THE VALUE OF SUSTAINABILITY FOR THE SINGAPORE ARMED FORCES

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Abstract:

In the military sphere, sustainability is often overlooked or disregarded as being irrelevant. It may be seen to be in direct conflict with other objectives. Furthermore, sustainability measures may be ignored for the sake of convenience. The main concern of the Singapore Armed Forces (SAF) will always be of security, and safeguarding national interests. However, the SAF does plan for long-term measures to reduce inefficiency. This is especially prudent considering the large share of the national budget allocated to defence expenditure. This essay will attempt to address the roles that sustainability plays in the SAF as well as envision certain areas where measures to improve sustainability may be implemented.

Keywords: Sustainability; National Security; Social; Economic; Environmental; Technology; Energy

INTRODUCTION

The essence of sustainability is simple—'development that meets the needs of the present without compromising the needs of future generations to meet their own needs.'[1] However, it is far from trivial in its implementation, particularly when embedded within the complex task of planning for the future. Sustainability principles may be in conflict with other objectives, or simply disregarded for expediency. This essay explores the inherent link between sustainability and national security, and discusses what sustainability means for the SAF.

THE CONCEPT OF SUSTAINABILITY

Often associated with idealistic aims of 'eradicating poverty' or 'preventing global warming', sustainability has become an easily dismissed topic. However, the principles of sustainability encompass much more—defining an approach to balance competing objectives within certain limitations, rather than necessarily eliminating the issues mentioned.[2] Fundamentally, sustainability seeks to protect human life, and going a step further, to enhance the quality of life.[3] There are many sustainability frameworks adopted by various governments, organisations and even militaries.[4] These generally focus on the integration of three key dimensions—social, economic and environmental.[5] Social sustainability focuses on human capital and promotes social stability; economic sustainability optimises the management of finances; and environmental sustainability seeks to maintain the natural resources necessary for human life.

RELEVANCE TO NATIONAL SECURITY

The apparent duality between sustainability and national security is actually an intertwined relationship of mutual dependence, as depicted in *Figure 1*.

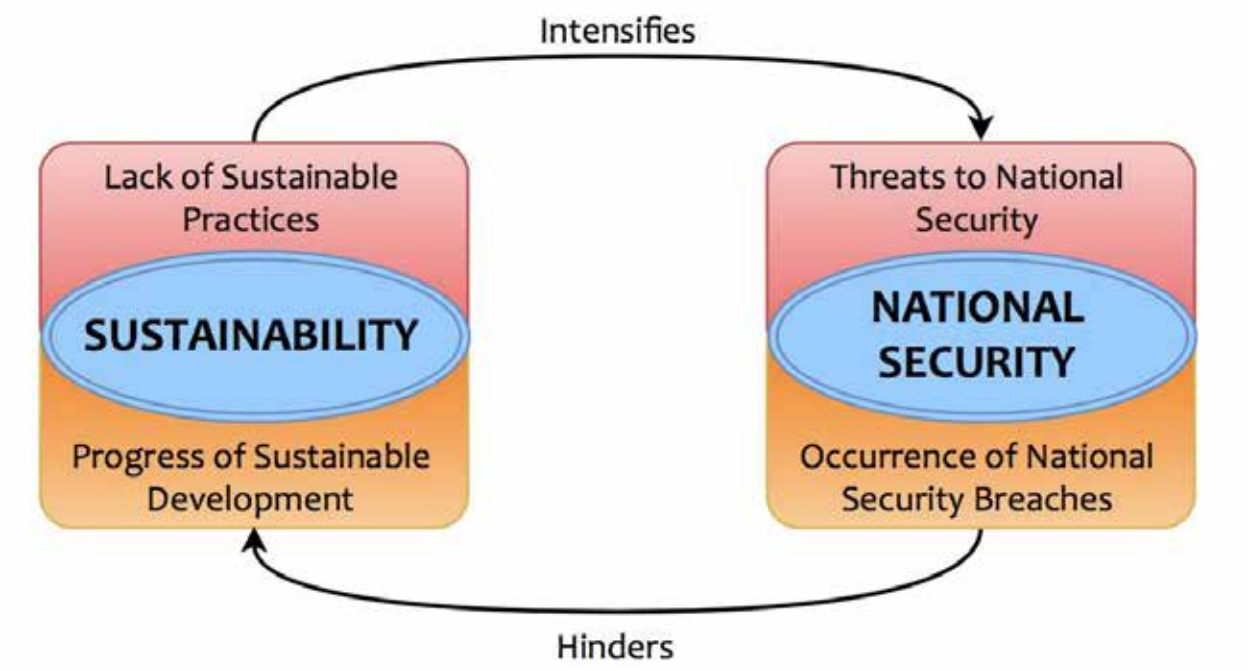

Figure 1: Mutual Dependence of Sustainability and National Security

IMPLICATIONS OF NATIONAL SECURITY

The scope of national security has been broadened over the years, extending beyond the traditional state-centric notions of sovereignty and military security. In his 2016 addendum to the President's Address, Deputy Prime Minister and Co-ordinating Minister for National Security Mr Teo Chee Hean mentioned "a terrorist attack, a virus whether medical or cyber, food contamination, and social fissures," as examples of Singapore's "increasing challenging threat landscape."[6] Such issues may threaten Singapore's development in terms of social well-being, economic growth, and sustenance of critical infrastructures like energy, water and transport. The occurrence of national security breaches will thus hinder sustainable development.

IMPLICATIONS FOR NATIONAL SECURITY

Conversely, the lack of sustainable practices in turn intensifies threats to national security. This is a complex and vast issue, arising across the various domains, with implications on the global, regional and national scale. The environmental domain will be discussed here, as it represents the most evident form of sustainability, yet has the least intuitive implications for national security. The effects of unsustainable practices (such as burning of fossil fuels, deforestation and emission of greenhouse gases) on global warming and, in a broader context, on climate change have been extensively advocated against.[7] However, the impact that these issues have on national security is less frequently communicated.

Unlike other forms of security threats, environmental concerns are often overlooked because they are viewed as issues gradually occurring in the background, rather than immediate, imminent threats. The argument primarily rests on the premise that degradation of natural resources and vital life-support systems has extensive effects, such as mass migration, growth of terrorism and escalation of conflicts over

resources.[8] Instead of analysing the multitude of consequences, a selection of consequences relevant in Singapore's context will be presented, though these examples are by no means exhaustive.[9]

First, consider the direct impact of climate change. While global warming refers to the rise in the Earth's surface temperature, climate change extends to the effects of that, such as the rise in sea levels and extreme weather patterns like heavier rainfalls and droughts.[10] This could lead to prolonged dry spells that threaten Singapore's water supply, as reflected in the decline of reservoir water levels.[11] Though this may not be a cause for alarm since Singapore has invested significant efforts in ensuring sufficiency in our water supply, climate change does intensify vulnerabilities in water security on the national level.[12] As such, Singapore has certainly begun to acknowledge the growing threats and stay on top of them, even if they seem distant. For instance, in 2013, Singapore gained permanent observer status in the Arctic Council as developments there, such as the melting of the ice cap and the opening of new sea routes, will have "implications for Singapore as a low-lying island and international seaport."[13] Moreover, beyond the risks that seem to be waiting to happen, some consequences of climate change are already affecting the daily lives of Singaporeans.[14] For instance, warmer and wetter conditions have encouraged the spread of infectious diseases.[15] These include vector-borne diseases such as dengue fever and more recently, the Zika virus.[16]

Although these may seem to deviate from the traditional security definition, they still remain key considerations for Singapore's national interests, by threatening our water needs, economic position and in extreme cases, our existence.[17] Just as the scope of national security has been broadened to include growing threats like terrorism and cyber-attacks, climate change or, more generally, sustainability issues also pose a cause for concern. In some ways, the emergence of non-traditional security threats may even be a result of failures in sustainable development.

Arguably, Singapore as a 'tiny red dot' on the world map may not substantially contribute to resolving a global issue like climate change. Nevertheless, it should be recognised that at the regional level, unsustainable practices do lead to security issues as well. An example is the transnational haze crisis, which has become a human and national security threat from the health and socio-economic risks associated with its severity.[18] This even has a direct impact for the SAF, as outdoor activities and training have to be adjusted to ensure the health and safety of SAF service personnel.[19] To combat the pollution that has lasting health impacts for our population, and for our neighbours, the SAF also plays a part as a responsible member of the regional community. In 2015, the SAF deployed a Chinook helicopter, along with a Singapore Civil Defence Force team, to assist with firefighting operations in the Indonesian forests.[20] Unfortunately, this was a retrospective attempt to reduce the damage rather than to prevent it from happening, as it is difficult to curb illegal slash-and-burn practices.[21] Such issues are multi-faceted and not easily resolved, complicated by their transnational nature.

APPROACH TO NATIONAL SECURITY

In order to tackle these complex and evolving threats, it is thus important to 'anticipate rather than react'.[22] This may be conducted in the form of risk analyses, but can also be done by strengthening resilience. Strategies capitalising on the idea that 'prevention is better than cure' are intrinsically linked to the concept of sustainability. By ensuring sustainability in the first place, national interests are still pursued but less 'firefighting' is required as the focus is shifted away from threats and military

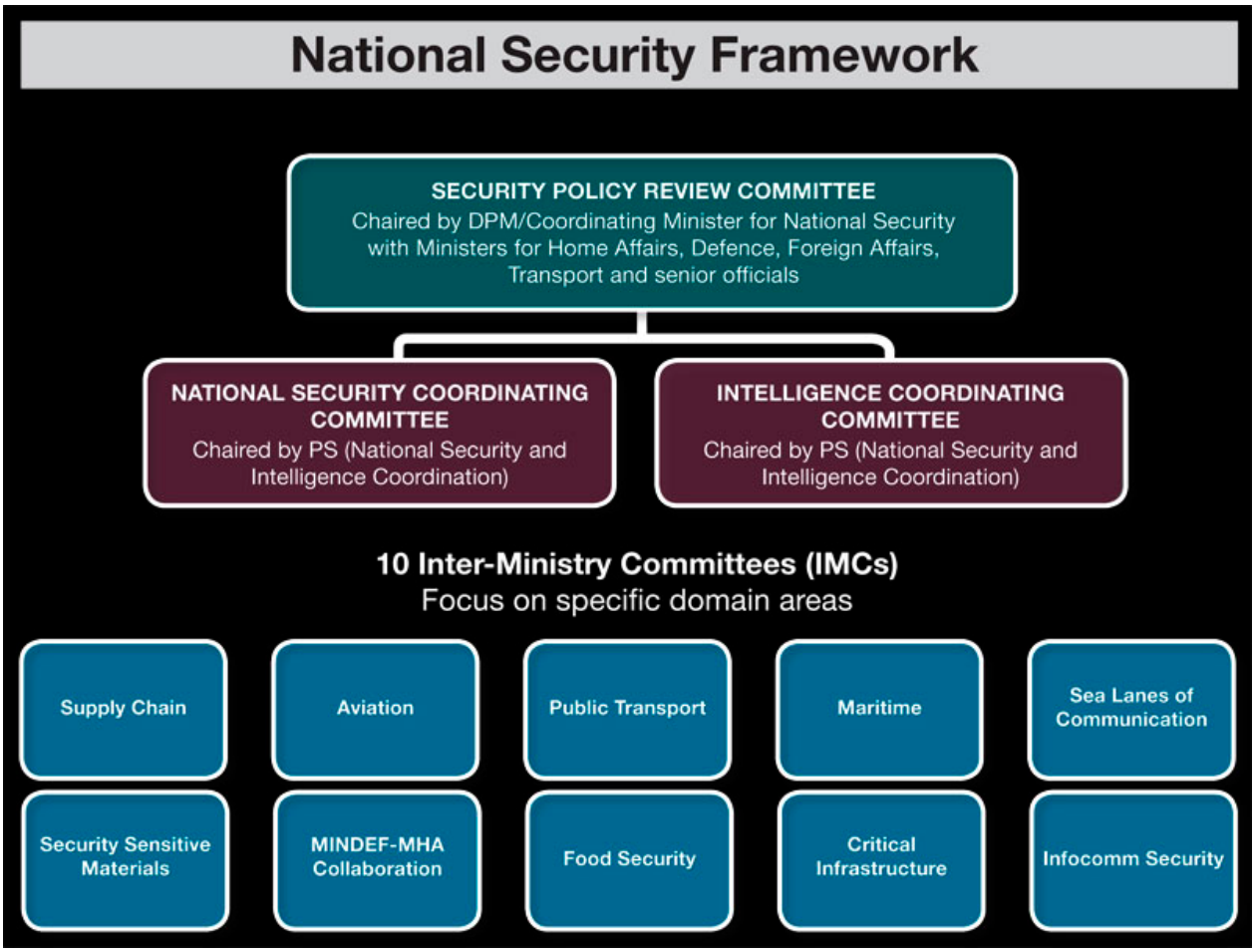

Figure 2: Singapore's National Security Framework

force.[23] This idea is captured in a 2011 paper titled 'A National Strategic Narrative', which highlights that "security means more than defence, and sustaining security requires adaptation and evolution, the leverage of converging interests and interdependencies."[24]

SINGAPORE'S FRAMEWORK

Although the military is often viewed as the primary agent of security, the idea that it cannot stand alone is not a new one. A 1987 United Nations (UN) Report aptly identified that "there are no military solutions to environmental insecurity."[25] Non-traditional security threats are typically multi-dimensional and transcend state boundaries. Hence, Singapore adopts a 'whole-of-government' approach to manage national security, shown in *Figure 2*. This allows the wide variety of traditional and non-traditional security threats to be comprehensively dealt with by the most appropriate specialist organisations. For instance, the sustainable development issues related to carbon emissions, water conservation or waste generation would fall under the purview of the Ministry of the Environment and Water Resources.[26]

At this point, it is worth distinguishing between two levels of sustainability—the sustainability of Singapore's development in contrast with that of SAF operations. The former is on a larger, national scale, and contributed to by many government ministries. Collaboration with other agencies is necessary for a

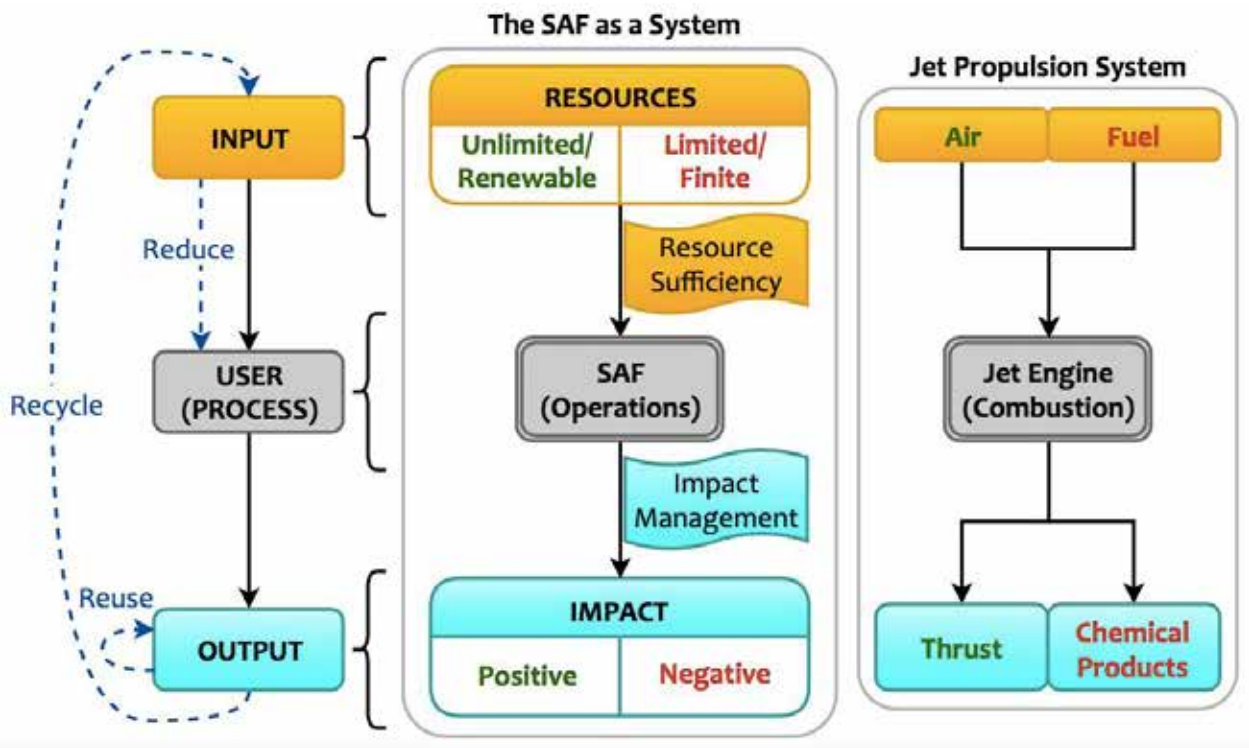

Figure 3: The SAF as a System of Inputs and Outputs

holistic approach, but the SAF still plays a key role as a driver for the rest of the Singapore community. Focus of the remaining discussion will be on the latter, to explore the possible value of sustainability within the SAF. This proposes sustainability principles as a means for the SAF to embrace the uncertainties of growing non-traditional security threats, by increasing our resilience to potential threats. This will contribute to, rather than deviate from, achieving our mission of enhancing Singapore's peace and security.

UNDERSTANDING SUSTAINABILITY FOR THE SAF

A simple model can be used to distil what sustainability means for the SAF, as illustrated in *Figure 3*. Just like a jet propulsion engine that utilises air and fuel for combustion to produce thrust and chemical products, the SAF is at the core of a system with inputs and outputs—as the user of a variety of resources to conduct operations, some impact will be generated alongside mission success. Some of these inputs may be 'unlimited' (air), and others finite in quantity (fuel). Similarly, some of these outputs may be positive (thrust), while others less so (greenhouse gases in the chemical products).

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Attaining sustainability in this model, therefore, requires that the process can go on forever, either with an infinite source at the input, or a loop from the output back to the input. This is in line with the '3Rs' concept that many will be familiar with: reduce the amount of input needed, reuse the product and recycle the output.[27]

PRINCIPLES OF SUSTAINABILITY

Focusing on the SAF in *Figure 3*, two key areas can hence be identified to ensure sustainability, namely resource sufficiency for the inputs and impact management of the outputs. The former seeks to balance the consumption and production of resources, while the latter attempts to reduce the overall footprint of activities. In order to achieve this, possible guiding principles for the SAF are listed in *Figure 4*.

Strategies targeting resource sufficiency are likely to have direct positive implications for the SAF, as these resources are necessary for operations. Conversely, strategies for impact management will affect the SAF indirectly, as the out-going arrow may consequently feed back into the system. For instance, utilising alternative energies (diversifying sources) will directly benefit the SAF in the face of depleting oil reserves, by providing flexibility in operations and reducing the logistics tail, while minimising carbon emissions (alleviating adverse effects) would have an indirect impact through climate change and national security considerations.[28]

Sustainability should also be studied in the various dimensions. When analysing what the social, economic and environmental dimensions represent for the SAF, it is appropriate to highlight that some aspects of sustainability have already been implicitly accounted for. As opposed to suggesting that the SAF may be lacking in sustainability, this essay proposes sustainability as a fresh lens through which the long-term enhancement of security and operations can be viewed.

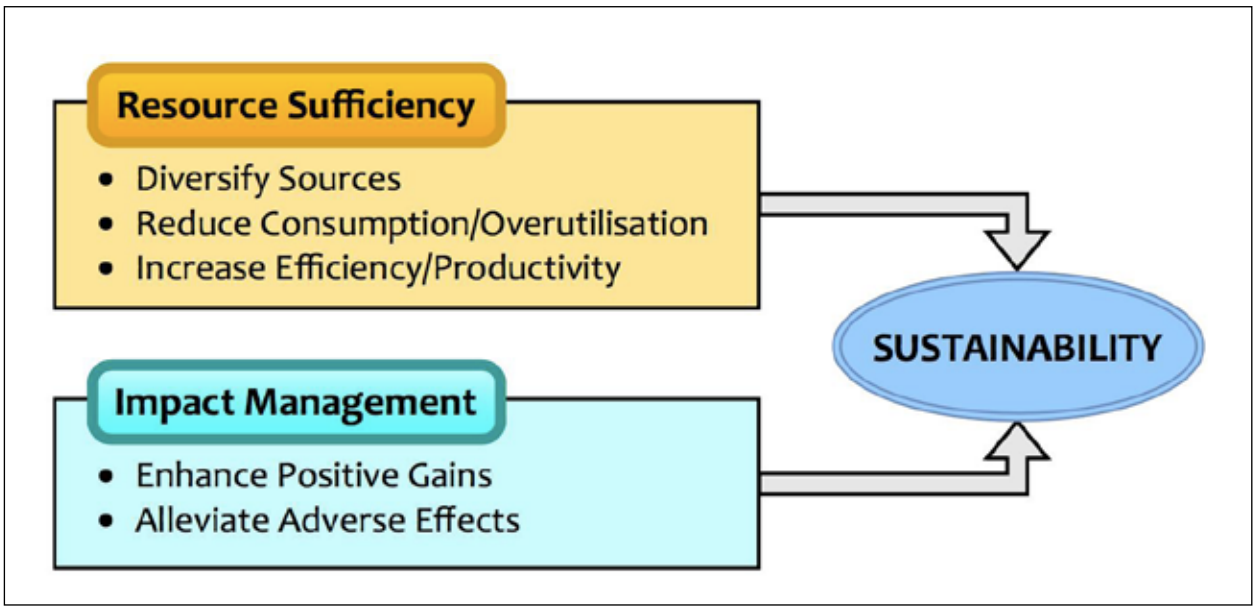

Figure 4: Guiding Principles for Resource Sufficiency and Impact Management

SOCIAL SUSTAINABILITY

First, the social dimension is focused on the most important asset in the SAF—our people. It encompasses training, leadership development, safety, manpower policies for recruitment and retention, as well as instilling a sense of purpose, shared values and common identity into every serviceman/woman. By inspiring the commitment and maximising the potential of each individual, the SAF develops a resilient and competent workforce, with a people-centric culture. In this regard, considerable progress has been made over the years through an increased focus on people development. Project CARDINAL in the Air Force was a clear initiative to steer this.[29] Table 1 below summarises existing policies and structures within the SAF that promote social sustainability under the various strategies identified.

In addition, it is worth noting that the SAF is a 'key national institution' that plays a crucial role in strengthening our social fabric, and enlarging the 'common space' for a diversity of Singaporeans from different backgrounds.[30] The National Service experience of 'every Singaporean son' also has an impact on enhancing the social resilience of the Singaporean community at large.

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ECONOMIC SUSTAINABILITY

The management of defence spending has always been done in a 'steady and prudent' manner.[31] In fact, sustainability has probably received the greatest focus in the economic domain, as the Ministry of Defence (MINDEF) has ensured consistent investments for the long-term sustainability of the defence budget, to avoid a 'feast and famine' approach.[32] It is useful to note that the three main aspects of defence expenditure are manpower, operations and deployments, as well as capability

SOCIAL SUSTAINABILITY	Resource Sufficiency	Diversify Sources	- Introduction of SAF Volunteer Corps[33] - Growth of female recruitment[34]
		Reduce Overutilization	- Outsourcing of logistical support to civilian contractors[35] - Technology as a force multiplier[36]
		Increase Productivity	- Training courses
			- Leadership Development - Applications of defence psychology
	Impact Management	Enhance Positive Gains	- People-centric culture
		Alleviate Adverse Effects	- Risk management - Training Safety Regulations - SAF Counselling Centre

Table 1: Examples of Social Sustainability Initiatives in the SAF

development (CAPDEV).[37] Hence, improvements in any of these areas through strategies in other domains may also contribute to financial cost reductions.

ENVIRONMENTAL SUSTAINABILITY

In the environmental arena, key natural resources required by the SAF include energy, water, food and land/sea space. As an example, consider how the SAF has accorded attention to resource sufficiency as a small island nation, with limited territorial space. This has allowed the SAF to not only support Singapore's economic activities and protect our sea lines of communication, but also maintain sufficient training areas. By diversifying sources, the SAF has gained access to training areas overseas, through defence arrangements and Memoranda of Understanding with other countries. Furthermore, the intention to relocate Paya Lebar Air Base illustrates an attempt to increase land space efficiency and 'enhance the effectiveness and resilience of the air bases', by expanding and replacing current facilities in Changi Air Base (East) and Tengah Air Base.[38] Without compromising operational readiness, the SAF makes way for Singapore's other residential and commercial land use needs. In this case, some efforts to reduce military utilisation of space may be done within the SAF, but planning of the overall land use also requires collaboration with external parties, such as the Urban Redevelopment Authority and Ministry of National Development.[39] This reiterates the need for inter-agency and, at times, multi-national efforts to promote sustainability.

Looking towards impact management instead, some of the main environmental outputs in the SAF include waste generation, pollution and noise. One key area that has been actively managed is that of noise generation, particularly aircraft jet noise over populated areas.

This also has a direct impact on operations as flying activities are ceased during certain periods to minimise disruption to the local community.[40] While techniques like flight path planning have been used for noise abatement, there are ways the SAF can continue to explore harnessing noise reduction technologies. Technology like acoustic liners in engines can play a critical role in improving noise efficiency, without necessarily reducing aircraft performance.[41] This may allow the SAF to reduce undesirable noise impacts for Singapore's population, without compromising mission effectiveness, and may even result in fewer restrictions and more flexible periods for flying.

MOVING FORWARD IN SUSTAINABILITY

ROLE OF TECHNOLOGY

One may then ask, "Where do our weapon systems fit in to all this? Are they not a resource too?" Indeed, on a tactical mission level, they may be seen as a resource along with troops and basic living necessities, to achieve the mission objective. However, on a broader level, they are part of the larger SAF ecosystem, utilising resource inputs like energy and manpower to be operated whilst generating output such as spent cartridges and carbon emissions, similar to the jet engine. They can be viewed as the technology that the SAF invests in, via our CAPDEV initiatives.

A common theme throughout the SAF's development is the use of technology as a force multiplier, also reflected in the SAF2030 vision.[42] Technology does have significant potential to enhance sustainability for the SAF, if capitalised on with the right intentions. As mentioned previously, technology can alleviate manpower pressures. For instance, unmanned systems may be used not only in the traditional sense of replacing manned aircraft platforms or troops on the ground (mules/humanoids), but also to supplement current operations in reconnaissance, thereby eliminating fatigue and safety considerations for 'dull, dirty and

dangerous' tasks. The greater autonomy achieved with improved control and software technologies also reduce the amount of manpower required for sustaining operations.

However, technology may also intensify the strain on resources by increasing resource demand. For example, by 2030, the number of Army units operating vehicular platforms is expected to almost double, increasing the mobility of our land forces.[43] Yet, with greater dependency on mechanised platforms and computer systems, the SAF will also have higher energy and cooling requirements. This would contribute to the depletion of resources, possibly causing a series of ripple effects, with indirect impacts to national security. Concurrently, the increased reliance on resources like fuel and energy creates a heightened risk of supply disruption, not only in its generation, but also in its storage and transfer.[44] This has a direct implication on mission effectiveness, especially with the growth of unconventional security threats like terrorism.

ENERGY RESOURCE SUFFICIENCY

The energy dependency of the military has increased in parallel with the changing characteristics of warfare, as evolution of military technology has moved into the 'age of automation.'[45] The quantity of energy consumption has increased from 1 gallon per soldier per day in World War II (WWII) to 4 gallons per soldier per day during Operation Desert Storm in 1991, and one can only imagine how much more it has increased since.[46] This is not only on the base level infrastructure, but also on an individual level. For example, the Advanced Combat Man System (ACMS) equips 'tactical units with network capabilities' through its personal radio, communication keypad, portable computer, head-mounted display, weapon interactor and remote sensors.[47] However, this also implies that soldiers have to carry battery packs to power the various devices, which may well be the critical component for functioning of the overall system. Ensuring resource sufficiency in the SAF's energy consumption is therefore crucial, and is a useful example to illustrate how technology can be harnessed.

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First, energy sources can be diversified, by developing new, lasting primary energy sources, as the SAF's platforms largely depend on 'oil-based liquid fuel in one form or another.'[48] A shift towards renewable energies like solar power on buildings and wave energy at sea is not a dream for the future, but viable alternatives to be implemented. The United States (US) Department of Defense already has a biofuel programme making progress in allowing Air Force aircrafts and the Navy's fleet to use alternative fuels without hindering operations, and possibly bring about cost benefits in the future.[49] Pushing technology further, novel energy harvesting techniques could be used on an individual level. A piezoelectric device can generate electrical energy from the kinetic energy of the mechanical motion of the soldier, and used to power the ACMS, for instance.[50] Technology is a very powerful instrument for exploring new energy sources.

Second, energy efficiency can be increased through suitable designs and energy efficient choices. As a simple example, compact fluorescent lightbulbs or light emitting diodes can be used in place of traditional incandescent ones.[51] While seemingly insignificant in small quantities, gains in efficiency can accumulate to larger energy savings. Design of buildings can also be optimised to maximise natural

lighting and allow efficient airflow for ventilation. The Headquarters Combat Service Support Command (HQ CSSCOM) was constructed with such features, along with solar panels on the roof and rainwater recycling, thus achieving significant energy savings.[52]

Finally, energy consumption can be reduced by conservation. This can be done with simple technologies like motion-activated sensors for lighting. In addition to technology, increased awareness and positive practices can also contribute to reducing energy dependency without great cost, like switching off computers and other appliances when not in use. However, it should be recognised that such savings are small in comparison to an activity with larger consumption, such as commuting across the island from one base/camp to another for meetings. Carpooling or making economical travel plans when possible, for example, will significantly conserve more energy. With the right mindset and a little effort, adapting our lifestyles can help to reduce energy consumption.

ENVIRONMENTAL IMPACT MANAGEMENT

Beyond capitalising on technology, other tools can be used to enhance sustainability in the SAF. To minimise the adverse effects of our systems, a life-cycle analysis can be performed on the various technologies used by the SAF.[53] This should be done not only in terms of cost considerations in defence procurements, but also in terms of environmental impact from the initial procurement to final retirement of the system.[54] This evaluates the impact throughout a product's lifetime, and identifies the most critical stages for which suitable mitigation measures can then be implemented. At a more everyday level, some negative effects of waste generation can often be mitigated by establishing good practices, like indenting appropriate quantities of food in the cookhouse or encouraging the recycling of paper, metals and plastics in camps. Undoubtedly, there are difficulties in doing so, associated with convenience or expediency. As such, implementing structures to minimise the effort required to recycle, for instance, may allow sustainable practices to be inculcated as a form of habit or part of a routine, thereby reducing environmental footprint. Such initiatives have already begun in other militaries, such as the Israel Defence Forces (IDF).[55]

Internationally, militaries have also started to participate in discussions on sustainability. In 2009, the UN Environment Programme held a meeting on environmental norms and military activities in Geneva, attended by many states including Israel, Japan and the US.[56] Amongst other issues, the military's contribution to environmental policies for sustainable development and environmental impacts of military activities were reviewed. It is never too late for the SAF to look towards sustainability.

CONCLUSION

The SAF is instrumental to Singapore's development—not only in enhancing security, but also in contributing to the community. In the face of emerging security threats, SAF operations have evolved beyond a traditional defence role. Although seemingly counter-intuitive, the concept of sustainability is inherently linked to that of national security, and presents a useful way of thinking. By investing in resource sufficiency and impact management, the SAF can embrace the uncertainties of our complex security landscape and better position itself to protect Singapore's national interests. Achieving this, however, is no mean feat. Besides utilising technology as a tool to enhance sustainability, the SAF ultimately requires innovation and the collective effort of its people to drive any changes. After all, many aspects of our daily

lives are like the jet engine—processes with inputs and outputs. If we see these processes through the eyes of sustainability and find the means to streamline them, via the strategies discussed or otherwise, the SAF will be well underway to start enhancing sustainability and optimising performance. The value of sustainability for the SAF, and consequently, for Singapore, is priceless.

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