# DEFENCE INDUSTRY LEADERSHIP PROGRAM 2020

# COVID-19, TECHNOLOGY & THE DEFENCE SUPPLY CHAIN

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## TABLE OF CONTENTS

*Given the changes to how we do business highlighted by COVID-19, how can technology benefit our national and global defence industry supply chain in terms of connection, engagement and understanding?*



## INTRODUCTION

The year 2020 has been like no other in recent history, the COVID-19 pandemic has disrupted 'normal' with impacts seen globally. The Defence enterprise has not been immune from the impacts of COVID-19, and the consequences of the pandemic on the Defence Supply Chain (DSC) has changed how it behaves, invests and prioritises.

To manage the complex problems addressed by the DSC, relationships are critical; and maintaining connection, engagement and understanding between parties is essential. Working with the constraints imposed by COVID-19 has come with many challenges, however it has also highlighted how technology can be used to overcome and allow business (including the DSC) to thrive.

In order to address the question, this concept paper will:
- Explore key aspects of the DSC, identifying what has changed due to COVID-19 with respect to connection, engagement and understanding;
- Evaluate several technologies to investigate viable solutions that could enable the DSC to improve connection, engagement and understanding; and
- Provide recommendations for the way forward for consideration by the Defence enterprise.

## DEFENCE SUPPLY CHAIN AND CONNECTION, ENGAGEMENT AND UNDERSTANDING

A supply chain is defined as "the series of processes involved in the production and supply of goods" (Oxford Learners Dictionary, 2021), and in the DSC, these processes cover scoping, procurement, manufacturing, warehousing and transport and communications, as detailed in Figure 1.



| Scoping | Procurement | Manufacturing, Warehousing and Transport | Communication |
|---|---|---|---|
| Engagement with suppliers and customers to understand the market. Occurs between Defence and Industry, and Industry organisations. | Initiates the requirement and extends through to acceptance of the goods. Occurs between Defence and Industry, and Industry. organisations | The 'doing' activities associated with supply of goods. Largely undertaken by Industry. | Underpinning all processes of the DSC - a key enabler for doing business. |

*Figure 1: DSC Processes*

Whilst these processes appear relatively straightforward, the complexity within the DSC comes from its scale and the extensive scope of the goods being supplied. The DSC covers the supply of bullets and electronic circuit boards through to armoured vehicles and submarines.

Core to delivering Defence supplies is the relationships between customers and suppliers. The key activities relating to connection, engagement and understanding (and which could benefit from the use of technology) in the DSC are as detailed in Table 1.

| Activity | Details |
|---|---|
| Meetings | Covering supplier evaluations, contract negotiations, progress updates, team-building, or information-sharing exchanges. |
| Governance and Assurance | Providing confidence that the supplies meet the contractual, regulatory and quality requirements; includes activities such as auditing, test witnessing and verification and validation (V&V). |
| Inventory Management | Providing confidence in the location and status of supplies. |

*Table 1: Key DSC Connection, Engagement and Understanding Activities*

## IMPACTS OF COVID-19

*"the pandemic has disrupted globalised supply chains, which over time have become a critical element of many of Australia's national economic sectors and Defence capability planning"*

- 2020 Defence Strategic Update

The impact of COVID-19 has been felt across all industries, and despite its size, the DSC has not been immune. Table 2 highlights how the conduct of key DSC engagement, connection and understanding activities have changed with COVID.

| Activity | Conduct Pre-COVID | Conduct During COVID |
|---|---|---|
| **Meetings** | Significant proportion occurred face-to-face, but teleconference and video conference was available if needed. | Largely limited to teleconference or video conference. |
| **Governance and Assurance** | Audit, test witnessing, site inspections all occurred with the 'customer' on site at the supplier's premises. | Activities cancelled or postponed. |
| **Inventory Management** | Supplier personnel required to be on-site to conduct physical checks on goods – depending on size of holdings may require teams of personnel. | Activities cancelled or postponed. |

*Table 2: Impact of COVID on Key DSC Connection, Engagement and Understanding Activities*

Whilst meetings have been able to continue to occur during COVID with virtual means, face-to-face interactions remain the preference for many workers (Synchroworks, 2020). However, for governance and assurance and inventory management activities COVID-19 has seen them come to a halt or be postponed. This has posed a significant issue for Defence goods from overseas suppliers and has prompted the Australian Government to prioritise investment in increasing the durability of the DSC and the strengthening sovereign capabilities (Australian Government, 2020).

The impacts of COVID are likely to be felt for years to come (Savage, 2020), and so working with the constraints imposed by the pandemic is essential. With a continuing need for meetings, governance and assurance and inventory management activities in the DSC, to build and maintain strong relationships, technology may provide solutions that can be embraced and enable business to continue.

## TECHNOLOGY EVALUATION METHODOLOGY

In order to understand how technology can benefit the DSC, some indicative technology options have been evaluated against a set of criteria. The potential technology options need to consider function and performance, but also the areas that make Australian Government procurement and the DSC unique.

Key areas outside of function and performance include government regulations such as consideration of Australian Content and the assurance that selected technologies do not create barriers for entry for business (in particular Small to Medium Enterprise (SME)'s). The security of information is another critical area for evaluation, technologies that enable communication between businesses generally create security risks and this must be considered in order to determine the suitability of technology to the Defence Industry.

The final set of selection criteria used to determine the relevance of technologies to the problem domain are identified in Figure 2.



**Function and Performance**
Technologies will be evaluated on their ability to :
- Replace the function of communication for the in-person meeting;
- Replace the function of governance and assurance for Supplier Evaluation, Audits and V&V that was previously performed in-person; and
- Improve supply chain resilience through inventory management.

**Security**
Technologies will be evaluated on their ability to provide secure solutions that could be applied to support information confidentiality and classification as required by the Australian Government Information Security Manual.

**Maturity**
Technology maturity is assessed to understand the risk or potential lead time of a solution.

**Cost**
Cost will be quantified to ensure it is accessible to the whole supply chain.

**Australian Content**
In accordance with Government procurement requirements.

*Figure 2: Selection Criteria Identification*

Each selection criteria has been rated qualitatively using a numerical linear scale, which provides standard numerical values and definitions for the proposed option ratings. Table 3 summarises the criteria ratings scale and definitions.

| Selection Criteria / Score | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Function and Performance of meetings, governance and assurance activities or inventory management** | No ability to replace the function and performance | Minimal ability to replace the function and performance | Potential to replace some aspects of the function and performance | Can replace the function and performance |
| **Security in accordance with Australian Government Information Security Manual** | Insufficient to comply with information confidentiality and classification | With modification could support information confidentiality and classification | Considered a secure solution that could be applied to support information confidentiality and classification | Certified and in-use |
| **Cost** | Over $1000k | $100k to $1000k | $10k to $100k | 0 to less than $10k |
| **Australian Content** | No Australian Content | No Australian Content but opportunity to evergreen solution | Some Australian Content | Australian developed technology |
| **Maturity** | Research | Development | Product | In Use in DSC |

*Table 3: Selection Criteria Ratings Scale and Definitions*

## WEB BASED VIDEO CONFERENCING

Web-based video conferencing (WBVC) has existed since the 1990s (Business Matters, 2015) and is a service which provides real time point-to-point (and multi-point) communications via the internet. There are several solutions available, with two well-known examples being Skype and Zoom (Deloitte, 2020). Whilst WBVC has been in use for decades, COVID-19 saw a sharp increase in its use for both business and personal communications; for example the number of daily meeting participants for Zoom went up from about 10 million in December 2019 to 200 million in March 2020 (Hacker, et al., 2020).

The assessment of WBVC is summarised in the Figure 3 and Table 4.
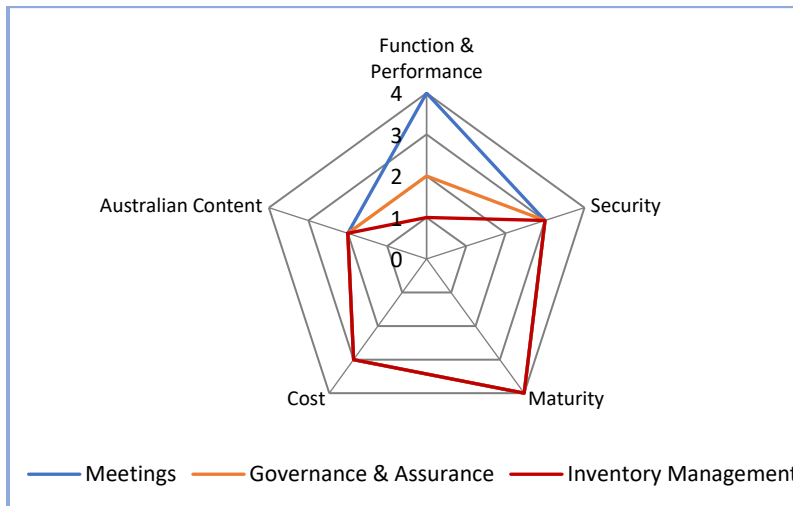


*Figure 3: WBVC Assessment against Criteria*

| Criteria | Assessment Details |
|---|---|
| **Function and Performance** | Demonstrated as capable of being an alternate to face-to-face meetings. Unlikely to be used in governance and assurance activities (such as physical audits and test witnessing) or inventory management as these activities take extended times and some form of physical interaction with supplies. |
| **Security** | Can be a significant weakness and issue, but is highly dependent on the specific solution, or implementation – Zoom has been banned from several large organisations including the Australian Department of Defence, NASA and Google (Vigliarolo, 2020), whilst Skype and Microsoft Teams have not suffered from the same issues. |
| **Maturity** | Several solutions exist and have been in use for decades. |
| **Cost** | Varies, most commercial or business solutions have a cost associated (but is not prohibitive) with free solutions also available (but generally have fewer features). |
| **Australian Content** | Solutions are largely international; however some local Australian support is now available for most platforms. |

*Table 4: WBVC Criteria Analysis*

As there are a multitude of WBVC solutions available and they are widely in use, the question is not whether they should be used, but which solution offers the best all round performance to support connection, engagement and understanding in the DSC. To make best use of the technology to support a durable supply chain underpinned by strong relationships, Defence and Industry should agree on a preferred platform (or series of platforms) which balance needs across all criteria.

## DIGITAL REALITY (AUGMENTED AND VIRTUAL REALITY)

Digital Reality (DR) is a potential candidate for this application (Seward, 2020), (Deloitte, 2019). DR refers to a wide spectrum of technologies that enables users not only to visualise but also to interact with the virtual environment through specialised equipment, including goggles, head-mounted displays, and 3D images. DR has the potential to impact supply chains in a number of ways including inventory management, test witnessing in critical environments, and complex and rapid decision making within and across organisations.

The assessment of DR is summarised in Figure 4 and Table 5.
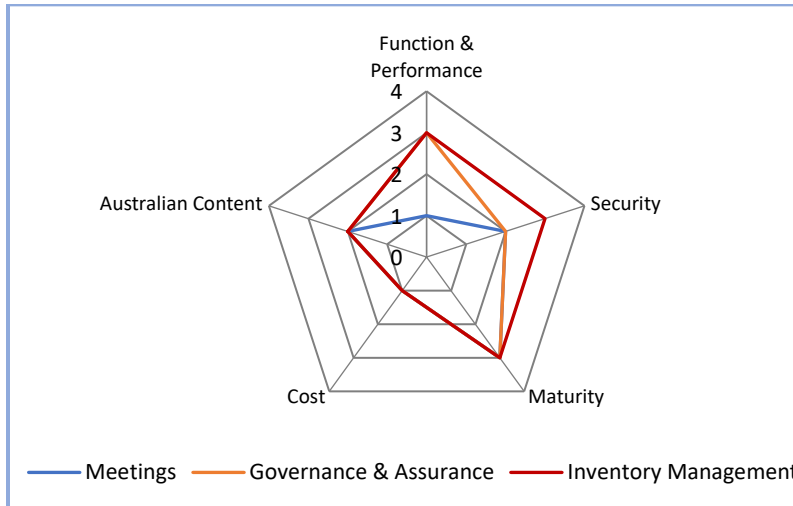


*Figure 4: DR Assessment against Criteria*

| Criteria | Assessment Details |
|---|---|
| **Function and Performance** | This technology has potential to improve stakeholder confidence through more substantial interaction with products during their lifecycle. |
| **Security** | Due to the high-volume data transfer requirements this technology may be vulnerable to cyber security threats. |
| **Maturity** | DR has evolved significantly in the last few years. However, it has not reached operational maturity in Defence industry. |
| **Cost** | A high cost investment may be required at the initial stage of implementation. |
| **Australian Content** | Currently Australian Content remains very low at production level. |

*Table 5 DR Criteria Analysis*

Barriers to mainstream adoption of DR technology in DSC remain in the areas of infrastructure, pricing, and security. In order to facilitate successful adoption of DR in the supply chain, necessary actions need to be taken to improve organisational readiness and user perception.

## ARTIFICIAL INTELLIGENCE (AI) / COGNITIVE TECHNOLOGIES

Artificial Intelligence (AI) combined with Cognitive Technologies (CT) has shown promise to address some of the current capability gaps within the DSC, in terms of engagement. AI is a combination of technologies, ranging from machine learning to natural language processing techniques, which allows machines to sense, comprehend, act and learn (Briggs, 2019). Cognitive technologies provide intelligent frameworks for people to interact using various types of data, and to complement them with AI applications (Schatsy, et al., 2015). While current networking technologies are mostly limited to audio and video communications, future intelligent communication frameworks are likely to include features like gesture tracking, eye-tracking, and emotion detection. AI/CT blended with smart devices will increase connected and coordinated "smart spaces" and intelligent ecosystems (Harvard Business Review, 2018).

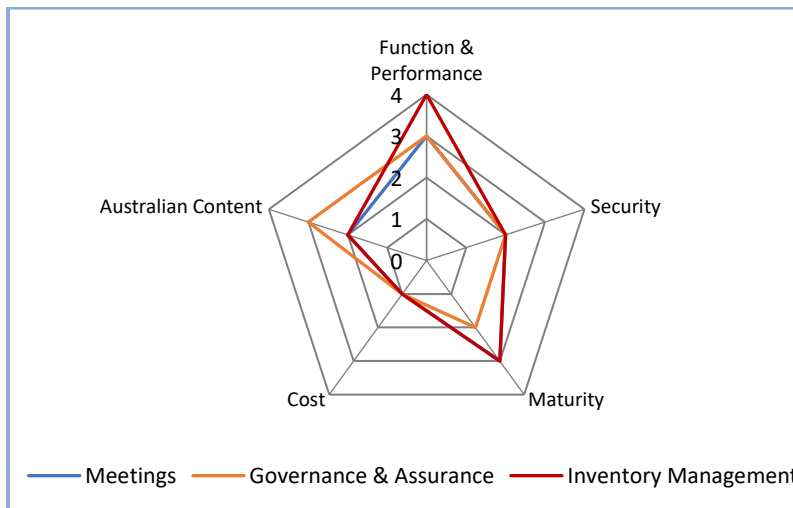The assessment of AI/CT is summarised in the Figure 5 and Table 6.



*Figure 5: AI/CT Assessment against Criteria[1]*

| Criteria | Assessment Details |
|---|---|
| **Function and Performance** | AI blended with smart devices provides geographically distributed teams intelligent communication networking facilities through automation or augmentation of human activities. It could also contribute to warehouse management by digitally organising inventory data, monitoring and managing shipping, and tracking information. |
| **Security** | While AI systems combined with CT provide numerous opportunities to improve DSC, they can be subjected to direct cyber-attacks and harm Australian Defence interests. |
| **Maturity** | Although AI and CT are matured individually, products augmenting AI with CT are still evolving. |
| **Cost** | Implementation of these technologies into smart devices will require significant investments. |
| **Australian Content** | Australia is well placed to implement these technologies, however, current Australian content in Defence applications is very low. |

*Table 6 AI/CT Criteria Analysis*

For successful implementation of this technology within the DSC, the right skill sets need to be developed within our work force by training them how to co-exist with intelligent machines.

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[1] In this assessment Meetings have an equivalent score to Governance and Assurance for Maturity and Cost

## 3D PRINTING

3D printing is an "additive manufacturing" process for decentralised and on-demand manufacturing of complex objects (DHL, 2016), (Knowles, 2019). It can reduce complexity in manufacturing and provides a number of advantages over conventional production techniques. A major benefit of 3D printing is the ability to produce a variety of products from a single 3D printer. This enables companies to adopt decentralised production concepts that can result in significant economic benefits.

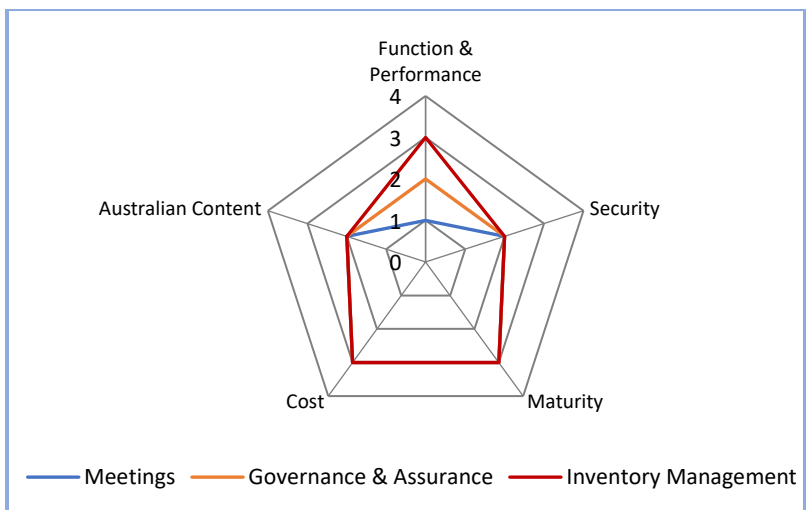The assessment of 3D printing is summarised in Figure 6 and Table 7.



*Figure 6: 3D Printing Assessment against Criteria*

| Criteria | Assessment Details |
|---|---|
| **Function and Performance** | Due to the local manufacturing capability and the reduced pressure to physically transport goods from place to place during pandemic or geo-political unrest this technology can be used for inventory management and test witnessing purposes. |
| **Security** | Decentralised manufacturing may require strict security measures to be imposed across a wide range of stakeholder organisations. |
| **Maturity** | 3D printing technology has well developed commercial standards, but these may differ from Defence requirements. |
| **Cost** | Although there is an initial cost associated with implementation of this technology, significant savings can be made in a long term. |
| **Australian Content** | There are many Australian Universities and industries heavily involved in this technology. |

*Table 7 3D Printing Criteria Analysis*

Despite the many benefits of using 3D printing for a variety of different product types, only a handful of Defence industries have integrated it as a core production technology. The successful adoption of 3D printing in the supply chain depends on the alignment of technology value drivers with DSC use cases, operational needs, and organisational readiness.

## CONCLUSION

The pandemic has highlighted the importance of a secure supply chain for Defence and Defence Industry. Connection, engagement and understanding underpin the strong relationships that ensure supply chain resilience. Technologies are needed to facilitate these relationships when connecting face to face is not an option.

There are many emerging solutions that could be used to address exiting capability gaps and greatly improve stakeholder engagement within the DSC. Some emerging technology trends are relevant to DSC and could contribute to post-pandemic growth (Gartner, 2020).

While there are many emerging technologies in this domain, there is no technology solution that will meet the criteria without further investment and support. The analysis of technology conducted in this report has illustrated a number of areas for development, but in particular, in all technologies assessed, security is the single biggest challenge. It is clear there is still work to do to enable supply chains to remotely interact for the purposes of meetings, governance and assurance activities and inventory management.

## RECOMMENDATIONS

The key recommendations as a result of the analysis are:

- The Commonwealth as a thought leader and investment director, in consultation with key industry representatives, should develop and publish their preferred "technology stack" as well as a technology roadmap to inform technology investment in Australia (both from a DSC as well as technology development point of view).
- Defence and Industry need to work together with security agencies to facilitate the implementation of these technologies in the information security context. A balance between functionality and the security of the supply chain needs to be found to support delivery of any proposed technology roadmap.
- Despite the pressure to address short-term challenges, decision makers should embrace technologies compatible with evolving supply chain demands and manage the risk accordingly.
- In order to encourage the Australian content in technology solutions, the Commonwealth and Industry leaders need to invest further to scaffold both the industries and SMEs in the DSC to use them.

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