The Future of Work and Education

How Governments can Create a More Systematic and Rigorous Approach to Skills Training

Frequency:
12.75 GHz

Utilisation:
97 %

Trackers:
52618

Data Compression
1/72

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Summary

> "The rise of automation and digitization has transformed the world of work but created a major societal problem - the mismatch of people with the right skills for the available jobs."

Bob Moritz – Chair of PwC at the WEF in Davos 2021

The mismatch of people with jobs is a problem that has been exacerbated by the COVID-19 pandemic and its devastating impact on labor mobility and unemployment. The ILO estimates global unemployment could increase by 140 million full time jobs.[1] Now more than ever therefore, the priority for governments must be to identify the key sectors for growth, assess the potential of its workforce to meet the talent demand, evaluate the cost benefits of upskilling, and introduce practical measures that activate employers, educators and learners.

This paper proposes that this response needs to be sector specific and scientific in its approach, to ensure that upskilling is cost effective and auditable. Assessment of learning outcomes also needs to be more rigorous, to ensure the "last mile" of the upskilling initiative, i.e. the actual acquisition of the skill gap identified, is achieved. Formal qualifications, if designed with the target population in mind, are a proven mechanism for both motivating learners and providing a greater degree of assurance for employers that a qualification is genuinely matched to job needs. Governments have an opportunity to take the necessary policy steps to encourage a more systematic approach to upskilling that re-energizes their national qualifications activities.

The World Economic Forum (WEF) 2021 Report, "Upskilling for Shared Prosperity"[2] articulated a Call to Arms, for the ears of all stakeholders, governments, businesses and education providers. This Call to Arms highlighted how the world of work is changing fast with the loss of jobs in some sectors offset by a growth in jobs in others. If disruption, uncertainty and growing inequality is to be avoided, and if opportunities in the digital, technological and green arenas in particular are to be grasped, then the imperative for reskilling those already in the workforce, and providing the skills necessary for new arrivals to thrive, is one of the most urgent matters facing governments and business.

This paper recommends four strategic priorities for governments to consider, that will help them respond effectively to this Call to Arms and make an impact on their human capital challenges:

01
Identify and prioritize the skills gaps to close based on national priorities

02
Plan to manage a fragmented and fast changing educational delivery landscape as a result of evolving skills and emerging educational technology solutions

03
Regulate with agility based on sectoral needs, and apply the right level of governance, at the right level of delivery

04
Design and manage a responsive and fit for purpose national qualifications framework that is aligned with a country's demographic profile

This paper presents a Skills Development System (SDS) that identifies all the essential functions in education and training governance. It also provides an approach to balancing the intensity of each of these functions, depending on sectoral needs. To illustrate what a fit for purpose SDS looks like, the approach has been applied to a range of sectors, including two that have developed mature and resilient systems, defence and medicine. Both these sectors need to assure skills to a high level due to the inherent risk in the jobs they do. However, the approach can also be applied to many other sectors with an upskilling imperative, and thus there are illustrations of what this looks like in tourism, agriculture, culture and manufacturing.

The paper also discusses the strengths and limitations of the costly and dynamic educational technology market. The recent experience of remote learning mandated as a response to the pandemic, has sharpened the collective understanding of how to leverage technology. Hands-on experience by professional educators, many of whom were relatively inexperienced with digital teaching, presents an opportunity to identify what works from what distracts. The paper also illustrates how a systematic approach to training design helps support the business case for investment in educational technology.

In essence, a fit for purpose SDS:

- Establishes as policy a systematic approach to and understanding of the roles and responsibilities of the Direct (regulator), Manage (sectoral or regional authorities) and Execute (education and training institutions) functions;

- Recognizes that effective decentralization of regulation and assurance demands a strong sector specific 'Manage' function with context, priorities, freedoms and limitations set out in clear policy;

- Mandates the use of an automated approach such as the Systems Approach to Training (SAT) to ensure a consistent outcomes focused approach for the analysis, design, delivery and assurance of learning interventions;

- Is learner and employer centric, supporting integration between general, higher education and vocational education and training, for lifelong learning.

The authors would like to see World Government Summit attendees commit to the following three initiatives that we believe will have a positive impact on the capabilities of their people and resilience of their economies:

01

Engage in developing a network of regional qualification frameworks that are interconnected and share qualification content and revisions to stay current with skill demands

02

Support the adoption of a systematic approach to training design and assurance, in particular in vocational and professional education and training

03

Establish and share on an active and continuous basis, an evidence-based understanding of the pros and cons of educational technologies in supporting learning outcomes

Introduction

Introduction to the Skills Development System

Global labor markets are undergoing significant and tectonic shifts. Much of the work in recent years from the WEF, ILO, OECD and others, has helped to advance our understanding of these shifts, but the impact of the COVID-19 pandemic has accelerated the urgency to put that understanding into practice. The ILO estimates global unemployment could increase by 140 million full time jobs.[3] Supply chains are being brought back on-shore, the 'green economy' is definitely an economy and no longer just a movement, and digital tools have blurred the lines between workplace and home. Societies that do not take deliberate action will almost certainly see a rise in the inequality within unequal labor markets and must mitigate the corollary welfare and security implications.

Economic growth can however be fueled by upskilling, assuming there is effective job creation. As the recent WEF 2021 Report, "Upskilling for Shared Prosperity" highlighted, the impact of getting this right has the potential to boost GDP by $6.5 trillion by 2030.[4] In countries with a younger, growing population, there are strategies in place to create an entirely new talent pool, for example in the culture sector in KSA, or find a good export job market for young tech-savvy Egyptians.[5] In countries with an aging population and a diminishing national pool of potential employees, reskilling existing employees is an urgent priority along with accepting the qualifications of foreign skilled workers. For many high demand skills areas, a shortage of national skills will likely lead to wage inflation and directly impact productivity and growth.

> "Governments, businesses and education providers should collaborate to build a strong, interconnected ecosystem committed to a comprehensive upskilling agenda."

WEF 2021. Upskilling for Shared Prosperity.

Recent studies by the WEF and ILO,[6] have identified the cost benefit analysis of upskilling/reskilling but base training cost assumptions on historic data. In a post-COVID world, with the advances in and acceptance of e-learning, this merits further examination.[7]

If the true cost of achieving target learning outcomes was examined using a more evidence-based method, the result of the cost/benefit decision may well be different. This paper, therefore, seeks to build on the current literature around upskilling by answering the question:

How can governments create a more systematic and rigorous approach to designing and funding skills training, using lessons learned from defence and healthcare?

Both defence and healthcare have grappled with the problem of upskilling for years and have consequently established rigorous quality assurance systems and learning design processes that are both effective and distributed. The resulting quality assurance mechanisms allow for a lighter, yet effective central governmental regulatory role 'the Direct layer', and a stronger 'Manage layer' that is aligned with the specific needs of the sector.

Overview of the Skills Development System (SDS)

	Key considerations:	Higher Education (Regulated by World Federation)	Vocational Education
Regulation	NQF is aligned with international standards to facilitate equivalency	Develops and owns the National Qualifications Framework (NQF)	
	The national regulator is accredited by global bodies for degree granting	Develops and owns the national (non subject specific) institutional and program accreditation standards	
	Regulation includes minimum faculty and teacher licensing standards	Issues and revokes licenses, accredits institutions and programs - 3rd level QA	
Management	General standards are translated into subject specific standards by experts. These are endorsed and still "owned" by the regulator	Develops subject specific institutional and program standards	Develops sector specific institutional and course standards
	2nd level QA supports the regulator and sector to ensure alignment with evolving occupational skills	Seeks input from employers on improving graduate skills	Ensures alignment to employer needs via sector councils, qualifications awarding bodies, professional associations
	Professional Associations support the process and design qualifications	Provides subject specific 2nd level quality assurance, and advises the regulator on licensing and accreditation	Provides 2nd level quality assurance of training providers
Delivery	Academies and colleges translate general and subject specific standards into programs and courses and institutional level policies, procedures and governance	Designs programs and courses aligned to national and subject standards	
		Delivers program and courses / manages institutional operations	
		Provides 1st level quality assurance on the programs it teaches	

Figure 1: The Skills Development System framework

The Skills Development System framework (SDS) (Figure 1) summarizes the core functions of education and training from a governance perspective. It encompasses three levels of governance: a) **the Direct layer** – the established regulatory functions in post-secondary education, and links these to b) **the Manage layer**, and c) **the Execute layer**. The OECD Observatory of Public Sector Innovation makes a case for the use of resilient systems and adaptive structures by policymakers and regulators to deliver public services that adapt dynamically to an increasingly complex world to produce viable solutions.[8] An SDS we believe can provide this adaptability.

Taking a vertical top-down perspective, an SDS integrates the direction of education and skills through setting policy and regulation standards for learning and qualification outcomes, which are passed down through 'the Manage layer' where the sector specialists, employers and associations define how those outcomes will be achieved, and in turn, then down to 'the Execute layer' where different modes of delivery supported by educators and employers enable and assure the learning outcomes have been achieved. From a horizontal perspective, the SDS helps bring Higher Education (HE) and Vocational Education and Training (VET) pathways closer together. This supports transference across academic and skills-based jobs and lifelong learning and appeals to the full range of learners and employers' needs. It is both learner centric and accessible.

The governance, regulatory and assurance structures in HE and some aspects of formal VET are generally well established in most developed and developing countries. UNESCO's Institute for Lifelong Learning is actively conducting research into how the "Recognition, Validation and Accreditation (RVA)" of non-formal and informal learning is structured and integrated with national qualifications frameworks.[9] These mechanisms are costly to run centrally and not reactive enough for the post-COVID current skills problem. This is evidenced by the significant growth in employers hiring against their own qualification on MOOC's such as Coursera, a trend that has accelerated during the pandemic. After all, the purpose of a national qualification is to reassure employers someone is qualified for a job, and if qualifications are not updated fast enough, employers have the knowledge and accessible platforms at their disposal to now do this themselves. In this context, national qualifications risk becoming increasingly obsolete.

This paper is not proposing any radical re-invention of the core functions of education and skills governance, what it does propose though is a rebalancing of intensity across and down the SDS functions, stronger coordination through smart technology, a tightening of governance around lifelong and workplace learning, and more robust self-regulation at the Manage and Deliver layers, where appropriate. A smartly integrated national SDS is potentially a cost-effective way to sustainably address sector, national and global skills gaps.

The following three chapters elaborate on how to design and manage an effective SDS.

Chapter 1: Making the Case for Future Proofed Education and Skills

discusses why governments need to future-proof skills training, and identifies four key operational considerations for how to achieve national and sectoral skills requirements and sustain workforce learning needs:

1. Managing sustainable upskilling and keeping pace with change;

2. Managing a fragmented educational delivery landscape;

3. Applying the right level of governance, regulation and assurance, and;

4. Designing and managing a fit for purpose National Qualifications Framework (NQF).

Chapter 2: Benefits of a Systems Approach to Delivering Future Proofed Education and Skills

covers how to create a systems approach to skills training and considers lessons learned from two sectors, defence and medicine. Medicine, and surgery in particular, is the quintessential applied training system[10] which requires a minimum number of hours spent per annum on upskilling and places a premium on the effectiveness of skills development and learning related to the task. Defence forces, on the other hand, use a Systems Approach to Training (SAT) to govern, analyze, design, deliver and assure education and training, and its principles are used across other highly regulated sectors globally e.g. nuclear, oil and gas and aerospace.

Chapter 3: A Methodology for Governments to Deliver Future-Proof Education and Skills

provides an indicative pathway for governments and sectors seeking to meet the challenges of reskilling, upskilling and skill shortfalls. The chapter suggests some strategic ideas and initiatives for reshaping existing national and sectoral Education, Training & Qualifications (ET&Q) practices and structures to be part of a coherent, effective and adaptable SDS. It provides some blueprints for how governments and sectors can flex the SDS to reflect changes in national policy, learning demand and delivery means, the skills and workforce context and the national prosperity agenda.

Making the Case for Future Proofed Education and Skills

1.
Making the Case for Future Proofed Education and Skills

Governments have a key question to answer: how can they generate a workforce with the skills needed to meet their aspirations and priorities for economic and social growth?

This chapter outlines four main considerations for managing an effective SDS: i) achieving sustainable upskilling, ii) managing a fragmented and changing educational landscape, iii) applying the right level of governance, regulation and assurance, and iv) managing a fit for purpose National Qualifications Framework (NQF) and the issuance of qualifications. Applying the responses to these considerations to existing SDS functions will go some way towards indicating where changes need to be made. Practical examples from the healthcare and defence sector are provided.

As outlined in the Introduction, a Skills Development System (SDS) (Figure 1) is a helpful way of structuring national education, training and qualifications functions. There are four primary considerations when designing and managing an effective SDS:

Managing sustainable upskilling; evaluating the investment in upskilling, and; setting a new model for upskilling and reskilling that includes a greater focus on life long and workplace learning;

Managing a fragmented and fast changing educational delivery landscape, including; the balance and synergy between Higher Educational (HE) and Vocational Education and Training (VET) and optimizing investment in edtech;

Applying the right level of governance, regulation and assurance that is fit for purpose by sector;

Designing and managing a fit for purpose National Qualifications Framework (NQF), including how make it agile and responsive to demographics and the emerging needs of the labor market.

Managing sustainable upskilling

When deciding to undertake a national upskilling initiative, governments must evaluate the need for upskilling generally, where upskilling will have the greatest impact, and which delivery models are the best fit for lifelong and workplace learning. Once key growth sectors have been identified, a well-designed and funded SDS provides confidence in achieving these upskilling objectives through the involvement of experts from industry, professional bodies, universities and colleges, and learning and development professionals in the workplace.

Additionally, the future workforce (and learner community) will be a blend of young, old, skilled, unskilled, local and international. To be successful in meeting the skills gap challenge, governments must understand their current workforce composition and align their workforce priorities according to their vision, demographics and economic and social ambitions. No country is alike. Countries such as Saudi Arabia have a higher proportion of a younger population, and a declared priority for growing and professionalizing local capability in new sectors such as tourism and cinematography. By comparison, countries such as Japan have an aging population, a diminishing national pool of potential employees and therefore a heavy reliance on imported labor for their growth. These contrasting circumstances share a common imperative: SDS initiatives must firstly align with cross-government workforce strategies; and the sector-focused Manage layer of the SDS needs to fit the needs of the workforce demographic. Design factors for each sector will include for example: the proportion of the skills gap that can be filled by the newly skilled younger workforce versus the upskilling of the existing workforce, and alignment with international qualifications and standards that support labor market mobility.

Most training and assessment of doctors after graduation is done in the workplace with senior practitioners instructing syllabi designed by specialist Colleges, such as the Royal College of Thoracic Surgeons, whose delivery is implemented, regulated and assured by Local Education and Training Boards (LETBs) which incorporate regional deaneries. The dean of each regional deanery (13 in England) has ultimate responsibility for the education and training of all junior doctors in the region, and for ensuring that practice and teaching reflects the latest scientific evidence, diagnostic and equipment capabilities and ethical standards. It is a bottom fed career entry model dedicated to maintaining skills that are current with latest practice and knowledge.

Defence gets its confidence that training is operationally focused, safe, risk based and spend is optimized[11] through the mandated use of a Systems Approach to Training (SAT) – see Chapter 2. The decentralized regulatory and assurance model means responsibility for this confidence is delegated throughout the education and training and qualification ecosystem. The workforce age demographic of defence tends to feature younger generations at its entry point and in junior leadership positions and a 'maturing, older but experienced' population in the middle and senior leadership positions. As a relatively fixed workforce model that also has a bottom fed career entry point, defence has to upskill. Faced with new equipment, emerging technology, threats and doctrine, the learning ecosystem is adapting to regularly reskill those already in the Forces while integrating individuals with the skills in digital, AI, cyber and automation.

Managing a fragmented and fast changing educational delivery landscape

Higher Education and Vocational Education

Since the pandemic struck, there has been a significant upturn in the willingness of Governments to encourage learners and post-secondary education into applied learning.[12] This is strongly endorsed by large employers, some of whom are looking at setting up their own skills academies or qualifications, suggesting that a single education system is not meeting their needs.[13] VET qualifications are explicitly linked to knowledge, skills and competence needed to perform known workplace tasks. Though the intensity of the execution of HE and VET varies — VET is generally less well funded and its regulation less consistent. The VET sector suffers from being undervalued by governments and under-appreciated by learners and employers in some modern economies.[14] Giving VET a substantiated policy and funding boost to its reputation in the eyes of learners and employers will help governments take significant steps towards meeting the skills challenge. There are clear signs of a strategic reset however, in terms of policy and priority. A dual-program model adopted by countries such as the United States, Germany, Sweden, and Switzerland places more importance on vocational education and combines it with on the job apprenticeships to boost youth labor participation rates (evidence shows participation reaching 50 to 65 percent).[15] The UK's latest Education White Paper 2021[16] declares that "new educational measures are designed to put an end to the illusion that a degree is the only route to success and a good job", and that further and technical education is the second class option. Figure 2 illustrates the progress being made to expand the number of VET programmes options available to students.
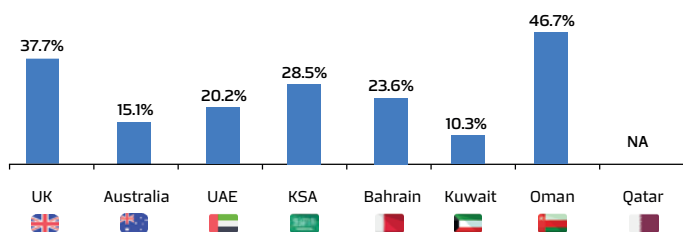
Figure 2:
Qualifications developed in key growing sectors as a percentage of overall qualifications per country, in % (2021)

Educational Technology

The phenomenal growth of educational technology and how and when to use it is proving to be another challenge for governments. Even before COVID-19, the growth and adoption rates in education technology ("edtech") worldwide to replace or complement other traditional methods of delivery was exponential. Estimates by the World Economic Forum show the online edtech market will reach $350 Billion by 2025.[17] With the plethora of edtech available, it is important to establish what business and/or training needs it is solving. The immaturity in

the sector is still leading to an experimental ad-hoc approach that governments can ill afford, and the experience of Covid-19 has both accelerated and refined peoples' appreciation of where it can and cannot help. The European Commission has recently started working on a set of guidelines to address student mental and physical well-being as a result of the Covid-19 experience.[18] Employers are seeing signs of "upskilling fatigue" as a result of the relentless drive to stay current, but with only online options available.[19] Consideration of four key issues, which are important to regulators, can help governments assess what edtech system they need:

1. **The ability to deliver and maintain competency for complex tasks;**
2. **How engaging it is for learners;**
3. **How competent are the educators in integrating it into their classes, and;**
4. **The level of realism needed in the training environment, otherwise known as "fidelity".[20]**

Any investment in an edtec solution must also consider the ability of institutions, trainers, operators and learners to embrace the technology. A pre-Covid-19 US survey revealed that 42% of teachers admitted their students knew more about the technology than they did and that school administrators were neither encouraging adoption of technology nor actively collaborating with edtech companies to improve the final product.[21] Post pandemic, no doubt this situation has improved, and it is therefore a rare window of opportunity for edtech companies to learn from the educators and students, who had no choice but to test its strengths and limitations over many months.

Finally, technology and the shift towards VET means that relevant skills training is increasingly likely to be delivered and conducted through simulation, within the workplace or through remote learning. The issue for regulators, then, is how to ensure the standardization, quality, and effectiveness of delivery and instruction regardless of the delivery location. The solution lies in part with SAT designed course curricula which provide standardized curricula no matter where it is delivered and in part by the creation of professional development pathways linked to certification/qualifications to develop competent trainers, facilitators and supervisors. This approach does not however necessarily require a standard duration of training; advances in AI and adaptive learning technologies are rapidly gaining traction and are easiest to pilot when there is a granular definition of learning objectives and sequencing available.[22]

UK Defence blends delivery and mapping of military training with both HE and VET pathways with a strong focus on apprenticeships for military trades such as engineering and logistics. This recognizes the demographic of young people who join and the necessity to incentivize people to stay, develop and progress through the ranks. The Army develops its workforce from within and has not historically tended to hire in skills, although there is some evidence this is changing as the nature of threats becomes more cyber based.[23] They are the largest single employer provider of vocational apprenticeships in the country with upwards of 20,000 people enrolled, across 180 different occupational categories at any one time.[24] The Defence sector has relatively recently crossed the border between VET into Higher Education (HE) and now partners with universities such as King›s College, Cranfield and University of Reading to add degree qualifications into their training programmes. The design of these programmes is different though from a typical degree program, and recognizes the need for a greater percentage of practice-based learning credits.

Medicine, airlines and defence invest significantly in a wide variety of edtech mostly for safety and cost reasons and to maintain competency for complex individual and team tasks. Lessons from defence show that applying a SAT based methods and media and fidelity analysis, supports intelligent identification of the type and blend of edtech and the level of fidelity replication required. Examples range from a specialist facility for replicating a fire at sea in which individuals and crews practice their fire control drills with and without breathing apparatus in a very realistic but controlled and safe environment, to sophisticated simulation exercises for air defence operators. **It is a matter of policy that the UK Defence's equipment procurement process demands SAT fidelity outputs as evidence for the authorization of funding for any investment in simulation.** Regarding workplace learning supervision, UK Defence has two means for assuring strong supervision. Firstly, the development and delivery of a formal Defence Instructor Pathway codifies the principle that knowing how to impart knowledge, to supervise workplace learning, and to plan and conduct training is an important element in the skillset of commanders at every level.[20]

The Pathway mandates courses and programmes that train the trainer as part of the overall training regime. Secondly, SAT formally records training allocated to the workplace with associated conditions and standards, recognising that elements of formal training are often delivered in barracks and in the field due to resources. This has the same rigor applied to its management and assurance as institutional training.
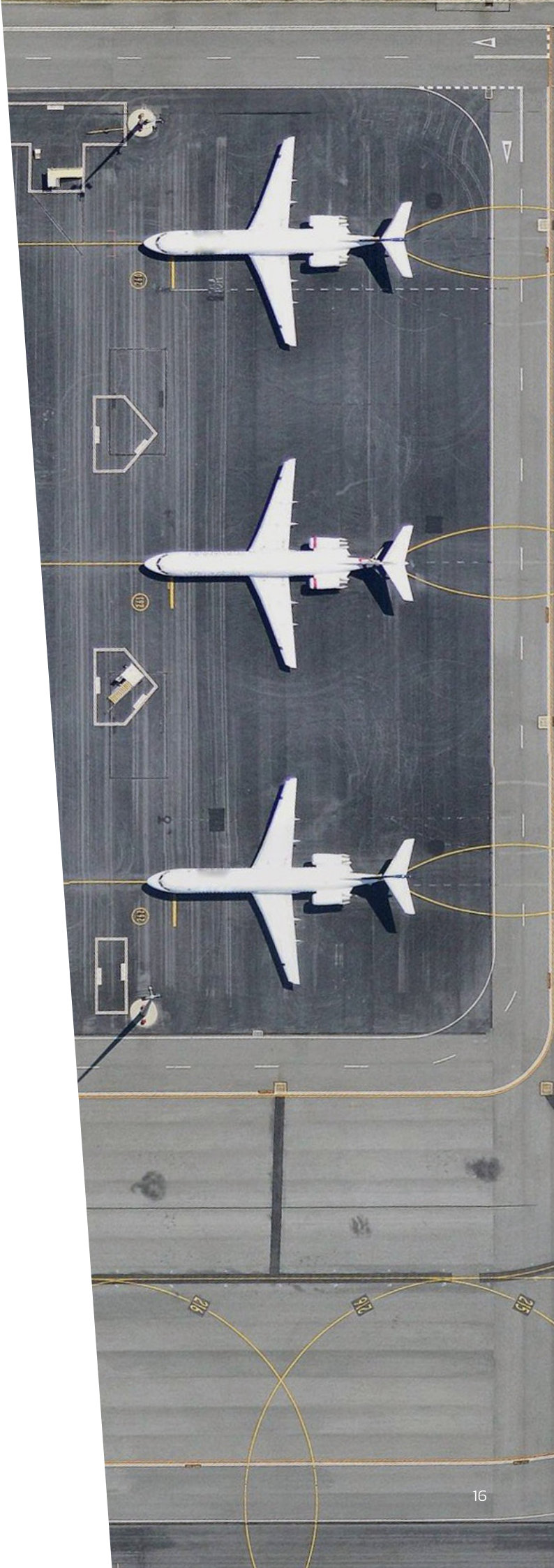
In medical education, the University of California San Diego for example, assigns several real patients to each medical student at the beginning of their studies. The students follow these patients throughout their time at the university – attending any surgery they might need to undergo, joining their GP during consultations etc. They are effectively apprentice doctors and although they are not responsible for any clinical treatment, they benefit from workplace learning early in their chosen career. Medical student residency programmes are well structured and governed through strong links between the teaching hospital and medical school. Clear standards are in place for the supervisor:resident ratios and the rotation of experience. Becoming a popular supervisor is the aspiration of many physicians and evidence of professional standing. Although there is a lot of investment in edtech in medicine, as cadaver and animal labs are costly and often impractical, it is also ROI focused. Some case studies show how the tactile fidelity training objectives for vascular surgery can also be achieved quite inexpensively with plastic tubing and a simple sensory probe.

Applying the right level of governance, regulation and assurance

The challenge for governments is to know how much central governance is required and at what level should its impact be felt. The case studies previously cited demonstrate how a more decentralized governance, regulation and quality assurance is already evident in the Manage layer of some highly regulated sectors such as healthcare and defence, where safety, risk, legal and professional standards apply. Some elements from these SDS's can be applied in a lighter touch way to other sectors though, and thereby help address the challenges of governance in VET skills and qualifications. Chapter 3 introduces a four-step methodology for answering this question based on sectoral needs and demographics

Designing and managing a fit for purpose National Qualifications Framework (NQF)

Linked to the growth in edtech is the exponential increase in the number of online short courses, certifications and qualifications. This growth is both an opportunity and a challenge. On the one hand a younger, digitally savvy workforce facing a working life of jobs (rather than 'a job for life') relishes the open access to low cost learning, on the other hand, the rapid expansion of Massive Open Online Courses (MOOCs), and the lack of standardization across courses such as Data Analytics, leads to confusion and distrust for both learners and employers.[26]

The challenge is to weigh the undoubted benefits of the availability of and accessibility to short courses delivered online against the requirements for effective, assured ET&Q,[27] in which learners and employers have confidence. Further, although many MOOCs are designed by experienced educators from reputable organizations, they assume a certain profile of learner, with minimum language skills and prior knowledge. These courses do not always cross international borders well and are a challenge for learners to access. Despite the plethora of MOOCs therefore, there are still many gaps to be addressed to maximize upskilling opportunities, particularly in developing countries.

Qualifications motivate learners, support career progression and mobility, indicate the quality and value for money of a course or programme, give employers confidence, stimulate lifelong learning and raise employability chances. In terms of encouraging social and job mobility, Recognized Prior Learning (RPL) and stackable qualifications encourage blended Higher Education/Vocational Education and Training (HE/VET) pathways that are easily accessible and valued. Not all sectors require the same level of rigor however and therefore regulation needs to be flexible and agile.

In a high-risk sector such as medicine, confidence in standards is critical and rigorous regulation will apply to a higher percentage of courses and qualifications. In contrast, in a low-risk sector such as tourism and hospitality, rigor can be restricted to courses and qualifications that support safe and legally competent workers.

National and international recognition for qualifications under-pins an effective national and global economy, as nations can capitalize on a global workforce to fill skills gaps in national workforces. Therefore, governments typically adopt national approaches to the awarding of qualifications, aligned to international labor market definitions, but that also aim to include the requirements of national employers in Sector Advisory Councils, Recognized National Development Committees or delegation to trusted institutions such as afore-mentioned medical deaneries. National approaches vary; the UK has more than 190 accreditation and qualification-awarding bodies and five Qualification Frameworks, while Australia has a single framework. Maintaining a fit for purpose NQF is however time consuming and costly, and requires ongoing coordination with employers, many of whom struggle to provide a perspective on their future skill needs.

The EU Centre for Vocational Education reported in 2019 that the concept of learning outcomes is becoming the common basis for almost all national and regional qualifications frameworks worldwide. "Several global trends such as internationalization, digitalization, migration, mobility, learning across borders and changing education, training and qualification systems set the context for national and regional qualifications frameworks."[28]

Their assessment was that in 2019, of the regional qualifications frameworks being developed, only the European Qualifications Framework and the ASEAN Qualifications Reference Framework were considered as operational, although the implementation of the other frameworks has broadened and deepened.

Managing the updating of national qualifications relies heavily on the cooperation of employers, and this is assuming they are willing to participate and knowledgeable of their future skill needs, which is not always the case. To stay market relevant, governments have an opportunity to connect more actively regionally to keep their NQF's up to date. It is imperative that the more developed countries support those who are still building the essential skills in their growing sectors.

The health sector accommodates a global network of qualification frameworks. Developing countries maintain complex databases of equivalency between qualifications from different countries, and there are many organizations supporting the work of equivalency and credentialing. Perhaps because of this complexity, medicine has proven to be reluctant to deviate from accepted professional development pathways. In some countries out of pure necessity for scale, Africa for instance, there are examples of market driven qualifications, "nurse practitioners" or "physician extenders" for instance, who are able to perform emergency procedures such as C-sections and appendectomies in remote regions. However, they are not qualified to do other procedures. Adoption of these roles as mainstream has been slow due to the many checks and balances and years of accepted ways of training and working; nor is it popular in countries who can import more doctors or where the regulatory system is not mature enough to manage the potential risks. Rapid advances in diagnostics and health technology is placing medical qualifications systems under stress, much like the growth in cybercrime is stressing the accepted training pathways of defence professionals.

Defence recognizes that nationally and internationally vocational qualifications have a recruitment, retention and resettlement value. In terms of recruitment and retention the achievement of qualifications supports the preparation for service, reflects upskilling while in service, and supports progression through promotion into other specialist areas. As previously mentioned, UK defence has strategic partnerships with universities including King›s College London, Cranfield University and the University of Reading, and with Further Education Colleges to recognize and accredit learning in the course of a military career and to award degrees, diplomas and other recognized qualifications.

Skills for Australia have outsourced the development and maintenance of national qualifications to Skills Service Organizations. PwC, a global professional services firm with a large market presence in Australia, are one of these Skills Service Organizations, tasked with qualifications development for over 14 sectors. The model is successful in part because it leverages PwC's existing access to employers and ability to test employer talent needs.[29]
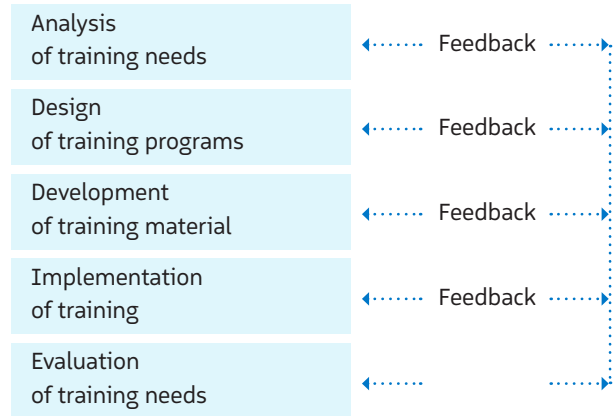
Benefits of a systems approach to delivering future proofed education and skills

2.
Benefits of a systems approach to delivering future proofed education and skills
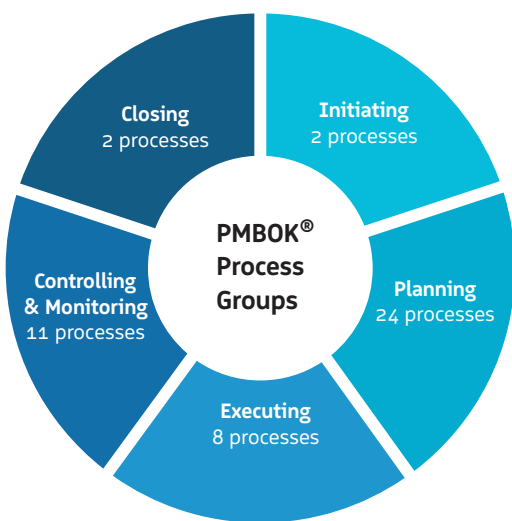
Chapter 2 looks more closely at a systems thinking solution for upskilling through the Systems Approach to Training (SAT). SAT is particularly widespread in high risk sectors such as defence and nuclear power. These sectors are characterized by having a focus on skills for the job, requiring a regulated, consistent training environment, and continued life-long learning. For other sectors too, the ability to match learning outcomes accurately to sector and employers' needs and provide consistent and measurable outcomes, is also key to accelerating upskilling efforts. The benefits of a SAT approach are valid across many and arguably all sectors.

A 'systems approach' considers the attributes of an entire system in order to solve a problem. The term describes a combination of a way of thinking with a set of processes, methods and practices that aim to effect system change.[30] Figure 3 identifies two different sectors (project management and nuclear power) that use a systems approach and the Open University who also follow a systems approach to programme design. Systems approaches allow the designer or facilitator to better manage, incorporate and anticipate both complex behaviors and emergent behaviors.

International Organization

Analysis of training needs	‹······ Feedback ······›
Design of training programs	‹······ Feedback ······›
Development of training material	‹······ Feedback ······›
Implementation of training	‹······ Feedback ······›
Evaluation of training needs	‹······ ······›

Project Management

Academic
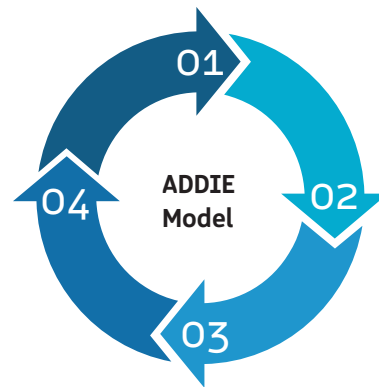
01 A – Analysis
Requirement, Need, Task, and Audience Analysis

02 D – Design
Learning Objectives, Outline, and Delivery Media

03 D – Development
Storyboards, Graphics, and Construction

**04 I & E – Implementation and Evaluation**
Quality test and Evaluations

Figure 3:
Structured training frameworks across different sectors

Several highly regulated sectors such as defence, medicine, public safety and the nuclear industry have adapted the principles of Systems Thinking to develop, implement and mature a **Systems Approach to Training (SAT) model** (Figure 4) to solve their skills problems. A mature SAT model goes beyond common terminology and methodologies, it includes an effective management and governance structure, or the 'golden thread' that runs throughout the layers of Direct, Manage and Execute. This 'golden thread' ensures coherence, standardization, and compliance across complex, global, and multi-dimensional organizations, and enables objective and risk-based ET&Q decisions to be made from evidence-based data.[31] SAT can be quite process heavy, but recent developments in SAT software have made it considerably more manageable and therefore accessible to other sectors who have previously not had the resources available or require lighter processes.

> Modern and intelligent SAT focusses on outputs, the aim being to train people to perform occupational roles to the required standard in the best way possible given the resources available.

Although common examples of its application are generally found in more risky and regulated sectors, the SAT model can be adopted at different levels of intensity and detail. More information on the origins of SAT are in the appendix.
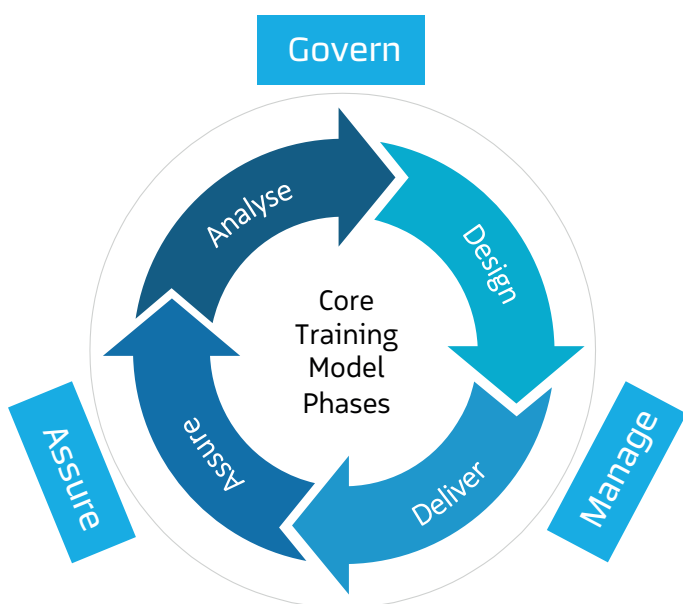
Figure 4:
An example of a Systems Approach Training (SAT) Model

The benefits of SAT

SAT is a methodical and trusted solution to solving (and preempting) education and training and qualification (ET&Q) problems. It has many benefits, some aligned to typical systems thinking, and others that justify its positioning as an enabler to solving the global skills challenge. These benefits are summarized below:

Learner centric – support and confidence for learners as they navigate through the plethora of ever-increasing courses and certificates looking for those that will increase their chances of continued employability and improve their mobility.

Employer centric – providing assurance that the needs of the employer and learner are met. The relationship between requirement setter (employer) and learning deliverer is a cornerstone of SAT.

Auditable – a trusted approach to solving the upskilling challenge, through the core auditable SAT activities of Analyze, Design, Deliver and Assure, with sectoral and professional participation as required. SAT can be used to identify capability issues that may have stemmed from the training and quickly rectify them. It also provides an audit of decision making on training risks. SAT also provides the means to measure and monitor performance of the overall SDS more easily as it is more process and metric driven.

Cost efficient – an approach to manage the balance of cost versus risk whilst meeting safety and legal standards and considering the business drivers. In times of constrained budgets 'training' is the element of business most commonly under threat and proving its value requires evidence-based analysis and recommendations and transparent decision-making processes.

Smart technology enabled – SAT identifies the most effective use of edtech, using fidelity and methods and media analysis. Justifying an immersive high fidelity live, virtual, constructive (LVC) skills-based training solution versus an e-learning knowledge module requires deep and detailed analysis and evidence. An ill-informed decision can be catastrophic. The 737 Max investigation report[32] cited that Boeing had intentionally sought to ensure that MCAS – an essential and relatively new flight system – was not defined as a new function in the plane in order to avoid "increased costs and greater certification and pilot training impact".

Applied learning – knowing when and why to place formal training or assessment into the workplace is a fundamental aspect of SAT. It articulates, records, tracks and supports the entire ecosystem of workplace training. It deals with reality and practicality; identifying where training can be best resourced (equipment, trainers, assessors, time, flexibility).

Minimum levels of assurance – SAT provides assurance that instructional standards are maintained across the execute layer through developing standardized curriculum and comprehensive trainer qualification pathways. Both of these continue to evolve to meet pedagogical and technological advances.

Flexible – governance can range from a centralized ecosystem whereby the Direct layer maintains most control (low risk sectors) to a more distributed ecosystem where responsibility and authority are delegated (high risk sectors). This flexible system is resource and process efficient and risk based.

Compliant with national and international standards – giving confidence and transparency to regulatory bodies and employers that the ET&Q solutions comply and align with international and national qualification frameworks.

Deep Dive: SAT in the Defence Sector

Defence ET&Q must prepare personnel, individually and collectively, to operate in complex and challenging environments, where the consequences of failure can be catastrophic and have strategic implications. Militaries around the world adopt very similar SAT models – the diagram in Figure 5 shows the models used in the USA, UK, UAE and Australia. All include cyclical processes of:

Analyze – addresses the training and qualification requirements to meet the occupational need and skills gap, focusing on; identifying the learner personas, size and risk of skills gap, and the blended delivery blueprint considering training fidelity, methods and media, resources and cost.

Design – addresses the design and development of the formal training and qualification outcomes and the supporting technology enabled methods and media to support delivery and assessment.

Deliver – addresses the management of the training delivery, which includes; resources, personalized learner pathways, certification and facilitator/instructor development.

Assure – considers if the training has been delivered in accordance with the agreed standards, and whether or not it continues to meet employer/sector needs.

Govern/Manage – the cycle is underpinned by robust governance and management systems, supported by technology, to oversee and deliver the regulatory activities and confidence in the SDS.
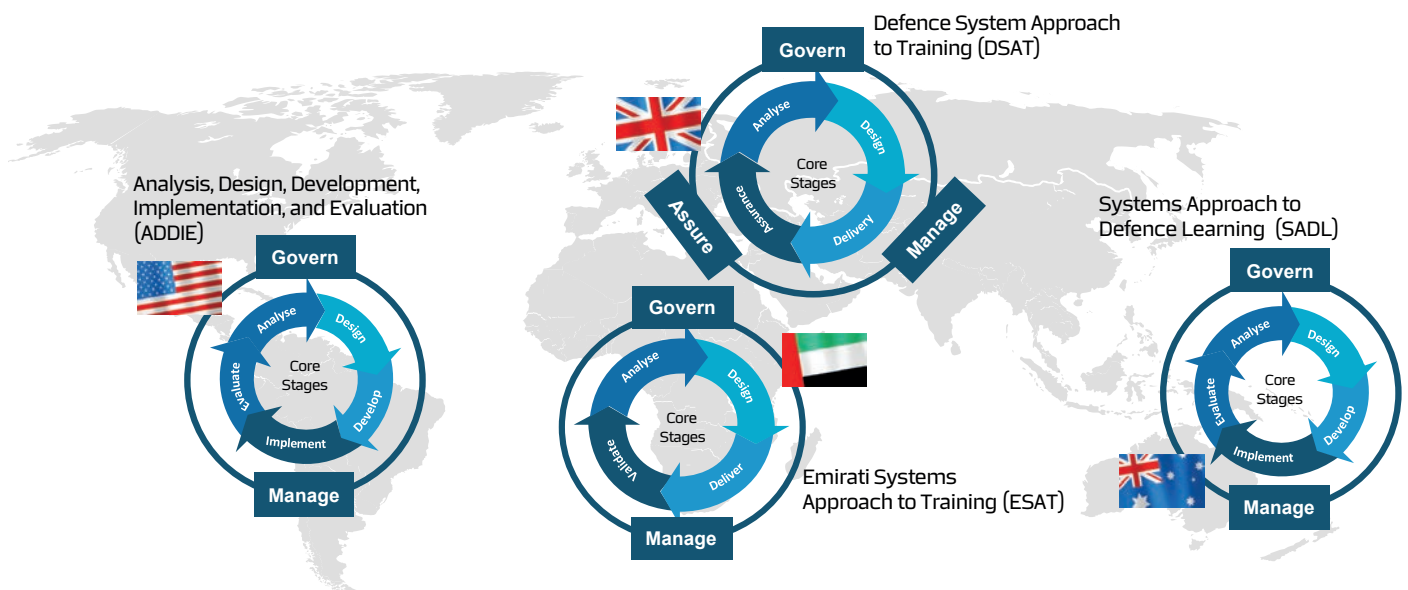
Figure 5:
SAT Models in Defence – USA, UK, UAE and Australia

There is a common misconception that SAT is an inflexible and process-driven activity, heavily focused on inputs like completion of paperwork, formatting of documents etc. The introduction of technology to aid the development of SAT products by automating processes and removing human error, coupled with the imperative to support training in organizations who must respond rapidly to emerging threats, have resulted in SAT being a force multiplier by the world's most effective militaries. SAT Technology has been shown to deliver 40% time saving costs and 20% total savings costs.[33]

The UK Defence Systems Approach to Training (DSAT)

"As Director of Army Training I was responsible for ensuring that individual and collective training met the operational needs of the British Army. The use of DSAT at a time when the Army was heavily committed on operational deployments and under considerable resource pressure was the key enabler for meeting that responsibility. Hard experience shows that any organization seeking to improve its training performance in terms of quality, effectiveness and efficiency should use a systematic approach to training to underpin its training effort."

Lieutenant General Sir Ben Bathurst KCVO, CBE, United Kingdom Military Representative to NATO.

The UK MOD's DSAT is among the most sophisticated and capable in the global defence sector and has been taken as a model to initiate similar systems across maturing defence forces. DSAT is mandated through JSP 822[34] to apply to all UK military training, both individual[35] and collective[36]. DSAT is underpinned by technology and is governed by a decentralized model with a significantly capable and resourced Manage layer (often referred to as the "Engine Room").

Its success is due to the expertise of those who deliver the DSAT capability and provide QA across the ET&Q spectrum, including a professional Education Corps. Specialized education officers at the Manage and Execute levels are supported by trained teams across the SAT functions; these teams are a blend of military (the majority), civil servants and contractors. For university accredited qualifications defence uses DSAT endorsed outputs to map the military course standards against the required qualification(s) standards, working in collaboration with the university to confirm alignment or identify gaps and solutions to close them. Military students who achieve course standards, submit a percentage of work for assessment and award by the university using QA assessment mechanisms such as independent Moderation and External Examiners.

The most recent changes and areas of interest within defence SAT and the supporting policy JSP 822 are:

Collective Training Needs Analysis, identifying the critical incidents and stressors within a team or larger collective unit, replicating those in a 'no fear to fail culture', and combining networks and multi-disciplinary organizations in a Live, Virtual and Constructive (LVC) and instrumented training environment as a 'surrogate for war'.

Management of distributed workplace/remote training, tracking delivery across multiple locations by multiple training providers, and recording and tracking deficiencies.

Reductions in course length and targeted use of edtech for online and distance learning to deliver knowledge units. Development of instructional designers' courses to reflect the skills required to design this type of training.

Use of Training Needs Analysis, in particular the fidelity analysis, in MoD procurement projects to provide business case evidence for budget approval for expenditure on training equipment.

Development of through life qualifications linked to career pathways for soldiers and officers aligned to military career courses.

Coaching and development of leaders.

UK SAT Case Study – 2012 Olympics regulatory confidence and qualification development

At the 2012 Olympics it was decided that the UK military would support civilian police and contractors' efforts to provide security at each Olympic venue. Approximately 17,000 military personnel were trained and deployed at short notice to perform security related tasks. The Chief of the Defence Staff directed that all military personnel be offered the opportunity to obtain a civilian security qualification recognizing their contribution to the Olympics. Yolanda Peck, Strategic Manager for City and Guilds MoD and Public Sector stated the following:

"The contract was agreed on 16 July 2012….two weeks later 12000 registrations…...a week later 36,000 question papers had been delivered to temporary examination centers. On 11 August 2012 the first certificates were presented to successful trainees. The whole project was delivered with military precision which proved how well the relationship between the MoD and an Awarding Organization can work………...a stunning example of efficiency, fantastic project management, customer support and best ever cross cooperation."

The extremely rapid implementation of this initiative demonstrates the ability of an agile and intelligently applied SAT process to provide the quickest way to achieve nationally recognized qualifications as well as provide the confidence to the awarding bodies in the qualifications and certification achieved, including confidence in decentralized QA processes.

The UAE's SAT

The youngest of the defence SAT models. UAE GHQ mandates that all training within its constituent elements is produced in accordance with SAT. SAT was first introduced in 2005/6, based initially on UK DSAT. It has evolved over time into a bespoke process, governed by policy that suits the UAE's specific needs. SAT practitioners are employed at Force HQs, at the operational units to conduct Analysis and Assurance, and within the training institutions to conduct Training Design, Development and Assurance. To attract and retain more Emiratis into this as a profession, a number of National Qualifications for SAT are being developed by an internal military qualification awarding center in collaboration with the Rabdan Academy.

A challenge maturing defence forces has faced, is that much of its military training is developed with the support of overseas military contractors, and training reflected what was delivered in the countries from which these contractors originated. As a result, training was potentially incoherent and not tailored to the specific needs of the military and the conditions under which they operate. The introduction of SAT has ensured that training is developed specifically to meet bespoke military requirements.

Cross Sector Case Study – Medical Training Simulation Analysis

One of the processes conducted during SAT is that of fidelity analysis – an assessment of the extent to which the training environment should replicate the workplace environment. Decisions made at this stage can have a significant impact on the nature and cost of training solutions, as high fidelity generally equals higher cost).[37] Simulation is a critical element to military education and can be exceptionally costly.[38] The cost benefit of identifying the optimum fidelity required is therefore a critical aspect of training design and is one that an effective SAT can address.

The healthcare sector also relies on simulation to underpin training, and the cost-benefit of fidelity analysis is equally important here.[39] In 2012 a research team at a Defence Medical ET&Q symposium at King›s College London demonstrated the tangible benefits of applying results of Fidelity Analysis in training option decisions. They concluded it was not necessary to replicate the operating theater entirely, simply the operating theater sounds, which could be achieved at a lower cost using a portable tablet device. Defence learnt from this research and applied it to their DSAT policy, supporting more focused and intelligent procurement of military simulation.

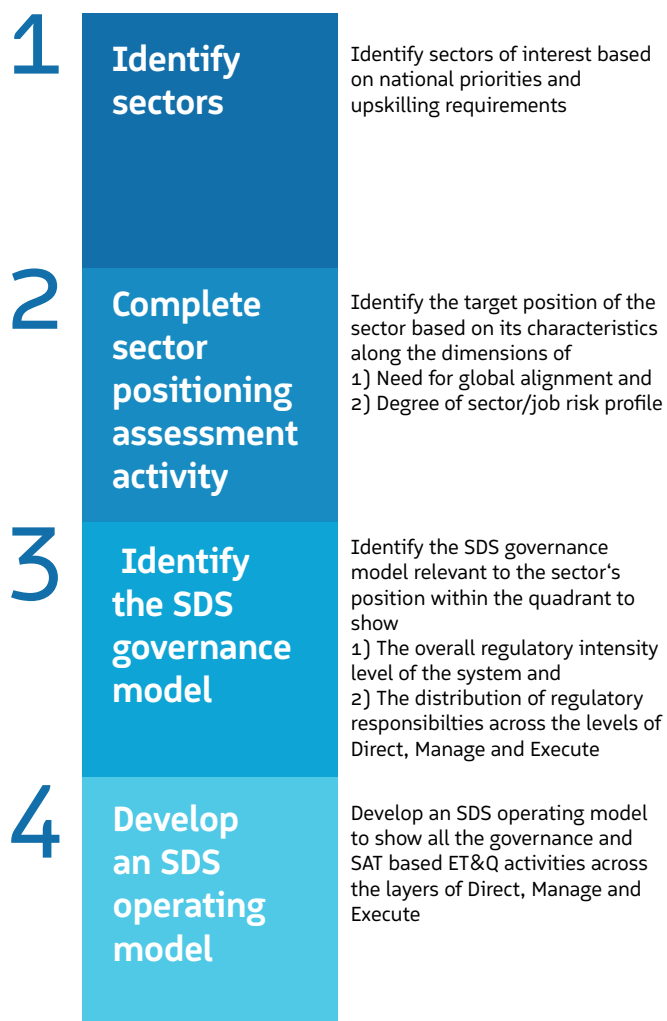# A methodology for Governments to deliver future-proof education and skills

3.
A methodology for Governments to deliver future-proof education and skills

This chapter introduces a methodology for building a Skills Development System (SDS) operating model based on SAT principles that will help solve the four key operational challenges governments face in future proofing education and skills:

1. Managing sustainable upskilling;
2. Managing a fragmented and fast changing educational delivery landscape;
3. Applying the right level of governance, regulation and assurance and;
4. Managing a fit for purpose national qualifications framework. The methodology factors in the different needs of different sectors and country demographics and provides models of governance that match the recommended regulatory intensity of the system on a sector by sector basis.

A key element to that evolution is to implement, firstly, a national overarching SDS and then to expand this further by developing, integrating and aligning sector level SDSs. As outlined in Figure 6, the design of an agile and fit for purpose SDS is guided by the following four steps:

1 Identify sectors
Identify sectors of interest based on national priorities and upskilling requirements

2 Complete sector positioning assessment activity
Identify the target position of the sector based on its characteristics along the dimensions of
1) Need for global alignment and
2) Degree of sector/job risk profile

3 Identify the SDS governance model
Identify the SDS governance model relevant to the sector's position within the quadrant to show
1) The overall regulatory intensity level of the system and
2) The distribution of regulatory responsibilties across the levels of Direct, Manage and Execute

4 Develop an SDS operating model
Develop an SDS operating model to show all the governance and SAT based ET&Q activities across the layers of Direct, Manage and Execute

Figure 6:
Step-by-step approach for the design of a Sector SDS operating model

Step 1 – Identify the country's focus sectors and associated future skills gap

Although the upskilling challenge is relevant across most sectors, it is recommended to pilot the approach on a handful of key growth sectors, those that have the potential to contribute the most to economic and social goals.

Step 2 – The sector positioning assessment model

The positioning assessment model identifies where each key sector[40] should be positioned by evaluating two parameters, global focus and risk profile:

Global Focus – considers the need to participate in the global skills market. This factors in considerations such as national demographics, the reliance or otherwise on international labor to provide skilled workers, and the advantages of complying with international sectoral standards and regulation. A sector may wish/need to meet international standards or set them.

Risk Profile – considers the inherent level of risks associated with the sector and how significant the impact is of failing to achieve and sustain minimum competence on public/personnel safety. It assesses how dynamic the sector is and the level of disruption the sector is susceptible to.

There are other dimensions that may be relevant to a sector. For example, the strength and quality of the private sector. In some sectors such as IT skills training, the barriers to entry are low leading to large numbers of small private sector, for profit organizations that may need tougher central governance. The current standard of the existing delivery layer may well influence the governance options as well. Another dimension may be employment potential, with a high employment potential meriting a stronger government intervention. For the purposes of this paper however, the focus is on two parameters that are more common across all geographies.

By answering questions under these two parameters (see Appendix B), regulators will be able to firstly; identify the recommended SDS governance model (centralized or decentralized) with the distribution of regulatory responsibility and intensity across the Direct, Manage and Execute levels, and secondly; the distribution and rigor of the SAT activities, thus shaping the SDS operating model for the sector. The assessment can and should be applied at both the sector and job level as it may not always correlate that where a sector has a 'global/high risk profile', all associated jobs share the same profile. Therefore, conducting a job 'positioning' activity can deliver SDS efficiencies.

We acknowledge that these questions are subjective and would need to be defined based on reliable metrics available in each market. Over time however, a good SDS is very metric enabled and continuous improvement should be easier for regulators to monitor. Figure 7 illustrates the results of these questions for eight different sectors across six countries;

UAE Defence (a high risk job sector that relies on international equipment and expertise);

Egyptian Agriculture (a growth sector in other countries and where Egypt has the opportunity to export labor due to lack of employment opportunities in country);

Chinese Space (a growth sector where China shapes international standards and can develop its own workforce);

UAE Hospitality (a growth sector with low risk job profiles, and dependent on a global workforce);

KSA NEOM Hospitality (a growth sector with aspirations to disrupt hospitality, reduce reliance on global workforce and set/attain global standards);

Healthcare in the UK (a mature and globally connected sector);

Culture in Saudi Arabia (a growth sector trying to strike a balance between international expertise and the intrinsic qualities of its national culture);

Finance Sector in the UAE (a low growth, mature and internationally dependent sector).

Figure 7:
Sector positional assessment, an indicative chart showing the positioning of key sectors in individual countries

Step 3 – Identify the recommended SDS governance model

Once the sector is positioned, the distribution of regulatory responsibilities across the Direct, Manage and Execute levels, and the intensity of the regulatory system can be identified, thus shaping the SDS governance model. Figure 8 illustrates the four recommended SDS governance models, each associated to a quadrant. The regulatory activity is based upon the SAT activities of Assure, Govern and Manage.

Higher alignment to international standards, qualifications and frameworks, with a high reliance on a global labour market to fulfil sectoral objectives

Global Focus

High intensity ←

Model 1 — Overall regulatory intensity = 8 – High
Direct / Manage / Execute

Model 3 — Overall regulatory intensity = 6 – Medium
Direct / Manage / Execute

Low intensity / High intensity →

Risk Profile High (Decentralized Regulation)
An inherently high-risk sector. Failure of competence has a significant, strategic impact. A highly dynamic environment with increased probability of disruption. Higher complexity in skills. Regulation and quality assurance requires effective delegation and self regulation

Risk Profile Low (Centralized Regulation)
A lower risk-sector and less impact of incompetence. A less dynamic environment and disruption probability low. Lower complexity in skill and competency maintenance. Central regulation effective, with minimum delegation in quality assurance and self-regulation

Model 2 — Overall regulatory intensity = 6 – Medium
Direct / Manage / Execute

Model 4 — Overall regulatory intensity = 3 – Low
Direct / Manage / Execute

Low intensity

Local Focus

National / local standards sufficient and a local workforce prioritized, minimal reliance on global labor market

Figure 8:
The SDS governance models identifying the distribution of regulatory responsibility (shape) across the Direct, Manage and Execute levels and overall regulatory intensity (color) of the SDS system

- **The shape –** of the model represents the distribution of the regulatory responsibility and activity across the Direct, Manage and Execute levels. A decentralized distribution pushes responsibility down through the Manage and Execute levels to provide greater rigor and accountability throughout the system. A centralized distribution maintains a majority of responsibility at the Direct level as the lower risk profile and focus on localization does not require as much rigor and regulatory activity throughout the system.

- **The shading –** of the model represents the overall regulatory intensity (regulatory activity and rigor) of the system, with high intensity represented by the darker shading. Model 1 has the highest intensity, models 2 and 3 have the same level of intensity and model 4 has the lowest.

Step 4 – Identify the recommended SDS operating model

Once the sector is positioned (Figure 7), and the governance model is identified (Figure 8), the SDS operating model, with an initial high-level blueprint, can be designed. The SDS operating model incorporates the regulatory responsibilities (Assure, Govern and Manage) with the other SAT activities of Analyze, Design and Deliver. As with the SDS governance model, the SAT activities within each model, guides the level of rigor, focus and resource to be applied at the Direct, Manage and Execute layers. The Delivery function within the Execute layer can be

further broken down into formal institutional and workplace delivery or self-study, as the latter will continue to increase and is already an opportunity for tighter standards controls. As risk profile and globalization reduces, the rigor and activity levels can be reduced, thus ensuring the SDS is appropriately focused and resourced. Figure 9 illustrates the four SDS operating model blueprints.
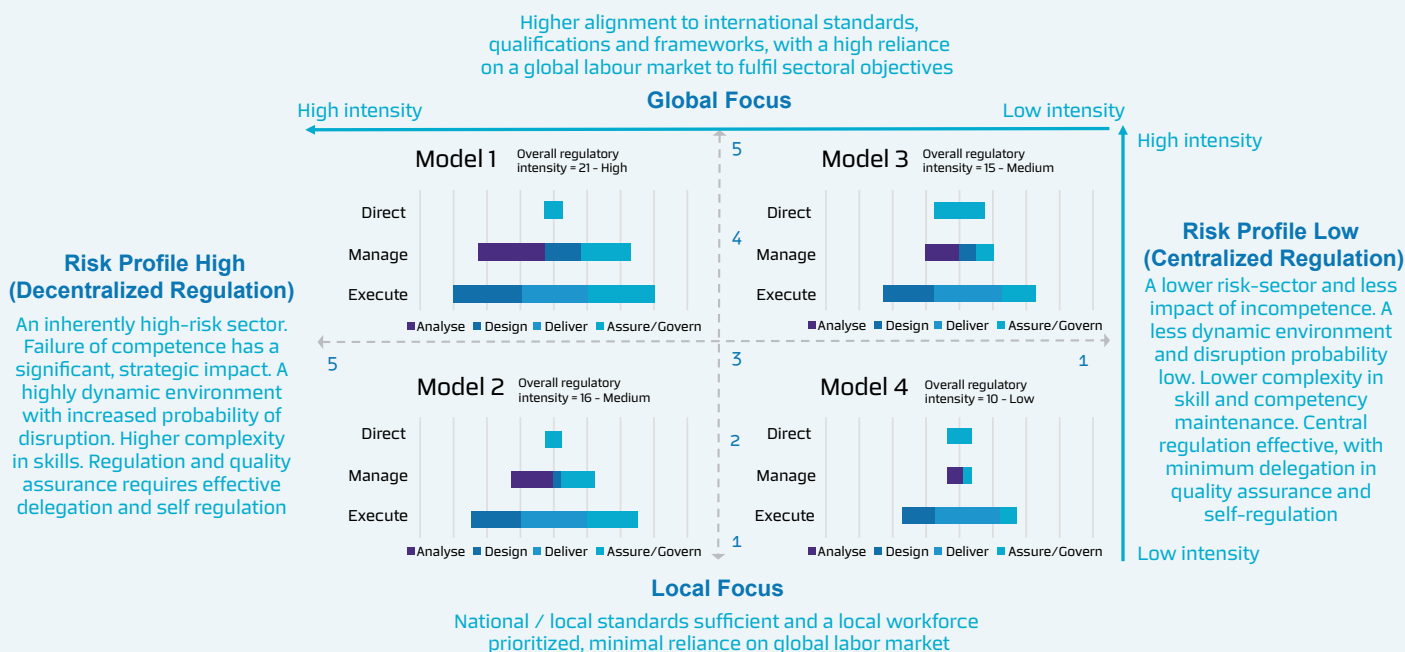
Figure 9:
The four SDS operating model blueprints, combining regulatory and SAT activity distribution and responsibility across the Direct, Manage and Execute levels, and overall intensity of the system

A high-level explanation of each SDS operating model blueprint is below:

Model 1 Delegated/Global – represents the high-risk job sectors (such as defence and healthcare) where a decentralized but intense regulation model coupled with a global standards perspective requires robust, yet agile regulation and delivery of SAT outputs. A SAT Professional approach is recommended.[41]

- **Direct –** an effective, light touch, providing clear and detailed strategy and policy that considers both national and international standards and frameworks, and supports global partnerships and collaboration. Responsible for regular and robust 3rd party assurance on the SDS Manage and Execute levels.

- **Manage –** the key to success for this model is a strong and effective Manage layer that acts as the 'engine room' of the system and the gearing mechanism between Direct and Execute. Its key purpose is to provide rigor to the design of standards and conduct of assurance to ensure curriculum, qualifications and delivery continues to meet the regulator, sector and learners needs. This includes

managing requirements of 'trusted bodies' such as medical royal colleges, qualification awarding bodies, skills advisory councils and professional associations.

- **Execute –** delivers a managed portfolio of quality designed courses through institutional and workplace formal solutions and with a significant dependence on higher fidelity simulation and the Live-Virtual-Constructive (LVC) environments. Design and assurance activities as well as training supervisor skills are key to this level to deliver standardization and maintain occupational competence.

Model 2 Delegated/Local – these sectors (such as Space in China) represent the same high-risk job profile as Model 1, but have a local focus, taking some account of international standards, in as far as they exist, in order to align operational performance, but otherwise prioritize the development and assurance of national standards, frameworks, and local labor. This can be intentional or because international standards aren't shared, or international partnerships cannot be forged, and countries are therefore made to go their own way. As essential global supply chains are now being brought onshore post Covid-19, this model is likely to be more relevant. In this model, the intensity and rigor of regulation can be somewhat lighter as there are fewer/ no international standards to align with, and the SAT activities may be reduced in either the level of detail, or a with a focus on safety, legal and national qualification requirements. A SAT Professional approach is recommended.

- **Direct –** an effective, lighter touch Direct level function, as per Model 1 providing clear and detailed policy but considers national standards, frameworks, partnerships and collaboration over international, with a reduced but effective 3rd party assurance function.

- **Manage –** this model still retains a 'Manage' engine room to meet the risk profile, but takes into account a reduced qualification requirement (national level) and may decide to focus attention on safety and legal standards.

- **Execute –** as with Manage, the SAT activities in Design and Assure can be reduced to meet the local focus. The blend of delivery is likely to require the same significant dependence on higher fidelity simulation and the Live-Virtual-Constructive (LVC) environments for the risk-based learning content.

Model 3 Centralized/Global – represents a lower risk profile sector (such as tourism and hospitality in the UAE), but retaining a global focus as dependent on importing or exporting labor and requiring alignment with international standards. These sectors are characterized by predominantly less complex and less dynamic skills-based competencies and less disruption leading to a more flexible remote, workplace and self-paced delivery ecosystem, which can be satisfied with a centralized, lighter intensity regulation approach. A SAT Light approach is recommended.

- **Direct –** sector strategic direction and policy to take account of international standards and regulations and a capability that can deliver the centralized governance operating model functions. Third Party assurance activities can be more focused and less frequent.

- **Manage –** a slim but effective Manage layer focuses the SAT activities of Analyze and Assure on primarily specialist and risk related training e.g. underwater diving instruction and food safety in the tourism sector, and those related to international qualifications.
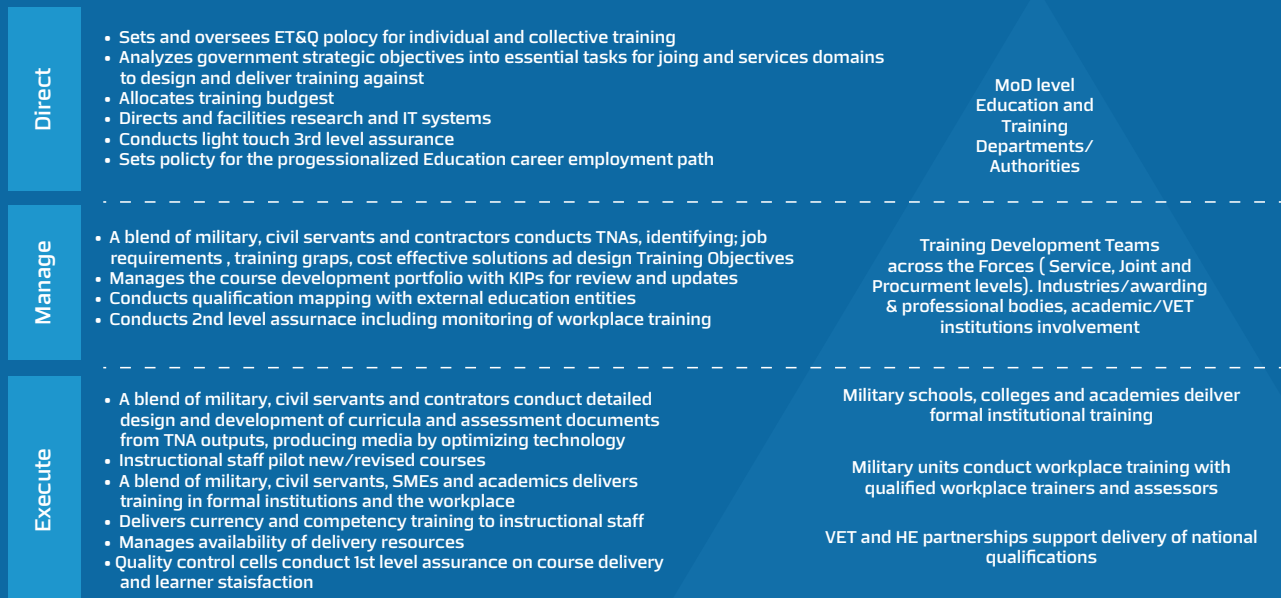
- **Execute –** similar to Model 2, and due to the likely plethora of courses, certificates and qualifications, the Design and Assure activities should be focused on the specialist and risk related subjects that require evidence of legal and safety compliance. Due to the emergence of e-learning, there is benefit in focusing on the more complex, and risk-based skills for formal institutional and workplace delivery and transferring all other content on-line to reach a potential global audience.

Model 4 Centralized/Local – represents the lowest level of risk profile, with a focus on national/local standards, and labor. This model is characterized by the light SAT approach that can be adopted to deliver the minimum standard to meet national, legal and safety requirements. There are fewer sectors that fall into this model, and tend to be those that are a national strategic priority, such as developing a culture sector in Saudi Arabia, or represent a significant opportunity for employment, such as the export of Egyptian labor to high growth Arabic speaking countries with small populations. A SAT Light approach is recommended.

- **Direct –** sector strategic direction and policy to take account of national standards and regulations and a lighter capability that can deliver the centralized governance operating model functions. Third Party assurance activities further reduced.

- **Manage –** minimal Analyze and Assure activities, focused on primarily specialist and risk related training, and where required, development of national qualifications. The SDS recommends this very slim Manage element that historically has not been mandated, to regulate standards and consistency in skills, courses and certificates.

- **Execute –** Design and Assurance activities can be lighter and focused. Potentially a higher demand than Model 3 for workplace and remote learning to support an increase in learner throughput and nature of the learning content.

An example of an SDS operating model blueprint for defense

Having identified the recommended SDS operating model blueprint, successful implementation requires regulators to design a bespoke sector SDS blueprint, with appropriate KPIs to test and refine its effectiveness. Figure 10 is an example of the blueprint for the UK's defence sector.

Direct
- Sets and oversees ET&Q policy for individual and collective training
- Analyzes government strategic objectives into essential tasks for joing and services domains to design and deliver training against
- Allocates training budget
- Directs and facilities research and IT systems
- Conducts light touch 3rd level assurance
- Sets policty for the progessionalized Education career employment path

MoD level Education and Training Departments/ Authorities

Manage
- A blend of military, civil servants and contractors conducts TNAs, identifying; job requirements , training graps, cost effective solutions ad design Training Objectives
- Manages the course development portfolio with KIPs for review and updates
- Conducts qualification mapping with external education entities
- Conducts 2nd level assurance including monitoring of workplace training

Training Development Teams across the Forces (Service, Joint and Procurment levels). Industries/awarding & professional bodies, academic/VET institutions involvement

Execute
- A blend of military, civil servants and contrators conduct detailed design and development of curricula and assessment documents from TNA outputs, producing media by optimizing technology
- Instructional staff pilot new/revised courses
- A blend of military, civil servants, SMEs and academics delivers training in formal institutions and the workplace
- Delivers currency and competency training to instructional staff
- Manages availability of delivery resources
- Quality control cells conduct 1st level assurance on course delivery and learner staisfaction

Military schools, colleges and academies deilver formal institutional training

Military units conduct workplace training with qualified workplace trainers and assessors

VET and HE partnerships support delivery of national qualifications

Figure 10:
Defence sector SDS Operating Model blueprint

Beyond the SDS operating model blueprint – an introduction to the Total Skills Development Solution framework

Progression and implementation of the SDS operating model blueprint is guided by the Total Skills Development Solution framework; a comprehensive tech-enabled methodology and suite of tools for achieving effective and cost-efficient upskilling. It's three main components as shown in Figure 11 are:

1.   **The core** – the skills development operating model at the core of the framework, which directs and guides the SAT/regulatory activities to be conducted.

2.   **Technology** – this includes a 'tech-enabled engine' driving and automating the SAT processes and outputs (e.g. Qualification Development System (QUADS)) and other supporting learning technology to respond to the disruption being seen in the delivery of training e.g. Learning Management Systems (LMS), e-learning, virtual reality and assessment proctoring.

3.   **Managed Services** – support to implement a Total Training Solution capability within a sector's E&T ecosystem.

Figure 11:
Total Skills Development Solution Framework
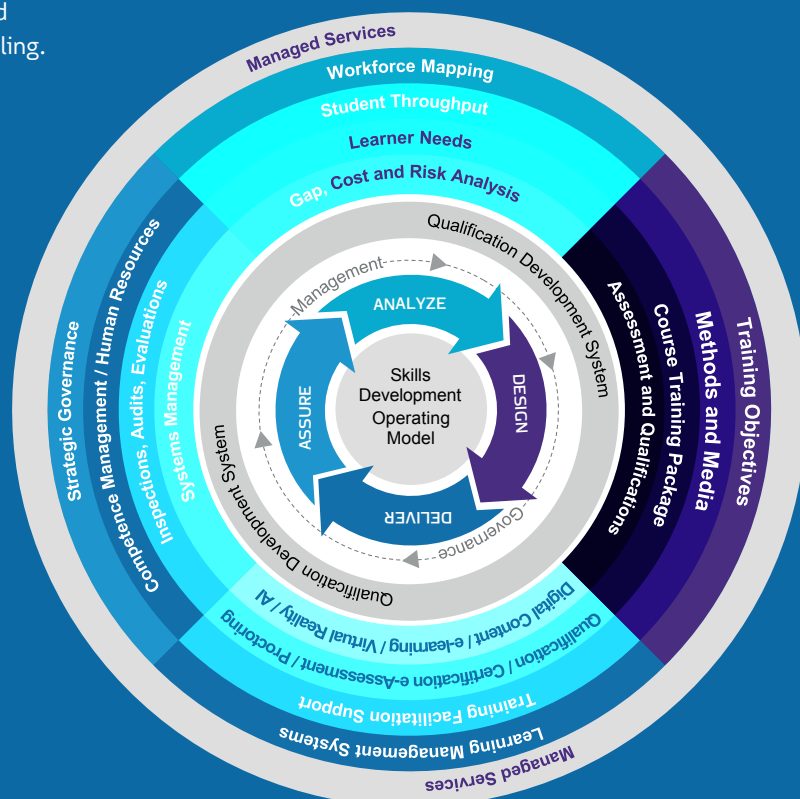
A tech-enabled Total Skills Development Solution brings the following benefits:

QUADS – The Benefits

Tackles the **main market 'disruptor'** when and how to digitize training delivery and the learner's journey

Dual **training and qualification design** in a single system, supporting a growing skill set and national demand

Optimizes system and human performance, **60% automation of data, savings in time, cost, resources**

Adaptable to client needs and integration with existing E&T systems to enhance digital services and assets

Automation efficiency gains

Automated processes are known to be more trustworthy & efficient

60% Automation of data

50% Potential reduction in time / resource

20% revenue savings annually through efficient processes

The steps, evaluations and recommendations in this chapter illustrate a practical approach that can be followed by regulators addressing the skills problem. The following list summarizes some of the important contextual considerations that need to be factored in:

- Ensuring skills development and ET&Q policy for each sector is aligned with the national vision and takes account of government economic, social, business and trade policies;

- Applying a systems thinking approach to designing SDS operating models must take place with a sectoral perspective – there is not a one size fits all model for optimizing regulation, especially when resources are scarce;

- Recognition that key to success of effective delegation is an effective and dynamic Manage layer, operating as 'an engine room', which is often a diverse group of public and private sector actors that requires coordination and appropriate funding creating qualifications and resourcing;

- Noting that the heavier resource burden in a delegated model requires the support of technology that underpins the integration of information needed vertically and horizontally;

- Lessons learned from mature operating models and ongoing cross border collaboration around skills can really support governments and regulators to fast-track the design and implementation of SDS.

We hope this paper provides some reassurance that there are proven ways to achieve upskilling and practical pathways to follow. Governments need to re-think their approach to upskilling and keep in mind the following:

- An agile, sectoral approach is required;

- Well written and regularly maintained qualifications are important upskilling levers, and;

- Change is probably required in the capabilities of the Manage and Execute layers, to make sure they are coordinated, empowered, systematic and transparent in their approach.

Appendices

Appendix A

The origins and examples of SAT

Appendix B

Sectoral assessment

Appendix A – The origins of SAT

There are several research papers, studies and policy documents which articulate SAT approaches and analyse their use across sectors and countries. Examples include:

Working with Change – Systems Approaches to Public Sector Challenges (OECD Observatory of Public Sector Innovation).[42] A comprehensive report which explores the theory and practice behind the use of systems approaches in tackling public challenges, including in E&T.

Joint Services Publication (JSP) 822 – Defence Direction and Guidance for Training and Education.[43, 44] This UK MOD publication articulates the Defence Systems Approach to Training (DSAT) and connected training management policies. It is owned by the MoD, aligned to ISO9001, regularly updated and held as a benchmark standard by countries committed to developing SAT ecosystems. In fairness, it is complex in parts (collective training) and simplified models have emerged to support effective implementation.

Experience in the use of systematic approach to training (SAT) for nuclear power plant personnel (IAEA, Vienna, December 1998).[45] SAT has been accepted as the international best practice for the training and qualification of nuclear power plant personnel. Powerful case studies from many IAEA countries including China, France, India, Russia, the UK and the USA demonstrate the commitment to SAT as unequivocally the only approach to training development within the nuclear power sector. The paper summarises the benefits of using SAT in the nuclear sector and demonstrates the IAEA's commitment to SAT and the maturity of the SAT approaches employed by IAEA member nations. It reinforces the importance of SAT in complex, high-risk and heavily regulated sectors.

The following screen shots illustrate the Job / Functional Analysis and Fidelity Analysis from QUADS – a tool that supports the implementation of SAT
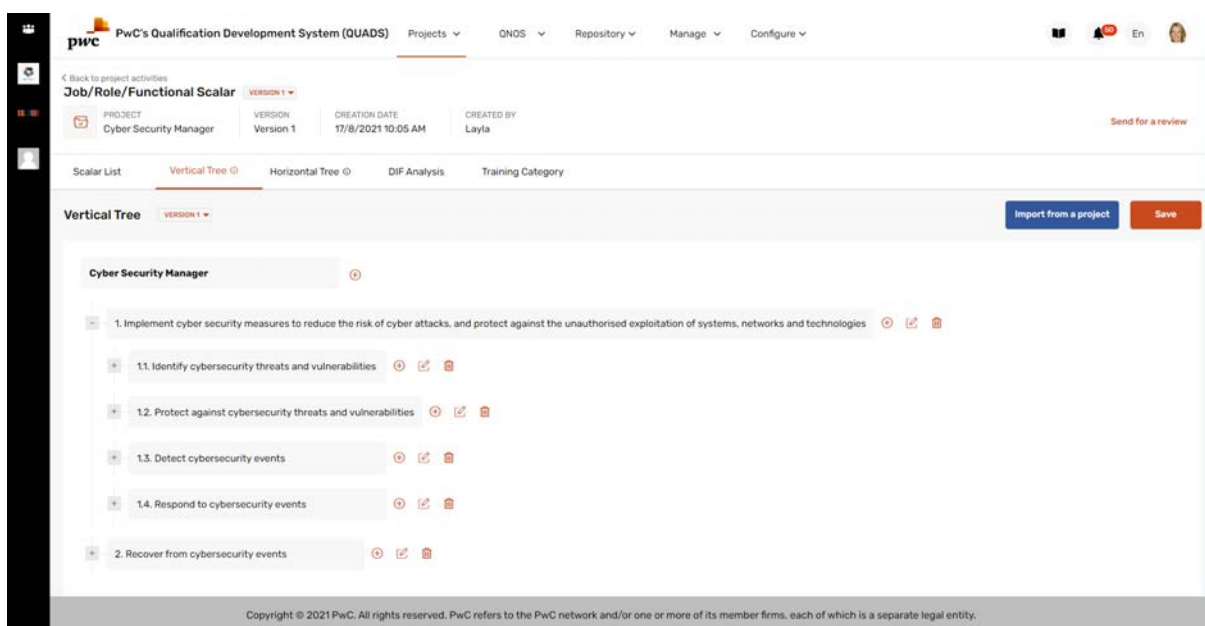

Figure 4: Skills Builder demonstrating job analysis for a qualification in cybersecurity
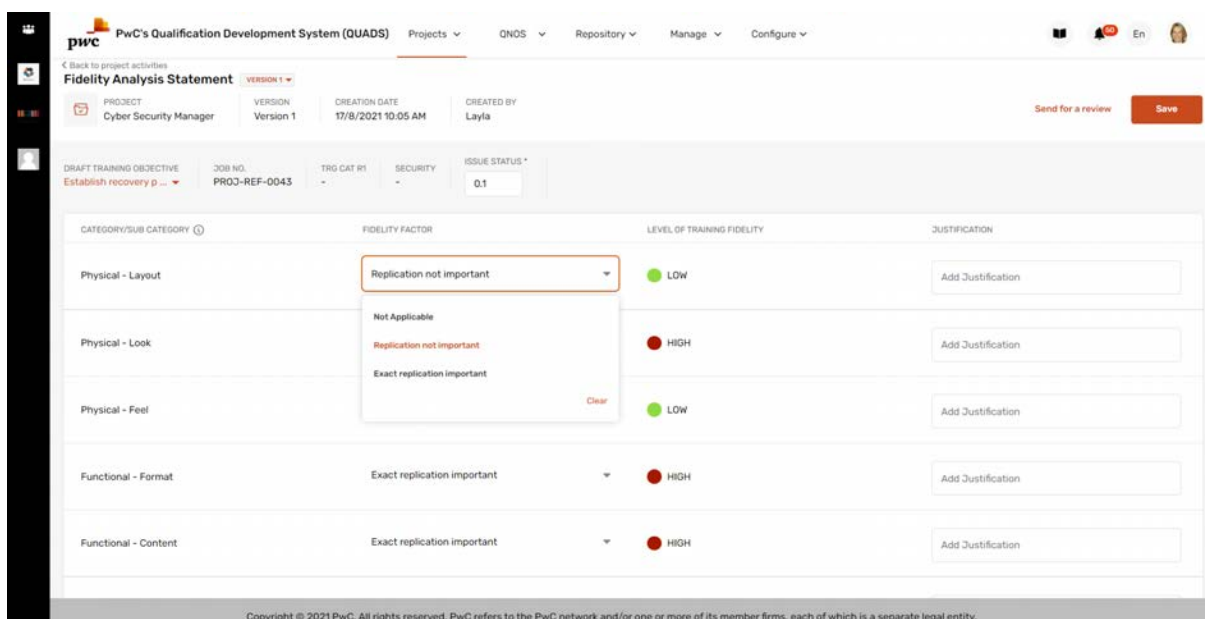

Figure 5. QUADS fidelity analysis for the different cybersecurity incidents – demonstrating that some are higher risk and more challenging to identify than others, and hence will need investment in simulation

Appendix B – Sectoral assessment

The following table provides the key questions that need to be asked to complete the positional model and analysis of these questions across four sectors.

Question	Defence – UAE	Agriculture – Egypt	Space – China	Hospitality – UAE
Along the y axis how globally focused does the sector need to be? Rate from 1 (low) to 5 (high)	Average 3.5	Average 4.5	Average 2	Average 4.5
How reliant on the global labor market does the sector/job's workforce need to be to fulfill sectoral objectives? The extent to which a sector/job depends on the global labor market. The more reliant on a global workforce, the more globally aligned and rigorous the regulation and assurance of E&T needs to be.	**3** Dependent on: some global military personnel to develop local military capability during periods of transformation and growth; global contractors for training and equipment support etc	**4** The country has no reliance on expatriate labour in this sector. Instead, the country needs to export labor due to a lack of employment opportunities in the country, whilst ensuring that the balance between those who work abroad and those who remain to work locally does not shift too far	**1** China has also developed the necessary elements for a well-rounded, successful space program, including the independent capacity required if a nation is to entirely control its destiny in space	**5** Tourism and hospitality is fully dependent on a global workforce to grow
How important will it be to have globally recognized standards (either by aligning to global standards or setting global and sector standards)? In a global and connected world, sectors/jobs need to consider the importance and impact of international standards, qualifications and frameworks and the extent to which they want to meet or set the standards. The more important globally recognized standards are, the more rigorous the regulation and assurance of the E&T needs to be.	**4** To operate in international coalitions requires an alignment and transparency in military operational standards including recognition of military ET&Q through national qualification frameworks	**5** Alignment with international standards supports the employment aspirations of many of the national workforce outside the country and also raises standards in the sector	**3** China's solid foundation although places them in an enviable, independent position in that cumbersome international partnerships are not necessary. They would rather not go it alone. So they build ISS compatibility into their technology just in case USA cooperation opens up	**4** Attracting and retaining large numbers of global tourists requires widespread alignment to expected minimum international standards and expectations

Question	Defence – UAE	Agriculture – Egypt	Space – China	Hospitality – UAE
Along the x axis what is the risk profile of the sector/job? Rate from 1 (low) to 5 (high)	Average 4.3	Average 1.5	Average 4.3	Average 1.7
How significant is the impact of failure of competence (in the sector/job) on public or personnel safety? Consider this in relation to the level of inherent risk associated with the sector/job and in the context of other sectors/jobs (e.g. defence and healthcare have a high impact of failure). The higher the impact of failure, the more rigorous and decentralised the regulation and assurance of the E&T can/needs to be.	**5** High risk to vulnerable people and national and global security	**1** Low risk at a national level. The focus on individual workplace safety and operator competence	**5** High risk for personnel and costly equipment. Acceptance of margins of error in any aspect of the space industry are marginal to non-existent	**1** Low risk to people – only through H&S issues e.g. Tunisia, Legionnaires
How much effort (in terms of time and complexity of task) is required to achieve and maintain minimum competency in the sector/job? Effort required to first build and then sustain competence, assuming the right people have been recruited against defined job specifications to meet entry requirements. The more effort required, the more decentralised and agile the regulation and assurance of E&T can/needs to be.	**4** When a military is not on operations it is training to maintain competence and due to changing nature of equipment and warfare the effort to maintain and assure standards is costly and complex	**1.5** Focus on the job and repeated skills rather than technical complex skills, so lower effort in terms of training complexity and cost	**4** Due to fast-paced technological changes and commercialisation of the space race, plus skill fade, there is constant need to refresh job competencies in the complex space sector	**2** Minimal at laborer level with on the job learning and supervision generally in place; management and specialists (chefs) combine experience with qualifications and workplace learning
How much is the sector/job getting disrupted or likely to get disrupted? Disruption in terms of employee demographics, technology, policy, equipment etc. The more disruption that is occurring or is likely to occur to the sector and associated jobs and learning, the more decentralized and agile the regulation and assurance of E&T can/needs to be.	**4** Significant disruption through technology, developing blending learning solutions (e-learning and simulation) and a transition to an Emirati workforce	**2** Technology advances create sectoral change with ripple effects for employment skills and standards delivered generally through vocational and workplace learning	**4** The sector is getting disrupted with the rise of giant commercial space companies such as Space X, Blue Origin, Virgin Galactic, and many small spacecraft parts manufacturers	**2** Disruption through technology and lost reputation, travel restrictions and industrial action etc, but the impact on learning is not significant

Endnotes

1. ILO 2020. Covid-19 ILO Monitor: Covid-19 and the world of work. Fifth edition: Updated Estimates and Analysis

2. World Economic Forum in collaboration with PwC: Upskilling for Shared Prosperity, Insight Report, January 2021

3. ILO.2020. Covid-19 ILO Monitor: Covid-19 and the world of work. Fifth edition: Updated Estimates and Analysis

4. World Economic Forum in collaboration with PwC: Upskilling for Shared Prosperity, Insight Report, January 2021

5. The culture sector is a priority in KSA's Vision 2030 for diversifying the economy. The Egyptian government is looking at high potential employment sectors for young Egyptians in the Middle East region, similar to the Indian software engineers success story of the 1990s

6. ILO: https://www.ilo.org/wcmsp5/groups/public/ed_emp/fp.skills/documents/publication/wcms_534307.pdf' Anticipating and matching skills and jobs'

7. "The Future of Jobs Report 2020, Oct 2020", "Towards a Reskilling Revolution: Industry-Led Action for the Future of Work, Jan 2019" and "Closing the Skills Gap: Key Insights and Success Metrics, Nov 2020"

8. OECD Observatory of Public Sector Innovation: Working with Change: Systems approaches to public sector challenges , 2020

9. https://uil.unesco.org/lifelong-learning/recognition-validation-accreditation

10. Genius on the Edge: The Bizarre Double Life of Dr. William Stewart Halsted by Gerald Imber

11. As examples of the cost of training: the US Army spent $542 million in 2018 to train its soldiers for underground combat. The UK Royal Navy awarded a £1 billion contract to British outsourcing firm Capita in 2020 to enhance its in-house training services. Training an F35A pilot costs $10.17 million in all up costs.

12. For example, PwC education and skills practitioners are supporting campaigns to re-vitalise applied learning in the GCC (with the merger of NQA and MoE in the UAE, the 28 billion riyal Human Capital Development Program in KSA), in the UK with the post pandemic initiatives on skills and apprenticeships, Australia, Indonesia and with the European Development Bank.

13. In 2018-20 large employers like Amazon, Google and IBM all introduced micro credentials for high demand jobs on MOOC platforms at low cost, and increasingly hire against these.

14. The number of people enrolling in higher level vocational qualifications in the UK fell by 63% between 2009/10 and 2016/17. Extracted from A Future for the Further Education Sector in England. Article; K Orr. Journal of Education and Work Volume 33 Issue 7-8 dated 25 December 2020.

15. World Bank : Latin America: Is better technical and technological higher education the answer?, February 2018.

16. UK Department of Education: Skills for Jobs: Lifelong Learning for Opportunity and Growth, White Paper, January 2021.

17. World Economic Forum: The COVID-19 pandemic has changed education forever. This is how, April 2020

18. K. Dervojeda, PwC Innovation Research Centre, The Hague, 2021

19. PwC Analysis, 2021

20. Fidelity is defined as the specific visual, tactile, olfactory, affective, auditory and sensory cues needed to learn and practice tasks in a specific, realistic environment to achieve desired learning outcomes. Fidelity analysis is one of the key differentiators of SAT and is described in more detail in Chapter 2.

21. Ed Tech Review: 3 Important reasons why ed tech is not effective, November 2019

22. PwC Academy analysis, in collaboration with Area 9 for emerging technology training courses

23. Defence Science and Technology Laboratory, POTRA Initiative, UK MoD

24. King's College London: Apprenticeships and the Pay Review Body Workforces: Final Report, 25 August 2020.

25. UK Joint Services Publication 822: Direction and Guidance for Defence Education and Training. (Updated November 2020).

26. Making micro-credentials work for learners, employers and providers, B. Oliver, Deakin University, August 2019.

27. Education is the process of facilitating learning, or the acquisition of knowledge, skills, values, morals, beliefs, and habits. Training is developing any skills or knowledge that relates to specific useful competencies/job roles. Qualification is the process of qualifying for an achievement, or a credential attesting to that achievement.

28. European Center for the Development of Vocational Training: National Qualification Framework

29. Skills for Australia, https://www.skillsforaustralia.com/

30. OECD Observatory of Public Sector Innovation: Working With Change – Systems Approaches to Public Sector Challenges.

31. United States Marine Corps Systems Approach to Training (SAT) Manual June 2004.

32. Final Committee Report, Boeing 737 Max, 2020.https://transportation.house.gov/imo/media/doc/2020.09.15%20FINAL%20737%20MAX%20Report%20for%20Public%20Release.pdf.

33. PwC Analysis

34. https://www.gov.uk/government/publications/jsp-822-governance-and-management-of-defence-individual-training-education-and-skills

35. Training designed to develop a mix of the Knowledge, Skills and Attitudes (KSA) of individuals.

36. Training aimed at improving the ability of teams, units or formations to function as a cohesive entity and so enhance operational capability.

37. JSP 822

38. As per research company Research and Markets, the global military simulation market was valued at US$10.2 billion in 2018 and is expected to grow at a CAGR of 3.12% from 2018 to 2028

39. As per research company Allied Market Research, the global

Endnotes

medical simulation market size was valued at $1.42 billion in 2019, and is projected to reach $3.19 billion by 2027, growing at a CAGR of 14.6% from 2020 to 2027.

40. The model can be used at a sector, function or job level.
41. SAT Professional and Light are 'modes' within PwC's bespoke Skills Builder – a SAT and Qualification software system.
42. https://www.oecd.org/media/oecdorg/satellitesites/opsi/contents/files/SystemsApproachesDraft.pdf.
43. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/932732/JSP_822_Part_1_.pdf.
44. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/935608/JSP_822_Part_2_V3.pdf.
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