (EBIT).

Andritz Geelong is part of a multi-national group of advanced manufacturers, employing 29,000 worldwide, with its head office in Graz, Austria.

The Geelong plant employs approx. 90 staff, (comprised of 70% new employees and 30% remaining from the Huyck Wanger operations). The site operates with 90% as full-time staff, 6% part-time and 4% casual employees. Eight employees work in logistics and customer service and one employee working in the IT department. Since the company specializes in felt manufacturing most of the employees are hired from the fields such as electrical, mechanical and chemical engineering. There are two shift patterns followed by the company throughout the year the first is 25x7 and 25x6. During the 25x7 shift pattern, the employees are 12 hr rotation with 2 on and 2 off. When running 25x6 the employees work three 8 hr shifts in a week. The plant produces 140 felts per month, which typically lasts 30 to 90 days. A key feature of felts produced by Andritz is there longer duration.

Austeng

VISUALISE. ENGINEER. DELIVER.

Austeng is a boutique engineering company, operating for more than 30 years it previously supplied specialist production equipment for the automotive industry. In recent years, the company has transformed; building on its strengths in design, engineering and development of customised machinery, it is now recognised for its capability to bring ideas and research to fruition, in prototype development and production. The company has steadily increased revenues, from $5 million to $6.5 million in 2019, been involved in several innovative collaborations with Deakin University in the advanced fibres sector and has recently invested in 8 Victorian companies.

Austeng currently employees 22 staff comprised of engineers, draft persons, trades (boilermakers and fabricators). Austeng utilises sub-contractors with electrical and drafting expertise and has an apprentice undertaking general fabrication. Recruitment occurs via agencies and websites such as SEEK. In-demand skills and experience include the ability to read and develop technical drawings, manufacturing understanding, engineering software modelling, business acumen, negotiation and interpersonal communication skills.

Carbon Nexus

The company was established in 2014 as an open-access carbon fibre/composite research facility, manufacturing carbon fibre solely for R&D purposes. Carbon Nexus collaborates with manufacturers and other organisations to test carbon fibre and advanced materials composites. The site is open 24hr, 5 days a week with members running a pilot line of carbon fibre, and employs a small team of contractors and casual staff. The facility typically employs PhD students in Engineering, Engineering postgraduates and laboratory technicians. Carbon Nexus requires staff with in-depth knowledge and skills in carbon fibre properties and carbon fibre testing. One of the main objectives of the company is to develop technology to effectively deal with carbon fibre wastage recycling in Australia. This also includes developing technology which lowers the cost of carbon fibre manufacture for market.

Carbon Revolution

Carbon Revolution was founded in 2007, in Geelong, to develop and commercialise single-piece carbon fibre wheel technology developed by the Company's founders. The Geelong-based company worked to commercialise research and development and new innovations in carbon fibre, with potential applications across a broad range of industries, to successfully manufacture high performing, lightweight wheels for the global automotive industry. Carbon Revolution achieved its first commercial contract with Ford Mustang (in 2014) and has since secured contracts to supply carbon fibre wheels for Ferrari and Renault. Carbon Revolution was listed on the Australian Stock Exchange in November 2019 and has annual revenue expectations of $54million. It is also looking to diversify and was recently awarded a $2.4 million grant to make lightweight carbon wheels for a Boeing helicopter.

There has been significant investment in the manufacturing plant located within Deakin University's Waun Ponds campus and the company is in the midst of a massive growth phase. The company is focused on increasing production and reducing production costs, through increased industrialisation and automation of processes, to increase production from 12,000 wheels per year in 2019 to 32,000 wheels per year in 2020. To date Carbon Revolution employees over 490 staff, however, with ambitious production targets, the workforce is expected to grow to 1000+ employees in the next few years. The workforce is comprised of X% blue collar roles in engineering, trades and operations and a further X% white-collar business and administration roles. The company is focused on recruiting diverse talent, both in Australia and overseas for specialised roles requiring advanced manufacturing experience and skills and utilises a mix of recruitment agencies. The workforce constitutes 15% female employees and is primarily a younger workforce with 60% of the employees under the age of 40. The company has employed engineers from different sectors such as mechanical, automotive, aeronautical, electrical and industrial.

Sykes

Sykes is a leading manufacturer of world-renowned rowing shells, founded by Jeff Sykes in 1966. Four Olympic Gold Medals and over 30 other medals at Olympics and World Championships stand as a testament to the excellence in design and quality of manufacture of racing boats which continues at the Geelong plant. Sykes employs approx. 50 staff, with a large team of engineers, skilled tradespeople, CAD designers, Finite element analysis experts and some of Australia's finest carbon fibre production staff. Sykes also employ Engineering Interns and Apprentices and are always looking to employ apprentices in marine craft and composites manufacturing.

In 2013 Sykes established a dedicated facility in China for production of Australian designed boats the 'Initiator' Single Scull range, with the Geelong facility focused on design, manufacture and repairs of Sykes Racing boats. For over 30 years, Sykes has built expertise in the field of advanced fibres, designing and manufacturing products using composite materials such as Carbon Fibre and Kevlar. Sykes continue to expand their expertise and knowledge and is actively involved in applying this expertise in other growth sectors including defence, transport components, construction, medical technology and new energy technology.

Quickstep Holdings Limited

Quickstep specialises in advanced composites manufacturing for the aerospace and defence industries. Operations are located in Geelong, at Deakin University's Warn Ponds campus which serves primarily as a research and development (and demonstrator) facility and the company is headquartered in Bankstown NSW which is a larger advanced manufacturing facility dedicated to the defence aerospace sector.

Quickstep listed on the Australian Stock exchange (ASX: QHL) in 2005, and is the largest aerospace-grade advanced composite manufacturer in Australia, with an annual turnover of $73.3 million in 2019.

The Geelong R&D and demonstrator facility, established in 2015, employs 10 people and is focused on engineering and build to specification projects for trialling and low volume production. Products manufactured in Geelong by Quickstep include, a carbon fibre chassis for the Micro-X portable x-ray device and carbon fibre wheelchair access ramps for Lockelec, used by the Victorian rail services.

With 260 employees in Bankstown the organisation has strong advanced composites capabilities in a range of areas, however, recognises the need to continually develop staff introducing an in-house Learning Academy. Quickstep currently recruits staff via agencies and SEEK, and has sought workers from the aerospace and automotive sector and via the Skilled Work Visa program for highly specialised skills. Operating a defence secure facility and manufacturing parts for the joint strike fighter requires a highly competent and skilled workforce able to meet the demands of the strictly regulated defence sector. In the future Quickstep is seeking to diversify and expand its operations to also service the commercial aerospace market.

WORKFORCE NEEDS - WHAT WE DISCOVERED?

Organisational context

The AFCG is comprised of a diverse set of organisations and businesses servicing domestic and international markets.

- The organisations typically operate in a high precision environment and utilise a workforce comprised of highly qualified researchers, engineers, and trained industry specialists.
- Workforces are typically male dominated, however all organisations expressed a desire to increase diversity in the workforce and lift the number of females employed in the sector.
- Most organisations operate 24hrs, with various shift patterns in order to meet client demand and service overseas markets.
- Each organisation incorporated research and development activities, and elements of commercialisation related to product manufacture.
- Organisations currently operate using a mix of manual and automated processes. All expressed a desire to increase the use of automation, robotics and better utilise the internet of things (IoT) to increase productivity.
- All organisations were cognisant of the need to create and foster a positive workplace culture and placed an emphasis on finding employees with the 'right fit' for their organisations on equal if not above 'technical' capabilities.

Job roles

The most common job roles across member organisations are:

- Engineers - mechanical, manufacturing, automotive, aerospace, electrical and industrial
- Operators
- Trades – metal fabrication, electricians, machinists, fitters and turners
- Laboratory and test technicians
- Logistics and supply chain
- Team leaders, supervisors and managers
- PhD researchers and interns.

In each organisation there is a smaller number of accounts, IT specialists, administration and international trade analysts.

Less common, and more difficult to fill roles include:

- Materials and processing engineers
- Quality engineers and quality assurance officers/staff
- Mechatronic engineers
- Industrial designers
- NDT (Non-Destructive Test) technicians
- PMM (Precision Milling Machine) operators
- Marketing and communications.

SKILLS REQUIREMENTS

For the purpose of this report it is beneficial to discuss the Cluster's workforce skills requirements by referring to specialist technical skills and broader transferable skills, often referred to as soft skills or in the training sector employability skills.

Specialist Technical Skills needs common across the Cluster, include:

- Automation engineers
- Chemical engineers
- Industrial engineers
- Material Machinists – moving from material to metal
- Mechanical engineers specialising in composites
- Process engineers.

Further in-demand skills, for fewer job roles, include:

- Engineers with automotive and aerospace experience
- International trade experience
- Non-destructive testing (NDT) experience
- Robotics and (computer) programming capability
- Spray painters with experience in specialised paint materials.

Every organisation emphasised the transferable skills or soft skills required for them to achieve their goals and objectives and importantly to sustain and grow operations. The transferable skills below were the most common across all organisations.

Transferable skills needs

- Communication and interpersonal skills
- Emotional intelligence
- Leadership and management skills
- Lean and continuous improvement approach/mindset
- Problem solving capability and skills
- Teamwork
- The 'right attitude'.

What do organisations mean by the 'right attitude'? This relates to an employees perceived 'fit' with the organisation in terms of values and behaviours. In simplest terms it relates to an employees work ethic and a positive 'can do' attitude.

WHERE DO ORGANISATIONS GET THESE SKILLS NOW?

Cluster members were asked about their current attraction, recruitment and retention strategies in order to gauge effectiveness in their ability to access the skills required for their current operations. Typically, organisations used internal Human Resources processes to a degree, however, the most common recruitment type was via an agency or labour hire company.

Training and development needs were most likely to be met by internal training programs. All organisations commented on the need to provide continuous learning and development programs for staff in order to meet the demands of high precision engineering, R&D or manufacture. Learning and development in most organisations began with an intensive induction program for new employees.

Member organisations employed a range of learning and development approaches for their staff, from the development of the Quickstep Learning Academy in their Bankstown facility to more fundamental approaches focused on induction and OH&S.

Quickstep Learning Academy (QLA)

Advanced manufacturing in Australia is facing significant challenges due to skills gaps and shortages, particularly with the adoption of new technologies and processes, driven by the advent of Industry 4.0, increasing the level of digitalisation and automation across the advanced manufacturing sector. This is especially evident in high growth companies like Quickstep, who is expanding rapidly at its Bankstown site.

It is Quickstep's view that industry needs to take a lead role in the local community and the company wants to be seen as an 'Employer of Choice' in Western Sydney and the advanced manufacturing industry. It is also Quickstep's belief that industry must form partnerships and alliances with the education sector, if these skills gaps and shortages are to be addressed.

To this end, Quickstep has established the QLA, a purpose-built facility within the Bankstown site that will bring together all resources available for skills, competency and capability development. The QLA is staffed by two full-time trainers, supported by teaching resources from TAFE and other learning organisations to provide bespoke, relevant and recognised skills programs. Subject matter experts and leadership within Quickstep also support the QLA, by delivering specific training modules to skill, up skill and cross skill its people. The QLA is focussed on developing and providing:

- Job specific and company specific training
- Appropriate in-house training both theory and practical
- Mentoring and support for all staff
- Coordinating external training resources
- On-the-job training (hybrid work/classroom), with dedicated support from competent employees
- Local community training and awareness sessions
- Sessions for educational sectors.

CHALLENGES AND OPPORTUNITIES

In order for Cluster members to sustain and grow operations, and meet their future organisational objectives several emerging workforce skills needs were identified, these include:

Automation – to increase revenue and sustainability in an increasingly competitive environment, organisations need to increase their capacity to automate processes and production. As a consequence, there is increased demand for workers with the ability to program and code machines and robots.

Industry 4.0 and the Internet of Things – Cluster members' ability to understand and harness the power of industry 4.0 to combine physical and digital technologies is paramount to sustained growth in a competitive advanced manufacturing environment. There is a growing need to automate processes and improve efficiency. Organisations are seeking increased skills in digital technologies, automation and robotics, with a number expressing a desire to undertake more research and development in this area.

Quality assurance and control – Cluster members operate in a high precision environment and quality control measures, auditing and risk management are fundamental to developing and delivering products which must meet customer and regulatory specifications. In addition, Cluster members are seeking to improve their ability to 'test' new processes and products.

Supply, distribution and trade – Organisations identified International Trade experience as an area of increasing skills need in order to effectively service international markets and ensure supply. Of particular increasing importance, members outlined the key skills below:

- Understanding foreign markets and cultures
- International business relations
- Export markets
- Customs
- Tariffs
- Packaging and shipping
- Supply chains.

Waste disposal and sustainable practices - There are opportunities for the Cluster to minimise waste and create a circular economy whereby one organisation's waste is another's raw material. Solving this challenge requires a multi-disciplinary approach, collaboration and entrepreneurial thinking.

Innovation and entrepreneurial skills – To remain competitive organisations recognised the need to be continually innovating to develop new and/or improved products and better and more efficient ways of making them. It is interesting to note that many Cluster organisations have developed from small entrepreneurial enterprises to sustainable and growing businesses servicing domestic and international markets. With entrepreneurial founders, the ability to foster an entrepreneurial culture within organisations, and amongst the Cluster, will be key to developing new market opportunities and partnerships for sustainability and growth.

Current recruitment practices – Access to a highly skilled workforce is paramount to Cluster organisations. Cluster member roles are typically filled using a mix of agency and in-house recruitment, however organisations are also reliant on importing skills from overseas following the decline of domestic automotive and supply chain manufacturing in Australia. Members expressed concern about their ability to attract and retain workers for roles across the spectrum from engineering apprentices with composite knowledge and skills to experienced production and process engineers, NDT (Non-destructive testing) technicians or CNC (Computer Numerical Control) Machinists. All recognised the need to develop a pipeline of local talent, whilst at the same time attract highly skilled and experienced professional and trades from other industries and regions.

STRATEGIES AND ACTIONS

For the Cluster to realise its vision and for the region to build a capable and competitive workforce to sustain and grow the advanced fibre sector, the following strategies have been identified for consideration and action.

> **There is an opportunity for the Cluster to provide assistance and support to develop long-term programs to attract, train and develop a pipeline of talent (skills) for the advanced fibre sector.**

Create a pipeline of talent and skills

There are several strategies the Cluster can adopt to increase the pool of local workforce talent, this may include the development of:

- **Awareness raising programs** which provide young people with opportunities for exposure to Cluster member organisations through various activities including, but not limited to:
  - Work experience opportunities, for secondary students
  - Participation and sponsorship of the Geelong Manufacturing Council and Skilling the Bay programs for senior secondary students, Geelong Future Leaders of Industry (GFLOI) and Girls Leading in Advanced Manufacturing (GLAM) industry immersion program
  - Targeted and tailored information and promotion of the AFCG to Careers Teachers and the Geelong Tech School
  - Creation of an annual Carbon Fibre and Composites design challenge for young people.
- **Pathways programs** such as promotion and development:
  - Apprenticeship pathways into the sector. This could include identifying a preferred apprenticeship course/pathway, and working with a preferred Registered Training Organisation and utilising a Group Training Organisation to develop the model and actively promote appropriate opportunities to participants. The Gordon currently offers pre-apprenticeship and apprenticeship pathway options in the composite industry area.
  - Re-skilling and upskilling programs for mature aged workers. Development of a coordinated approach transition workers from other sectors to Cluster organisations. For example, a Cluster coordinated intake and delivery of the industry designed Course in the Use of Carbon Fibre in Composite Manufacturing with The Gordon TAFE.
- **Graduate recruitment programs.** The Cluster could develop a series of scholarships and cadetship opportunities for University and VET students. This could also include a ‘Rotation’ program across organisations for a range of technical roles.

PATHWAY OPPORTUNITIES AT THE GORDON

Certificate II Engineering Studies Mechanical, Fabrication and Composites

Certificate III Engineering Studies Mechanical, Fabrication and Composites

Diploma Engineering - Technical

Certificate II Engineering Studies Mechanical, Fabrication & Composites provides pre-employment training and a pathway into the engineering, manufacturing or related industries. Specifically, a graduate of this course will be eligible to:

- undertake a work-based traineeship or apprenticeship in a range of engineering, manufacturing or related areas.
- enrol in Certificate III qualifications in the engineering, manufacturing or related areas.
- seek entry-level employment in the engineering, manufacturing or related industries.

The course also provides a pathway to further study.

Certificate III in Engineering - Composites Trade defines the skills and knowledge required of a composites tradesperson within the metal, engineering, manufacturing and associated industries, or other industries where composites tradespersons work. The qualification has been specifically developed to meet the needs of apprentices in the above trade. The skills associated with this qualification are intended to apply to a wide range of composites work, including laying up composites, selecting, handling, using and storing materials and components, undertaking repairs and modifications, adjusting resin chemicals and selecting and using joining techniques.

Diploma of Engineering - Technical
This course is for people wanting to work as an engineering technician carrying out tasks such as engineering design and quality control / assurance monitoring.

Students will gain compulsory competencies in organising and analysing information, interacting with computing technology and selecting engineering materials. Students will also gain a range of elective competencies in areas relevant to your current or intended employment, such as CAD, drafting, quality control/assurance, basic fluid power, basic mechanical design, production scheduling, cost estimating and non-destructive testing.

PATHWAYS TO UNIVERSITY

Upon successful completion of the Diploma of Engineering, students will be eligible to receive credit points into a range of undergraduate engineering degrees at Deakin University:

- S460 Bachelor of Civil Engineering (Honours)
- S461 Bachelor of Electrical and Electronics Engineering (Honours)
- S462 Bachelor of Mechanical Engineering (Honours)
- S463 Bachelor of Mechatronics Engineering (Honours).

COLLABORATION AND KNOWLEDGE SHARING

Cluster member organisations have a large proportion of highly skilled workers, whilst at the same time recognise several areas of deficiency or difficulty attracting and developing skills and expertise. It is our observation that each member organisation also has key strengths which, if shared and/or accessed by other members would build capability across the sector. In this respect, the Cluster can play a role in facilitating the sharing of knowledge and/or increase collaborative opportunities for members.

Activities to support collaboration and knowledge sharing may include hosting/coordinating:

- Discovery or Learning series program to assist member organisations to understand each other's business and explore opportunities for collaboration. For example, Andritz is an ISO accredited organisation, and have expertise in supply chain management and operational efficiency. There may be an opportunity for other organisations to learn from their approach. Likewise, organisations are looking to diversify their operations to maximise the use of equipment and resources. Activities that encourage Cluster members to explore the uses of equipment and resources during normal periods of 'downtime' could further maximise the value of physical and human resources for economic benefit.
- A cross Cluster mentoring program with regard to leadership development or specialised technical roles. The introduction of mentoring programs could also assist with knowledge transfer from more mature and experienced workers to younger new entrants to the sector to mitigate the effect of 'brain drain' due to a high proportion of older workers (for some Cluster members).
- Multi-Disciplinary approach to problem solving in order to promote design thinking across Cluster organisations. Workshops could be used to 'explore and solve' real industry problems, e.g. finding ways to recycle waste from carbon fibre and composite manufacture. There may be an opportunity to pilot a Cluster specific Course in Multidisciplinary Design. This newly created course provides a framework for cross-disciplinary teams to design solutions to industry specific problems.

Multidisciplinary Design

The 22505VIC Course in Multidisciplinary Design challenges learners to think beyond their own design discipline to examine how multiple disciplines can engage effectively to create improved design outcomes. The course is not intended to develop specific, discipline-specific design skills – learners will develop these skills in their 'home' courses. Instead, this course brings learners from different design disciplines together to challenge their own preconceived notions of design by collaborating on a live industry multidisciplinary design brief. The focus is thus not on the design outcome but rather on the design process that learners apply in response to the design brief.

To best enable a simulated real-world environment, the following Units of Competency have been clustered in the design of the course:

Micro-credentials to maximise learning and skills development

Member organisations identified a number of areas of need to extend skills and capability, and deepen expertise amongst their workforces. The box below shows the most common skills needs identified by Cluster members. Whilst formal qualifications provide viable and valuable skills development, there are limits to the timeliness and validation of the skills and experience they provide. Many organisations cannot afford to have staff off the floor for long periods of time and as technologies and work change they need to be able to upskill workers quickly and efficiently. In this instance, micro-credentials have the potential to meet development needs, whilst at the same time providing Cluster approved skills certification, and possibly even credit bearing recognition of new skills attained.

Common skills identified by Cluster member

- Leadership development
- Problem solving
- Critical and creative thinking
- Resilience
- Emotional intelligence
- Teamwork and collaboration
- International trade
- Digital Technologies and the Internet of Things
- Automation and robotics
- Commercialisation
- Data analysis
- Quality Assurance.

Recruitment strategies

- Working together to support overseas recruitment campaigns for specialist skills
- Working together to better promote employment opportunities to women and increase female participation.

Pooling of resources for specific and highly skilled activities

As well as building workforce skills and capability through training and development, there is an opportunity for the Cluster to pool resources (both physical and human) to improve access to specialised activities. These include:

- Shared quality and testing - Cluster members require access to highly specialised testing facilities and processes, however the use and expertise required could be more effectively shared across the Cluster. This could also include the development of specific Non-Destructive Testing capability.
- Research and development - It is evident there are clearly established R&D relationships, however there is potential to build from this foundation, conducting further joint (or Cluster led) R&D into the creation of a circular economy, further enabling a sustainable and leading advanced fibres manufacture in Geelong and Australia more broadly.

Micro-credentials – a working definition

There is no one definition of micro-credentials, however VOCED the NCVER International Tertiary Education Database, 'In Focus' offers a generally accepted definition:

'Micro-credentials are also known as digital badges, nano degrees, micro-certifications, web badges, mini degrees and open badges. Compared to a degree, diploma, certificate or other lengthy accredited training, micro-credentials focus on smaller elements of learning. They are mini qualifications often gained by participating in short, free or low-cost online courses. These smaller blocks of learning can formalise soft and hard skills attained at work, such as teamwork, critical thinking and problem solving. They can also help fill skill gaps, such as working with big data.' [14]

A key benefit of micro-credentials is the development of certification with the particular industry in mind, ensuring that the qualification meets industry-specific needs, is relevant and is recognised by future employers. This new approach to professional development is tailored and generally transferrable. [15]

14 https://www.voced.edu.au/focus-micro-credentials, published Dec 2018, accessed March 2020
15 https://www.obviouschoice.com.au/what-are-micro-credentials, access March 2020

Champion the principles of Life-long learning

The trends shaping the future of work and education are already being experienced by Cluster members, who recognise the need to keep pace with automation, robotics and big data to remain competitive. In the OECD's Trends Shaping Education series, the authors explore the global megatrends affecting the future of education and focus on the importance of lifelong learning to equip people with the skills, knowledge and attitudes to thrive amid the changing patterns of life and work as the digital economy unfolds.[16] Whilst Cluster members benefit from high quality graduates of Bachelor's and Master's degrees, many recognise the need for continuous life-long learning using an array of educational modes is of increasing importance.

> **"The Cluster has the ability to leverage proximity to, and relationships with, world-class and nationally renowned education and training providers such as Deakin University and The Gordon TAFE; establishing an Industry and Education Collaboration to advance the Cluster and truly build a world-class workforce."**

16 'Making micro-credentials work for learners, employers and providers', Emeritus Professor Beverley Oliver, Deakin University August 2019

RECOMMENDATIONS

In order to develop a world-class workforce, the following strategies have been recommended for consideration by the Cluster. There are interdependencies with regard to the recommendations and it is suggested members take a staged approach to implementation and prioritise as necessary.

1. Develop a sustainable local workforce to provide access to skilled and agile workers (talent).

1.1. The Cluster establishes partnerships with schools, TAFE and University to develop an early entry pathways program for senior secondary students to enter the sector. These partnerships could leverage and build on existing programs such as GFLOI and GLAM and the Geelong Tech School to increase awareness and influence student intentions to follow a STEM pathway to employment in the sector.

1.2. Develop a Cluster specific apprenticeship model to open up pathways into the sector and increase the number of apprentices undertaking engineering with a composites focus.

1.3. Develop innovative and alternative training pathways to support the inclusion of under-represented groups, such as women and new migrants, into the sector.

1.4. Create prescribed pathways for mature aged/existing workers from sectors of synergy with advanced fibre product manufacture. The Cluster could further capitalise on the industry designed and accredited Course in the Use of Carbon Fibre in Composite manufacture by facilitating a coordinated approach to course intakes and placements in industry.

2. Support member industries to enhance their capacity to grow and thrive.

2.1. The Cluster takes ownership of the development of long-term strategies to build capability and capacity amongst member organisations leading to increased productivity, quality and innovation.

2.2. Collaborate with education providers and government to develop a set of Cluster endorsed (or approved) micro-credentials that build skills in identified areas of need; improving access to upskilling.

2.3. Advocate for government funding skills sets and micro-credentials to adequately support workforce development.

2.4. Devise new approaches to collaboration and problem solving, particularly with regard to sustainability, reducing waste, decreasing production costs and development of a circular economy. The Cluster could benefit from piloting specific cross-discipline design thinking workshops to specifically address these problems whilst at the same time developing employee skills and expertise in design thinking, teamwork and innovation.

3. Raising awareness of advanced manufacturing as an attractive career and business opportunity.

3.1. The AFCG must build a brand which identifies member organisations as providing attractive and desirable career opportunities.

3.2. Implement a regional or state-wide campaign to create interest in the range of career opportunities in the sector.

3.3. Utilise the ‘Cluster’ brand to develop targeted recruitment campaigns and provide a central digital hub of employment opportunities.

RECOMMENDATIONS		SUGGESTED ACTIONS	NOTES
1.	Develop a sustainable local workforce to provide access to skilled and agile workers (talent)		
1.1	Create partnerships with schools, TAFE and University to develop and promote entry pathways for senior secondary students to the sector.	• Leverage and build on existing programs such as GFLOI and GLAM to provide industry immersion. • Work with the Geelong Tech School and create a STEM project that incorporates carbon fibre and composites.	
1.2	Develop a Cluster specific apprenticeship model to open up pathways into the sector and increase the number of apprentices undertaking engineering with a composites focus.	• Build a place-based apprenticeship model with members and industry. • Actively raise awareness and promote apprenticeship pathways locally (and across the State).	
1.3	Develop innovative and alternative training pathways to support the inclusion of under-represented groups, such as women and new migrants, into the sector.	• Collaborate with GMC, The Gordon and Deakin University on developing training opportunities to engage and support existing and emerging under-represented groups.	
1.4	Create prescribed pathways for mature aged/existing workers from sectors of synergy with advanced fibre product manufacture.	• Facilitate a coordinated approach within the Cluster membership to course intakes and placements in industry. • Develop tailored programs (accredited/non-accredited) that will meet the training skill requirements and demand of the Cluster membership i.e. adapting existing courses to micro-credentials.	

RECOMMENDATIONS		SUGGESTED ACTIONS	NOTES
2.	Support member industries to enhance their capacity to grow and thrive		
2.1	The Cluster takes ownership of the development of long-term strategies to build capability and capacity amongst member organisations leading to increased productivity, quality and innovation.	• Implement a membership wide-coordinated workforce development plan.	
2.2	Collaborate with education providers and government to develop a set of Cluster endorsed (or approved) micro-credentials that build skills in identified areas of need; improving access to upskilling.	• Explore options for developing micro-credentials in key skills for advanced manufacturing and composite industries. • Prioritise the needs and pilot development of Cluster endorsed micro-credentials.	
2.3	Advocate for government funding skills sets and micro-credentials to adequately support workforce development.	• Develop briefing paper on micro-credentials for the advanced manufacturing and composites industries • Review government funding options for project partnership/s.	
2.4	Devise new approaches to collaboration and problem solving.	• Design and pilot specific cross-discipline design thinking workshops to assist with developing employee skills and expertise in design thinking, teamwork and innovation.	

RECOMMENDATIONS		SUGGESTED ACTIONS	NOTES
3.	Raising awareness of advanced manufacturing as an attractive career and business opportunity		
3.1	The AFCG must build a brand which identifies member organisations as providing attractive and desirable career opportunities.	• Review and align brand recognition to achieve workforce development and training skill goals. • Launch a new brand awareness campaign to raise awareness of the AFCG's goal to develop a world-class workforce.	
3.2	Implement a regional or state-wide campaign to create interest in the range of career opportunities in the sector.	• Develop a communication strategy to raise awareness of the range of career opportunities within the advanced manufacturing and composites industries	
3.3	Utilise the 'Cluster' brand to develop targeted recruitment and provide a central digital hub of employment opportunities.	• Develop a recruitment strategy that supports the workforce demand for Cluster members. • Assist Cluster members to adopt complementary brand awareness towards sustainable career opportunities.	

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