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HOW TO EAT A DIGITAL ELEPHANT: A SOCIO-TECHNICAL SYSTEM THEORY PERSPECTIVE ON RCAF DIGITAL TRANSFORMATION

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> *Going digital is a mindset, it's culture change…it's about how we can fundamentally change how we operate as an Army through transformative digital technologies, empowering our workforce, and re-engineering our rigid institutional processes to be more agile…*
>
> Dr. Raj Iyer, CIO, U.S. Army

Introduction

Modern warfare is a complex endeavor that is now much more than just politics by other means. It relies heavily on digital transformation as a critical component in the success of military operations. This is evident in the Russian invasion of Ukraine where the contemporary battlespace is aptly referred to as the 'wizard war' where Ukraine's fighting spirit is coupled with advanced intelligence and battle-management software to yield a distinct tactical advantage. This operational edge exerts "the power of advanced algorithmic warfare…[which] equates to having tactical nuclear weapons against an adversary with only conventional ones."[1] Those who can rapidly process vast amounts of information to observe and orient can possess real-time joint targeting effects, which holds the initiative and underscores the criticality of digital tools as a force multiplier.

In the Canadian context, the Canadian Armed Forces (CAF) understands the operational imperative of this digital evolution and in June 2022, published the CAF Digital Campaign Plan. This document provides a strategic roadmap that intends to completely transform the CAF, inclusive of its elemental services of the Canadian Army (CA), Royal Canadian Navy (RCN), Royal Canadian Air Force (RCAF) and Special Forces (CANSOF), into a digital institution by 2030. To do so, it highlights five elements that will be crucial pillars to its success: People, Data, Process, Technology and Culture.

While all five elements are important for digital transformation, this paper will focus on the social elements of *People* and *Culture* and posit that they are the essential ingredients for a successful digital transformation within the RCAF. This approach is reinforced by the overemphasis of digital-hardware-platform centric capabilities (the technology) in the recently published *RCAF Strategy: Agile, Integrated, Inclusive*, which undermines the criticality of social systems (people, culture) - both are needed to harmonize towards a successful digitally transformed end-state. Specifically, this essay will argue that emphasis of social systems, through the lens of Socio-Technical System (STS) theory, be leveraged for a balanced approach to address this wicked problem of RCAF Digital Transformation. Eating the digital elephant one *byte* at a time – in manageable morsels of *leadership*, *structure,* and *culture* would posture the RCAF to be more receptive to the integration of emergent technologies. Further, examples from the aircraft maintenance

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[1] Ignatius, David. 2022. *How the algorithm tipped the balance in Ukraine.* December 19. Accessed April 17, 2023. https://www.washingtonpost.com/opinions/2022/12/19/palantir-algorithm-data-ukraine-war/.

community both internal and external to the RCAF will illustrate practical means to cultivate the social systems of leadership, structure, and culture. Insight from the CA and RCN's Digital Strategy and Action Plan, and investment in partnerships with industry will also help identify gaps in the RCAF approach to digital transformation – enabling the necessary conditions towards the 2030 goal from the CAF Digital Campaign Plan.

Why Socio-Technical System (STS) Theory Framework?

STS Theory is a powerful lens to examine digital transformation as it views success as reliant on a harmonious co-existence between the technical systems (e.g. advanced digital technology such as cloud-computing, artificial intelligence, etc.) and the social systems (people, culture, values, norms) that are part of an organization. Drawing on the analysis by Imran et al on their case study analysis of industrial organizations,[2] the applicability of STS Theory to the CAF is sound given its comparable rigid structures that are resistant to change, and process-driven bureaucracies. The CAF Digital Campaign Plan supports this comparative with its description of our institution as "linear, vertical, static and process driven."[3] As previously mentioned, the harmony between the technical system and social system are what help provide meaningful implementation for digital technologies. For the purposes of this paper, the focus will remain on the social systems as it is often overshadowed by the more tangible overt attention of military hardware and weapon system platforms, digital and technical capabilities – as proven in the RCAF Strategy narrative. Technical system implementation is assumed to transpire concurrently through a project office adhering to traditional procurement bureaucratic processes.

On the social system aspect, the three defining factors are leadership, organizational structure, and culture. While this paper lays out the three pillars in somewhat isolated and logical manner, it is the synergistic effect of all three pillars that act jointly in an eco-system that provides an optimized effect. This means that characteristics under the leadership pillar, if carried out effectively, will have interdependent benefits to the structure of the organization and/or the organizational culture. This mutual reinforcement is where the truth value proposition of STS Theory thrives for digital transformation.

Digital Transformation vs Digitization

To set the context of this paper, a definition of digital transformation is needed to clearly differentiate itself from like-terminology such as digitization. In the CA's Digital Strategy, digitization is described as "the foundational step to deliberately convert something non-digital into a digital representation or artifact." A simple example would

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[2] Imran, Faisal, Khuram Shahzad, Aurangzeab Butt, and Jussi Kantola. 2021. "Digital Transformation of Industrial Organizations: Towards an Integrated Framework." *Journal of Change Management: Reframing Leadership and Organizational Practice* 451 - 479.

[3] National Defence. 2022. *Canadian Armed Forces Digital Campaign Plan.* June 22. Accessed April 19, 2023. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/canadian-armed-forces-digital-campaign-plan.html.

be a paper leave pass into an electronic copy that can be attached to an email. Digitization is therefore more of a conversion or improvement of a tool rather than an overhaul of an organization's culture and investment in its people for continuous improvement. Conversely, digital transformation is described by the same CA document as "forging a new symbiotic relationship with technology…reinventing how objectives are accomplished and accelerating the entire business." Similarly, Hinings et al. defined digital transformation as 'the combined effects of several digital innovations bringing about novel actors, structures, practices, values, beliefs that change, threaten, replace or complement existing rules of the game within organizations [or ecosystems]."[4] This definition goes beyond digitization and more aptly describes the implications of social systems (people and culture) within an organizational change context as the center pieces. A mind map conceptualizing digital transformation for an industrial organization is detailed in Figure 1 – quite intricate with symbiotic impacts across business lines that draw relevancy and parallels to a military organization.[5] An extrapolation of people and culture leads us to the STS pillars of leadership, structure and culture which will be explored in more detail in subsequent sections of this paper.

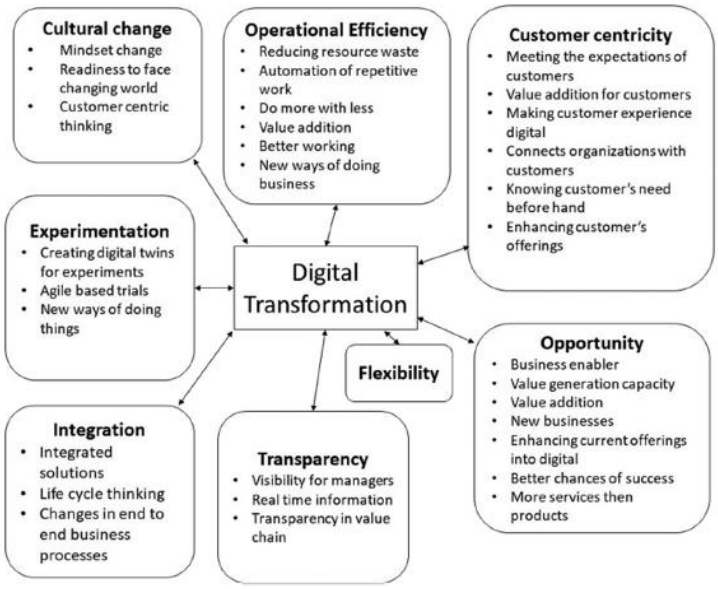

Figure 1: Digital Transformation of Industrial Organization (Journal of Change Management) *(Imran, et al. 2021)*

[4] Hinings, B, T Gegenhuber, and R Greenwood. 2018. "Digital innovation and transformation: An institutional perspective." *Information and Organization* 52 - 61.

[5] Imran, Faisal, Khuram Shahzad, Aurangzeab Butt, and Jussi Kantola. 2021. "Digital Transformation of Industrial Organizations: Towards an Integrated Framework." *Journal of Change Management: Reframing Leadership and Organizational Practice* 451 - 479.

Problem Identification: The RCAF "Gap" towards Digital Transformation

The importance of modernization was first explicitly stated in 2017's Defence Policy, Strong Secure and Engaged.[6] Then in wake of COVID-19, the CAF released the Reconstitution Directive in 2022 that doubled down on modernization to include digitization and prioritizing the development and implementation of the CAF Digital Campaign Plan as an enduring strategic priority. Against the immediate challenge of reduced recruitment, imbalanced retention and ever-increasing attrition, the CAF still singled out modernization and digital transformation as a priority – arguably equal to the reconstitution effort of its forces. Yet, the RCAF is the only elemental service that lacks a dedicated digital strategy. The CA published its "Modernization Vital Ground: Digital Strategy" at the same time as the CAF Digital Campaign Plan in June 2022.[7] This document was essentially a refined sequel to the CA Modernization Strategy (CAMS) that did not place the requisite emphasis on the importance of digital transformation as a vital ground for the CA to operate as a modern fighting force. Its content is comprehensive with initiatives relevant to both field forces and in a corporate office setting – both symbiotically crucial to providing an operational end-product. The RCN published its Digital Navy strategic document in 2020 and highlighted specific focus areas where investment into networked systems, cloud computing, personal mobile devices, and modern enterprise software would unlock data-driven decision making and provide an efficient and seamless work environment for its personnel. More remarkably, it called for the creation of a Digital Navy Office (DNO) with specific accountabilities to lead the RCN towards digital transformation. The creation of DNO illustrates the RCN's dedication towards digital transformation as it takes SSE and the Digital Campaign Plan's envisioned 'ends' and binds it to practical 'means' and produces tangible 'ways' to make digital transformation happen. Even though CANSOF do not have a dedicated Digital Strategy, their policy document provides a glimpse of their efforts towards digital transformation – namely, *Gradient Ascent*, described "as a new digitalization and data analytics initiative designed achieve a level of competency in the digital space commensurate to what [CANSOF has done] with the kinetic space."[8]

While the release of the RCAF Strategy in February 2023[9] is the most recent of all CAF strategic documents, when compared to its peer service documents, there is lack of tangible direction on how to usher its aviators to action towards digital transformation,

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[6] Government of Canada 2017. *Strong Secure Engaged: Canada's Defence Policy.* Accessed April 29, 2023. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/canada-defence-policy.html.

[7] Government of Canada. 2022. "Canadian Army: Modernization Vital Ground." *Digital Strategy*. June. Accessed April 28, 2023. https://www.canada.ca/content/dam/army-armee/migration/assets/army_internet/docs/en/digit-strag/Digital_Strategy.pdf.

[8] —. 2020. "CANSOFCOM: Beyond the Horizon." *A Strategy for Canada's Special Operations Forces In an Evolving Security Environment.* July 21. Accessed April 28, 2023. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/cansofcom-beyond-horizon.html.

[9] —. 2023. "Royal Canadian Air Force Strategy." *Agile - Integrated - Inclusive.* February 8. Accessed April 28, 2023. https://www.canada.ca/en/air-force/corporate/reports-publications/royal-canadian-air-force-strategy.html.

specifically, it espouses strategic 'ends' but lacks the 'means' and 'ways' for tangible progress. The RCAF Strategy focuses centrally on Agility, Integration, and Inclusion, which are all important in its own right but lack the emphasis on how to meet the digital transformation mandate outlined in the CAF Digital Campaign Plan. This is the first problem area which is the lack of tangible 'ways' and practical "means" to execute beyond simple aspirational "ends". The RCAF Strategy does name one of its four strategic objectives as "modernization" but explicitly focus on the hardware or technical platforms as its main thrust. For example, NORAD Modernization, Future Fighter Capability Project, Strategic Tanker Transport Capability, Remotely Piloted Aircraft System are listed alongside the aspirational intentions to leverage emerging and disruptive technologies such as Artificial Intelligence, Machine Learning, Quantum Technologies.[10] In the context of digital transformation, there is very little mentioned in the RCAF Strategy about human-centric initiatives such as relevant training or education in digital technologies, mentorships, partnerships with leading technology firms, or academia. This provides an imbalance to the pathway of digital transformation, heavily leaning towards technical tools, systems and capabilities as the sole means of forcing our organization into cultural understanding, cognitive competence, and motivational alignment with digital transformation. Under Scott's institution analysis model, this focus on hardware only for RCAF digital transformation would be akin to forcing a regulative change (e.g. modernized NORAD technology) without considering the normative and cultural/cognitive compatibility of an organization.[11] In the context of STS Theory, it cautions that technical systems are only part of the equation towards digital transformation. The other part, save from the environmental consideration, relies on the social systems; as highlighted by past literature: "critical system failures often occur for non-technical reasons, [more so] due to human and socio-technical factors."[12] Thus, a secondary problem is identified, which is the necessity of a healthy symbiotic relationship between technical and social systems for implementing a successful digital transformation.

Drawing inspiration from the CAF Digital Campaign Plan, CA's and RCN's Digital Strategy documents, it is clear that the common theme among all are the focus on the people as a means to unlock an amenable culture to aspire towards digital transformation. The people and culture theme from these CAF documents are essentially in lock-step with the STS Theory framework that more explicitly covers these pillars in the form of Leadership, Structure, and Culture – all necessary ingredients for an organic smooth organizational change towards digital transformation.

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[10] Ibid.
[11] Scott, Richard W. 2003. "Institutional carriers: reviewing modes of transporting ideas over time and space considering their consequences." *Industrial and Corporate Change, Volume 12, Number 4* 879-894.
[12] Di Maio, Paola. 2014. "Towards a metamodel to Support the Joint Optimization of Socio Technical Systems." *Systems*. January 30. Accessed April 30, 2023. https://www.mdpi.com/2079-8954/2/3/273.

Leadership

The STS framework views Leadership as a cornerstone to enable a successful digital transformation. The onus on leaders is to conduct critical roles and to do so effectively with the appropriate set of competencies. According to Imran et al, critical roles range from "spreading awareness of digital transformation topics, promoting collaboration, driving digital change and cultural aspects of digital transformation, leading by example, promoting mentoring, bringing transparency [to their work] and being value-driven." or executive c-suite to set enabling conditions to empower and foster the workforce to grow in a digital manner. To do so, the leadership needs to be outfitted with the requisite skillsets and more importantly the competencies conduct critical roles needed at the helm of digital transformation. Crossan, Dusya and Sturm's Character Based Leadership (CBL) model defines leader competencies as "…[representing] the knowledge and skills necessary for effective leadership…competence as the ability to do something due to natural talent or developed skill."[13] The CBL character-competency entanglement framework, in Figure 2, provide a pathway for effective leadership to transpire: a culminating effect among character, competencies, and commitment. In the context of digital transformation, leaders who are able to effect institutional change and lead the organization into this endeavor are assumed for the scope of this essay to have character and motivation aligned from years of military professional development and intrinsic commitment for the profession of arms. What is then absent is a comprehensive means to ensure competencies, as defined by Imran et al, such as "adaptability, communication skills, data-driven decision-making, empowerment, failing fast, experimentation, risk taking, surface-level technical knowledge and vision."[14] Such skills have direct linkages in the private industry where strategy and change management are foundational to lead a digital transformation can and should be leveraged for the RCAF's own digital journey.

Figure 2: The Character-competence Entanglement Model *(Crossan, et al. 2010)*

[13] Crossan, Mary, Rachel Sturm, and Vera Dusya. 2017. "The entanglement of leader character and leader competence and its impact on performance." *The Leadership Quarterly 28* 355.

[14] Imran, Faisal, Khuram Shahzad, Aurangzeab Butt, and Jussi Kantola. 2021. "Digital Transformation of Industrial Organizations: Towards an Integrated Framework." *Journal of Change Management: Reframing Leadership and Organizational Practice* 451 - 479.

In industry, businesses have the flexibility to directly hire digital transformation subject matter experts as leaders who have had proven success in other organizations. An illustrative example is IKEA's path to digital transformation by hiring Barbara Coppola as the Chief Development Officer. Barbara worked for 20 years in the technology sector at Google, Samsung, and Texas Instruments before guiding IKEA from 7% to 31% of e-commerce growth in three years.[15] Innovative tools have enriched the customers shopping experience by allowing them to avoid checkout lines simply by enabling price-scanning and check-out features on their own mobile devices at the store. Contrastingly, the CAF is rigid in that its institutional leaders are grown internally through the hierarchal structure with time-in as controlled gates to promotion. This means institutional leaders at the executive level, namely General Officers/Flag Officers (GOFOs) are a product of the investment of education and training during their formative years. By definition, GOFOs are generalist and have a vast capacity to understand a large variety of information but to lead niche and technical change within an organization, even save technical knowledge, change management principles aside, they lack the technical or academic expertise to do so, not to any fault of their own. The focus should then to provide requisite and relevant education opportunities to ensure their competencies to oversee large change management initiatives, especially digital changes, are available and mandated prior to reaching the GOFO rank level.

A potential remedy to ameliorate this gap of professional competency would be to draw on experiential learning as an immediate and expedient method of upskilling our next generation of GOFOs by curating their tutelage starting at the Major/Lieutenant-Colonel rank level. While course-based learning such as a traditional master's program would be an option, the relevance and pragmatism offered by participating in an experiential learning program would be a preferred option to cement lived-experiences into applicable competencies.

The RCAF's Air Warfare Centre (RAWC) has facilitated exchange programs or rather, fellowship programs with organizations such as think-tanks, non-for-profit and private industry. This mechanism could be the pathway for inculcating future GOFOs with the practical experience they would need to oversee large and complex change management initiatives such as digital transformation. Recently, Air Canada journeyed through a digital transformation to divest paper-based maintenance recording and defect management by introducing in electronic tablets (e.g. iPad). This transformation was led by Keith Dugas, the Director of Maintenance overseeing Artificial Intelligence and Connected Operations.[16] This change initiative described an astounding success to modernize business practices by maximizing the amount of time an aircraft technician spends troubleshooting and repairing a defect on-aircraft while minimizing wasted time transiting to a computer to transcribe paper-based maintenance log sets. What is not mentioned but can be inferred is the amount of insight that could be gleaned from enacting such a large-scale digital implementation plan at such a high paced environment

[15] Stackpole, Thomas. 2021. *Harvard Business Review: Inside IKEA's Digital Transformation.* June 4. Accessed May 6, 2023. https://hbr.org/2021/06/inside-ikeas-digital-transformation.

[16] Dugas, Keith. 2022. *Aircraft MRO: Managing and synchronizing devices of all types at Air Canada.* Accessed May 5, 2023. https://issuu.com/aircraftit/docs/aircraft_it_mro_v11.4?fr=sNDliZTI4Mjk4NQ.

where profit margins are tied inextricably with aircraft serviceability. Aspiring GOFOs could have partnered with Keith Dugas to understand data-driven decision-making process of when and how to implement the project; to partner with a third-party vendor or whether to conduct the tablet synchronizing and management in-house at Air Canada. Areas of risk that were analyzed and ways to mitigate them would have been their trial period of using a proof of concept first before the full roll-out of electronic tablets. Aforementioned competencies of communication skills, adaptability, the right attitude, empowerment, failing-fast,[17] experimentation would all have been be invaluable lessons learned if a partnership via the RAWC's fellowship program with Air Canada had been leveraged.

Removing the focus on the GOFO level, there is also an argument to be made to cultivate learning and education opportunities as a normative baseline, specifically experiential learning-based programs like the RAWC's fellowship program, for those who will not become GOFOs but rather will be a critical team-player as a middle-manager, agnostic of rank or commission. Non-Commissioned Members as well as officers both deserve the opportunity for relevance in training and education on digital literacy.[18] They could broaden their understanding as candidates on this fellowship program to see what industry such as Air Canada exploits for improved work flows. They need to understand that their workspace and environment need to modernize with technology, which is not a dig at legacy processes but that they, the warfighter (office or field forces),[19] deserve much better to streamline their work, reducing effort and time so that they can focus on other important tasks.[20] This attitude to innovate and modernize is ever so important in today's context of reconstitution where we need to do smarter (not more) with less resources.

In 2022, the a RAWC fellowship was created to target the Aircraft Maintenance industry and exchange best business practices. This fellowship involved an AERE Major who spent six months at Air Canada Maintenance Facility in Toronto from April to September 2022 to learn about their maintenance operations.[21] During this time, the Major was exposed to the entire comprehensive maintenance program that supports Air Canada's domestic and international commercial aviation enterprise. This provided a unique opportunity for RCAF Air Maintenance leadership to compare best practices and learn innovative ways to make aircraft maintenance more seamless, efficient, and effective for its stakeholders of technicians, supervisors, and managers. Revelations on Air Canada's agile training and onboarding of aircraft technicians, real-time monitoring

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[17] Eyre, General, interview by Joetey Attariwala. 2023. *CDS Annual Review: General Wayne Eyre* (April).
[18] —. 2019. *The Department of National Defence and Canadian Armed Forces DATA STRATEGY.* September. Accessed April 18, 2023. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/data-strategy/data-strategy.html.
[19] Roche, Sean, interview by David Perry. 2022. *Defence Deconstructed Podcast: Lessons Learned on Digitization* (April 15).
[20] Tang, Barry. 2021. "RCAF Journal, Vol 10, No. 3, Summer/Fall 2001." *A Canadian Kessel Run: Smuggling an Agile/DevOps Capability into the RCAF/CAF/DND.* October. Accessed May 5, 2023. https://publications.gc.ca/collections/collection_2022/mdn-dnd/D12-16-10-3-eng.pdf.
[21] Hirsimaki, Konsta. 2023. "RCAF Air Warfare Centre: inForm Article." *An Aerospace Engineer's Glimpse into Air Canada Maintenance.* January. Accessed May 5, 2023. http://trenton.mil.ca/rcaf-awc/en/inform/articles/iss83-jan-2023.pdf#zoom=100.

of in-flight aircraft maintenance diagnostics, and leveraging technology within the aircraft hangar for maintenance and support work (e.g. aforementioned digitization towards iPad) were enlightening. However, the appetite for follow-on fellows to partner with Air Canada did not materialize, despite the explicit request of Air Canada's Vice-President of Maintenance to growth this strategic partnership, due to reasons unknown. This short-sightedness and lack of transparency prohibits outward growth of the RCAF to become innovative and embrace digital transformation, dooming itself towards an insular state of strategic drift. As a stepping stone, this program could be introduced to RCAF logisticians to learn best practices from Air Canada such as their imminent Radio Frequency Identification (RFID) or Automatic Identification System (AIS) program[22] to effortlessly track tools and spare parts, or how aircraft maintenance in the RCAF can leverage WIFI in its hangars to bring about real impactful change.

The RCAF approach to digital transformation needs to incorporate a deliberate action plan to outline the need to leverage experiential learning with industry to hone leadership competencies across trades and rank levels – posturing its leaders to successfully lead large change initiatives such as digital transformation.

Structure

Organizational Structure forms the second crucial pillar in the STS framework. The deliberate design of who is responsible for implementing digital transformation sets the tone for the organization. Should the responsibility to lead and implement digital transformation be cross-cutting and led by each existing Level 1 (L1) organization? Or is this better suited for a dedicated organization that consists of a sole primary job to conduct and manage digital transformation? Imran et al's case study of industrial organizations did not lead to a conclusive result on which correlated with a higher chance of a successful digital transformation, [23] but consideration to both approaches are noted.

In the wake of sexual misconduct and toxic culture in the CAF, the Deschamps' 2015 report led to numerous recommendations to improve the CAF. The response came in the form of a CDS/DM Initiating Directive to "create a Chief Professional Conduct and Culture (CPCC) to rapidly identify scope of work and priorities, and develop a detailed action plan [to ameliorate] its professional conduct and culture."[24]. While concrete progress from CPCC is being made and transparently shared on its website, it is the deliberate construct of CPCC as a structure that has allowed for these tangible gains, namely in the form of a symbolic order[25] where an entire organization replete with a 3-

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[22] Gaudet, Travis. 2022. "Canadian Forces College." *Sustainment Tomorrow: Thefits of Automated Identification Technology for the Canadian Army.* January. Accessed May 5, 2023. https://www.cfc.forces.gc.ca/259/290/24/192/Gaudet.pdf.

[23] Imran, Faisal, Khuram Shahzad, Aurangzeab Butt, and Jussi Kantola. 2021. "Digital Transformation of Industrial Organizations: Towards an Integrated Framework." *Journal of Change Management: Reframing Leadership and Organizational Practice* 451 - 479.

[24] —. 2021. *CDS/DM Initiating Directive for Professional Conduct and Culture.* April. Accessed May 5, 2023. https://www.canada.ca/en/department-national-defence/corporate/policies-standards/dm-cds-directives/cds-dm-initiating-directive-professional-conduct-culture.html.

[25] Ouellet, Eric. 2009. "The Canadian Army Journal." *Rethinking Military Leadership From a Sociological Perspective.* Accessed May 5, 2023. https://publications.gc.ca/collections/collection_2009/forces/D12-11-

Star General/Lieutenant-General, staffing of personnel, and most importantly, dedicated funding. This course of action transparently outlines the effort and resources put forth towards the critical mission which is positive and inclusive culture change within the CAF and naysayers would be unable to shy away from the dilution of subject importance should existing L1 organizations were charged with culture change initiatives within their extant organizational structures and funding envelopes. The span of control of tasks, and saturation of multiple primary jobs would render the CAF culture change imperative to a secondary role. Instead, those new members entering the CAF would now be socialized to the existence and more importantly, to the criticality of CPCC as a dedicated L1, more so than what words can depict as each member of CPCC advocates for its mission and purpose.

The Navy's Digital Strategy follows a similar approach as it overtly states the necessity of creating the Directorate of Digital Navy (DDN) to oversee the Digital Navy Office (DNO) to perform coordination functions and optimize collaboration among stakeholders.[26] It goes even further to describe the tangible tasks that this organization would be responsible for namely, the cross pollination of digital information via annual stakeholder forums, regularly progress reporting, and even setting up agile contracts to encourage innovative small-scale contracts to nurture a digital culture.[27] The RCAF would benefit from this approach to put words into action, righting the absence of a RCAF digital strategy, and laying down tangible action plans and tasks for functional authorities to champion. DGAEPM would play a critical role along a similar vein of the RCN's mission for DGMEPM's pursuit of a digital twin[28] - to optimize maintenance schedules for conditions-based rather than time-based tasks for aircraft vis-a-vis ship maintenance programs. Fueled by real-time information and data to drive operationally focused decision making. Having a dedicated structure such as the DDN and DNO as overt structures within the complex organization signals dedication towards digital transformation.

Similarly, the DoD Chief of Digital Artificial Intelligence (CDAO) Office which, launched in February 2022, has amalgamated many like departmental entities for a "[stronger] alignment and synchronization to accelerate decision advantage and generate advanced capabilities for our warfighters."[29] Most importantly, the CDAO structure is mandated to create enabling digital infrastructure and services that support Components' development and deployment of digital-enabled solutions. It also has the authority to

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12-1E.pdf.

[26] —. 2020. "Digital Navy." *A Strategy to Enable Canada's Naval Team for the Digital Age.* Accessed April 28, 2023. http://www.navy-marine.forces.gc.ca/assets/NAVY_Internet/docs/en/innovation/rcn-digital-navy-initiative_v2.pdf.

[27] —. 2020. *Digital Navy: Action Plan.* February 07. Accessed April 27, 2023. https://www.canada.ca/en/navy/corporate/what-we-do/innovation/digital-navy/digital-navy-action-plan.html.

[28] Thompson, Ian. 2019. *Digital twinning of ship structural fatigue: state of the art review and strategic research.* July. Accessed April 27, 2023. https://cradpdf.drdc-rddc.gc.ca/PDFS/unc339/p810431_A1b.pdf.

[29] Deputy of Secretary of Defence. 2021. *Department of Defence: Establishment of the Chief Digital and Artificial Intelligence Officer.* December 8. Accessed May 5, 2023. https://media.defense.gov/2021/Dec/08/2002906075/-1/-1/1/MEMORANDUM-ON-ESTABLISHMENT-OF-THE-CHIEF-DIGITAL-AND-ARTIFICIAL-INTELLIGENCE-OFFICER.PDF.

selectively scale proven digital and AI-enabled solutions for enterprise and joint use cases – illustrating the STS theory of mutually reinforcing across the pillars of leadership, structure, and culture.

While much less developed than the DoD's CDAO, Canada's Deputy Minister of National Defence, Bill Matthews issued a statement in December 2022 to announce the creation of a Digital Transformation Office (DTO).[30] This is in line with the US' approach with the creation of the CDAO to remove silos of efforts, synergize resources and provide deliberate support of the digital transformation initiatives across services. As of May 2023, no updates have been provided on its progress but the effort of creating this new structure is in itself a step in the right direction. With a dedicated structure should come commensurate funding, otherwise which would be obscured and nested within existing organization structures. More dialogue and socialization between the DTO and CAF services, namely the RCAF needs to take place to better identify areas of focus for digital education/training, and potential scaling of worthwhile digital solutions to permeate a digital culture. The prior discussion on *structure* focused on formal entities and it is worthwhile to note that *informal* structures can exist as well that aid in supporting an environment or more aptly a thriving culture for digital transformation. Due to its interconnectedness and mutual reinforcing effects, the sub-topic of *informal* structures will be discussed in the subsequent heading of culture.

Culture

The organizational structure plays a crucial role in the success of digital transformation in the CAF. Traditionally, the CAF operates under a rigid hierarchical system where power and decision-making authority lie with the top echelons and are passed down to the tactical level. However, this top-down approach can stifle collaboration and innovation from the broader workforce, limiting the organization's ability to adapt to a rapidly changing digital landscape. To address this, agile organizations are adopting flatter structures, where decision-making authority is more decentralized and better aligned with the workforce's physical, social, and cultural contexts. While management principles like "Management by Walking Around" attempt to bridge this gap in hierarchal organizations, they lack the continuity necessary to foster true collaboration, two-way communication, and empowerment at all levels. Command concepts like Alberts' and Hayes' "Power to the Edge" pushes decision rights to the frontlines by flattening information distribution and patterns of interaction.[31] Similarly, "Mission Command" provides flexibility in tactical execution within the confines of the commander's intent for the mission. These command philosophies are often misunderstood but strive for the same goal of creating a generative culture. Westrum's generative culture dismisses power structures of rank, title, and position as an afterthought. In a generative culture, the normative value here is focused on the team's

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[30] Matthews, Bill. 2022. *Message from the Deputy Minister regarding the Digital Transformation Office.* December 6. Accessed April 18, 2023. https://www.canada.ca/en/department-national-defence/maple-leaf/defence/2022/12/message-deputy-minister-digital-transformation-office.html

[31] Alberts, David, and Richard Hayes. 2003. *Power to the Edge: Command and Control in the Information Age.* Accessed May 5, 2023. http://www.dodccrp.org/files/Alberts_Power.pdf.

overall product and output rather than processes and figurehead formalities. The leader or team can focus on pathological values (personal power, needs, and glory), or, they can focus on bureaucracy (rules, positions and departmental turf). The third is a concentration on the mission itself. These three patterns are summarized in Figure 3 and show how organizations process information, communicate and behave.[32]A generative culture prioritizes performance of the team's goals over all else and espouses the values of high cooperation, innovation and risk-sharing.

RCAF's Plan Qulliq (PQ) serves as a successful illustration of a generative culture nested within a bureaucratic and pathological ancestry. PQ is a small team within the RCAF that focuses on operationalizing innovation into software solutions. The team consists of regular force and reservists that spans both the officer and non-commissioned officer cadres. It is led by a Lieutenant-Colonel who is a pilot with no technical background in digital software development. This is representative of most of the members in that their passionate for innovation has driven them to heutagogy for digital technical competencies by working closely with industry partners. Together, user input of the RCAF business, coupled with technical expertise in software development led to iterations of useable software for the end-user. These Minimum Viable Products (MVPs) eventually captured the attention and imagination of 8 Wing's flight operations cell; and dispatchers along with pilots were both culturally converted to the utility of the software they all collaboratively developed. One pilot's testimony succinctly captures the sentiment:

> It's nice to see software that supports our operations in an intuitive manner. I like that it looks like software I'm using at home. When you have beautiful apps like Instagram at home, and then you have to battle old software at work, that's painful. *Dispatch* is a step in the right direction and it's noticeably improving our quality of life at home and on the road.[33]

In terms of developing competencies for digital transformation, the members of PQ have demonstrated that experiential learning by *doing* software development via an Agile DevSecOps[34] methodology has contributed to their digital competence. Further, a generative culture to foster a healthy learning environment has reinforced the pillar of leadership competency development, which also strengthens the importance that setting up an innovative unit such as PQ has on the other STS pillars towards a joint effect.

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[32] Westrum, R. 2004. *A typology of organisational cultures.* December 2. Accessed April 20, 2023. https://qualitysafety.bmj.com/content/qhc/13/suppl_2/ii22.full.pdf.

[33] —. 2020. *Dispatch: Transforming RCAF Operations.* June 9. Accessed May 5, 2023. https://www.canada.ca/en/air-force/corporate/reports-publications/rcaf-perspectives/dispatch-transforming-rcaf-operations.html.

[34] DevSecOps is a software engineering culture that guides a team to break down silos and unify software development, deployment, security and operations (DoD 2021)

Table 1 How organisations process information

Pathological	Bureaucratic	Generative
Power oriented	**Rule oriented**	**Performance oriented**
Low cooperation	Modest cooperation	High cooperation
Messengers shot	Messengers neglected	Messengers trained
Responsibilities shirked	Narrow responsibilities	Risks are shared
Bridging discouraged	Bridging tolerated	Bridging encouraged
Failure→ scapegoating	Failure→ justice	Failure→ inquiry
Novelty crushed	Novelty→ problems	Novelty implemented

Figure 3: Westrum's organisation culture models

Culture needs to eat strategy.[35] It needs to be organic and not forced. It is needs to inspire the future generation with contemporary victories and wins. Witness to successes and sharing of failures all need to co-exist in a collaborative and open space. Leaders' role to encourage collaboration is paramount to generative culture. The origin story of how one of the RCAF's innovative initiatives is an active example of this passionate contagion – its evangelistic effect to spur new minds to experiment is what will drive digital transformation. From an interview conducted with Maj (Ret'd) Andrew Sheahan, he shared in an email the exact moment of appeal and belief was when he was heard by the developers of their design requirements for the *Dispatch* software and within a few short days of iteration, a co-created MVP was produced. DevSecOps methodology where user empathy is solicited alongside software developers to help solve and digitize business solutions are the exact type of collaborative culture the CAF needs to move towards digital transformation.[36] This original task centered on streamlining aircraft operations dispatchers' workloads, and was then expanded towards other features and is responsible for the current Rcafé[37] chat platform.

Rcafé platform is another grass-roots innovation that has cross-cut all STS pillars of leadership, structure, and culture. To elaborate, the Rcafé program is an online chat forum that any user can access from home or at work a device of their choosing. The only requirement is to register first using a DWAN email account. This chat platform was designed to allow RCAF members, agnostic of rank, to communicate with the broader

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[35] Engel, Jacob. 2018. *Why does Culture 'Eat Strategy for Breakfast'?* November 20. Accessed May 5, 2023. https://www.forbes.com/sites/forbescoachescouncil/2018/11/20/why-does-culture-eat-strategy-for-breakfast/?sh=5b5f0d2a1e09.

[36] Sheahan, Andrew, interview by Barry Tang. 2023. *Original Story of Dispatch/Flight Deck* (April 10).

[37] Reddit. 2021. "Reddit/CanadianForces/." *Internal RCAF social media website launched; rcafé.* Accessed May 5, 2023. https://www.reddit.com/r/CanadianForces/comments/k62ybe/internal_rcaf_social_media_website_launched_rcaf%C3%A9/.

RCAF community on a variety of topics. It has also evolved into a Dragon's Den format as one use-case to cultivate grass-roots ideas to institutional problems. The RCAF commander has hosted a number of Vector Checks that "allows all personnel to pitch new ideas… and champions and resources are assessed to foster its growth."[38] This forum touches the leadership and structure elements because it equalizes power distances that often prohibit any meaningful conversation in traditional office or military settings. A corporal can create a post on a certain air-force related topic and a GOFO could be replying instantaneous with candid, informed and unfiltered facts, opinions, and emoticons. This provides access to all rank levels previously unfathomable. While there are certain caveats if unprofessional conduct arises but the positives definitely outweigh the negatives. Rcafé also touches on the cultural aspect of the STS pillars as RCAF leaders have now demonstrated a tangible forum to listen to their troops regardless of rank or position. The value placed on insight and ideas from all rank levels empowers the organize and gives a voice for those to be heard. The RCAF approach to digital transformation needs to further exploit such paradigm shifts of communication methods and encourage more agile discussions across different trades and communities. Topics to leverage Rcafé could be dedicate forums on digital training and education whether internal to the CAF or external in industry. A community of best practices to share digital advances within each tactical or operational level across tradecraft would fuse institutional silos of excellence together for synergistic gains.

Conclusion

The CAF Digital Campaign Plan serves as the regulative pillar to mandate the institution to undergo digital transformation by 2030. The Reconstitution Directive further reinforced this as a strategic priority even against the backdrop of severe recruitment, retention and attrition challenges. To be a relevant military force capable to deliver operational effects, the CAF must modernize and embrace digital transformation. Specifically, the RCAF needs to emphasize the social systems of leadership, structure, and culture to ensure they are all cognitively and normatively aligned to integrate new emergent technologies that major capital projects will procure as new hardware and platforms for the RCAF. Despite the lack of a dedicated RCAF digital transformation strategy, the RCAF *Strategy* highlights solely on these new technological capabilities but does little to showcase the importance of its STS pillars. To provide more tangible ways and practical means, examples from peer services such as the CA and RCN showed the need to provide action plans. External examples involving Air Canada Maintenance were used to highlight partnership opportunities to develop leadership competencies. The importance of overt localized symbolic orders in the form of CPCC, DTO and CDAO were highlighted, along with their commensurate resources. Internal examples of existing RCAF initiatives such as PQ, Dispatch, and Rcafé highlighted profound work on the cultural front to create a generative and collaborative environment.

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[38] Meinzinger, A. 2021. *CDA Institute: RCAF Commander LGen Meinzinger on Space Capabilities, Innovation in the RCAF, and Pandemic-era Readiness.* April 9. Accessed May 5, 2023. https://cdainstitute.ca/a-discussion-with-rcaf-commander-lgen-al-meinzinger/.

While viewed in separate pillars, the true value proposition is unlocked when all STS pillars of leadership, structure, and culture co-exist to provide joint and synergistic effects. The actions of a competent leader to communicate digital wins or to deliberately fund DevSecOps[39] software breeds cultural pride and acceptance to tackle the next digital transformation challenge. The creation of a dedicated digital transformation unit or entity will reinforce a leader's commitment to lead by example with dedicated funding and personnel resources. The novel communication tools used by a competent leader to actively hear a good idea from any service member agnostic of rank perpetuates the collaborative environment that is needed for digital transformation.

To successfully digitally transform a rigid structure such as the military/RCAF is no small feat, and it will take time. The best approach is to start off in small manageable chunks of leadership, structure and culture - so as not to be overwhelmed by the digital elephant. Future studies should include how to adequately capture performance metrics to identify a successful digital transformation else it will be unknown whether this wicked problem will have been solved or persists in a different spiritual animal.

[39] Deloitte. 2022. *Operations and opportunities in command and control: The digital revolution comes to the Canadian Armed Forces.* Accessed May 5, 2023. https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/public-sector/ca-en-public-sector-operations-and-opportunities-in-command-and-control.pdf.

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