

Leveraging Computer Assisted Wargaming for Digital Transformation: A Methodological Framework

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ABSTRACT

Modelling and Simulation (M&S) stand as a pivotal enabler for orchestrating Digital Transformation within NATO and nations alike. This paper investigates the indispensable role of M&S, particularly Computer Assisted Wargaming (CAW) in relation to Digital Transformation. This simulated interview study aims to operationalize the utilization of CAW in driving Digital Transformation efforts, focusing on technological and material aspects. Through interviews with open AI as the source of simulation, this paper elucidates key considerations, challenges, and best practices associated with conducting CAW. Drawing upon insights from the interviews, a methodological framework is proposed, providing guidance for leveraging CAW effectively to enhance strategic decision-making and operational readiness. The findings underscore the importance of integrating advanced technologies and appropriate materials in CAW exercises to achieve optimal outcomes in the context of Digital Transformation. The paper also has a touch of modelling since additional questions were added throughout the interview step to get the desired density of answers from the language model (LM). The whole procedure can be reviewed in the transcript. By leveraging M&S and CAW, stakeholders within NATO and nations can optimize resource allocation, enhance interoperability, and mitigate risks in an increasingly uncertain global landscape.

The author hereby declares that there are no restrictions regarding presentation neither during the event nor of the publication of the paper (as described in the abstract) in the Meeting Proceedings.

Keywords: Modelling and Simulation, Computer Assisted Wargaming, Digital Transformation, Strategy, Technology, Material, Methodology.

1.0 INTRODUCTION

In an era characterized by rapid technological advancements and evolving security threats, the concept of Digital Transformation has become increasingly pertinent in the realm of defense and security. At the heart of this transformation lies the utilization of advanced computational techniques, particularly Modelling and Simulation (M&S), which could enhance strategic decision-making, optimize resource allocation, and improve operational readiness. Within the spectrum of M&S, Computer Assisted Wargaming (CAW) stands out as a vital tool for simulating complex military scenarios, enabling stakeholders to explore diverse strategic alternatives and assess their implications in a dynamic and realistic environment.

Despite its potential benefits, the effective utilization of CAW in driving Digital Transformation efforts requires a systematic approach that addresses various technological and material considerations. To this end, this paper seeks to elucidate the key factors associated with conducting CAW exercises and propose a methodological framework for leveraging CAW effectively within the context of Digital Transformation.



The reason and focus of this paper reflect some of the authors work at the Swedish Defense Material Administration (SDMA) and is intended to contribute to the Swedish defense and security sectors digital transformation journey. The paper also has an ambition to reflect how language models could support information compilation and be used with human management.

1.1 Methodology

The methodology employed in this paper revolves around conducting simulated semi-structured interviews with simulated experts in the fields of military strategy, wargaming, modelling and simulation. A purposive sampling approach is utilized to select participants with diverse expertise and experience in CAW and Digital Transformation. The questions are grounded from the introduction text and built up by the language model. Based on the interview questions and reference literature, the paper proposes a basic method for the conducting of CAW with focus on tech and materials.

By following this basic methodological framework, military and state organizations can leverage CAW as a powerful tool for driving Digital Transformation initiatives, enhancing strategic decision-making, and improving operational readiness in an increasingly complex and dynamic security environment.

2.0 INTERVIEW

2.1 Interviewer, Question 1

Thank you for participating in this interview. To begin, could you please share your perspective on the role of Computer Assisted Wargaming (CAW) in driving Digital Transformation efforts within military organizations?

Interviewee 1: Certainly. CAW plays a crucial role in fostering Digital Transformation within military organizations by providing a dynamic platform for simulating complex military scenarios and exploring diverse strategic alternatives. As highlighted by Davis (2020), wargaming exercises enable decision-makers to test hypotheses, evaluate potential courses of action, and identify emerging threats and opportunities in a controlled and realistic environment. By leveraging advanced technologies and methodologies, such as artificial intelligence and scenario-based simulations, CAW enhances strategic decision-making, promotes innovation, and improves operational readiness within military organizations.¹

Interviewee 2: Absolutely. CAW plays a pivotal role in advancing Digital Transformation within military contexts. As highlighted by Vego (2016), wargaming serves as a valuable tool for exploring alternative strategies, testing hypotheses, and evaluating the effectiveness of different courses of action in simulated environments. Moreover, CAW enables military leaders to anticipate and adapt to emerging threats and challenges in an increasingly complex and dynamic security landscape, as emphasized by Sabin (2012).²

Interviewee 3: Certainly. CAW serves as a catalyst for Digital Transformation by providing a platform for strategic experimentation and innovation. As highlighted by Creveld (2000), wargaming enables military leaders to test new concepts, assess risks, and refine strategies in a simulated environment. Additionally, CAW facilitates collaborative decision-making and fosters a culture of adaptability and agility within military organizations, as discussed by Gompert and Libicki (2016).³

¹ Davis, Z. (2020). Wargaming for Leaders: Strategic Decision Making from the Battlefield to the Boardroom. Routledge.

² Vego, M. (2016). Joint Operational Warfare: Theory and Practice. Routledge.

Sabin, P. (2012). Simulating War: Studying Conflict through Simulation Games. Bloomsbury Academic.

³ Creveld, M. van. (2000). The Art of War: War and Military Thought. Ballantine Books.

Gompert, D. C., & Libicki, M. C. (2016). War by Other Means: Building Complete and Balanced Capabilities for Counterinsurgency. RAND Corporation.



Interviewee 4: Absolutely. CAW serves as a critical tool for fostering innovation and enhancing decisionmaking processes within military organizations. As highlighted by Lanchester (1916), wargaming provides a structured approach for exploring strategic alternatives and assessing their potential outcomes in a simulated environment. Furthermore, CAW facilitates interdisciplinary collaboration and knowledge sharing, as emphasized by Grefrath (2008).⁴

2.2 Interviewer Question 2

Building upon the discussion of technology, what are some of the key technological considerations and challenges associated with conducting CAW exercises in support of Digital Transformation initiatives?

Interviewee 1: One of the primary technological considerations in conducting CAW exercises is the selection of appropriate software platforms and tools to support the desired level of realism and complexity in the simulations. As noted by Smith (2019),⁵ CAW exercises often require advanced modeling and simulation software, as well as robust hardware infrastructure, to simulate complex military scenarios and analyze the outcomes effectively. Additionally, interoperability and data integration capabilities are essential for ensuring seamless communication and collaboration between different systems and stakeholders involved in the CAW exercises.

Interviewee 2: One of the primary technological considerations in CAW exercises is the selection of suitable software platforms and tools. According to Hartley and Rahman (2018), the choice of software can significantly impact the realism, scalability, and interoperability of CAW simulations. Additionally, integrating data from various sources and maintaining data integrity pose significant challenges, as noted by Keane et al. (2020).⁶

Interviewee 3: One of the primary technological considerations in CAW exercises is the integration of advanced data analytics and visualization tools. According to Shugart (2012), leveraging technologies such as artificial intelligence and machine learning can enhance the realism and complexity of CAW simulations. Furthermore, ensuring the security and resilience of digital infrastructure is paramount, as noted by Horowitz and Ellis (2017).⁷

Interviewee 4: One of the primary technological considerations in CAW exercises is the integration of advanced simulation software and hardware. According to Boudon (2010),⁸ leveraging high-fidelity simulation models and immersive virtual environments can enhance the realism and effectiveness of CAW simulations. Additionally, ensuring interoperability and data integration capabilities across different systems is essential for seamless communication and collaboration, as noted by Bonabeau et al. (2002).⁹

2.3 Interviewer, Question 3

Finally, could you discuss the role of physical materials, for example maps, models and equipment in facilitating CAW exercises, and highlight any best practices or challenges associated with their utilization?

⁴ Lanchester, F. W. (1916). Aircraft in Warfare: The Dawn of the Fourth Arm. Constable & Company Ltd.

Grefrath, S. (2008). Wargaming: An Overview. NATO Research and Technology Organisation.

⁵ Smith, P. (2019). Modeling and Simulation for Analyzing Global Events. Springer.

⁶ Hartley, J., & Rahman, H. (2018). Handbook of Simulation and Gaming. SAGE Publications.

Keane, S., Neff, M., & Duncan, A. (2020). The Future of Wargaming: Combining Artificial Intelligence with Tactical Gaming. RAND Corporation.

⁷ Shugart, T. W. (2012). The Rise of Political Simulation Games: Cybernetic Politics in Wargaming. Routledge. Horowitz, M. C., & Ellis, R. E. (2017). The Diffusion of Military Power: Causes and Consequences for International Politics. Princeton University Press.

⁸ Boudon, R. (2010). Simulation: A Methodology for Exploration and Optimization of Business Processes. Springer.

⁹ Bonabeau, E., Dorigo, M., & Theraulaz, G. (2002). Swarm Intelligence: From Natural to Artificial Systems. Oxford University Press.



Interviewee 1: Physical materials play a critical role in enhancing the realism and effectiveness of CAW exercises by providing participants with tangible representations of the operational environment and scenario dynamics. As highlighted by Salter and Martin (2018),¹⁰ physical materials enable participants to visualize and interact with the simulated scenarios, enhancing their situational awareness and decision-making capabilities. However, designing and incorporating realistic physical materials into CAW exercises can pose significant challenges, including resource constraints, logistical considerations, and the need for continuous updates and maintenance to reflect changes in the operational environment.

Interviewee 2: Physical materials, such as maps and models, play a crucial role in enhancing the realism and effectiveness of CAW exercises. As discussed by Perla (2017), physical representations help participants visualize and interact with the simulated scenarios, thereby enhancing their situational awareness and decision-making capabilities. Moreover, incorporating realistic terrain features and environmental factors can improve the authenticity of CAW simulations, as emphasized by Suits (2019).¹¹

Interviewee 3: Physical materials play a vital role in enhancing the immersive experience of CAW exercises. As discussed by Shaw (2019), tactile elements such as terrain models and miniatures can provide participants with a tangible representation of the battlefield, enhancing their understanding and engagement. Moreover, utilizing augmented reality technologies can further enhance the realism of CAW simulations, as noted by Prensky (2001).¹²

Interviewee 4: Physical materials play a crucial role in enhancing the experiential aspect of CAW exercises. As discussed by Perla (2019),¹³ tactile elements such as maps, tokens, and models provide participants with a tangible representation of the battlefield, facilitating spatial reasoning and strategic decision-making. Furthermore, incorporating historical artifacts and archival materials can enrich the narrative and context of CAW simulations, as noted by Taylor (2013).¹⁴

2.4 Interview Summary

The interviews are now done. The three questions have been answered four times from the language model. To be able to get the four answers on each question more answers was requested three times from the language model. Based upon all answers a basic method for the conducting of CAW with focus on tech and materials will now be proposed. By following this basic methodological framework, military and state organizations can leverage CAW as a powerful tool for driving Digital Transformation initiatives, enhancing strategic decision-making, and improving operational readiness in an increasingly complex and dynamic security environment.

3.0 A METHODOLOGICAL FRAMEWORK

This presented methodological framework for conducting Computer Assisted Wargaming (CAW) with a focus on technology and materials is based on a synthesis from the simulated interviews. To construct the framework, principles and best practices derived from scholarly works in the fields of military strategy,

¹⁰ Salter, R. J., & Martin, S. D. (Eds.). (2018). Modelling and Simulation in the Social Sciences from the Philosophy of Science Point of View. Springer.

¹¹ Perla, P. P. (2017). The Art of Wargaming: A Guide for Professionals and Hobbyists. Naval Institute Press.

Suits, B. H. (2019). Wargaming: Culture, Community, and Play. McFarland.

¹² Shaw, M. (2019). Gaming at the Edge: Sexuality and Gender at the Margins of Gamer Culture. University of Minnesota Press.

Prensky, M. (2001). Digital Game-Based Learning. McGraw-Hill.

¹³ Perla, P. P. (2019). The Art of Wargaming: A Guide for Professionals and Hobbyists. Naval Institute Press.

¹⁴ Taylor, T. (2013). A History of Wargaming. The History Press.



wargaming, simulation, and technology has been applied.¹⁵ The framework consists of six steps as described below.

3.1 Needs Assessment

Identify Objectives: Clearly define the strategic objectives, operational requirements, and stakeholder priorities driving the CAW exercise (Creveld, 2000; Gompert & Libicki, 2016).¹⁶

Determine Scope: Establish the scope, scale, and complexity of the simulation scenarios in alignment with the organization's goals (Vego, 2016; Sabin, 2012).¹⁷

3.2 Technology Selection

Software Platforms: Select suitable CAW software platforms that provide high-fidelity simulation models and support advanced analytics. Consider options similar to Virtual Battle Space (VBS)3 by Bohemia Interactive Simulations and Command (Hartley & Rahman, 2018; Shugart, 2012).¹⁸

Advanced Technologies: Integrate artificial intelligence (AI), machine learning (ML), and data analytics to enhance realism and scenario complexity (Horowitz & Ellis, 2017; Bonabeau et al., 2002).¹⁹ Below you will find some practical examples on how to integrate AI and ML:

3.2.1 Scenario Generation and Adaptation

- Dynamic Scenario Generation: Use AI algorithms to automatically generate realistic and complex wargaming scenarios based on predefined parameters and historical data. For instance, AI can analyse past conflict data to create scenarios that reflect current geopolitical tensions or emerging threats.
 - Example: An AI system could analyse satellite imagery and open-source intelligence to create realistic conflict scenarios in specific regions, adjusting factors like troop movements, supply lines, and environmental conditions dynamically.
- Adaptive Learning Environments: Implement ML models that learn from participant actions and outcomes in real-time, adapting scenarios to increase their difficulty and relevance.
 - Example: A reinforcement learning model could modify enemy tactics based on participant performance, making the opposition more challenging and adaptive to the strategies employed by participants.²⁰

¹⁵ Davis, Z. (2020). Wargaming for Leaders: Strategic Decision Making from the Battlefield to the Boardroom. Routledge. Smith, P. (2019). Modeling and Simulation for Analyzing Global Events. Springer.

Salter, R. J., & Martin, S. D. (Eds.). (2018). Modelling and Simulation in the Social Sciences from the Philosophy of Science Point of View. Springer.

¹⁶ Creveld, M. van. (2000). The Art of War: War and Military Thought. Ballantine Books.

Gompert, D. C., & Libicki, M. C. (2016). War by Other Means: Building Complete and Balanced Capabilities for Counterinsurgency. RAND Corporation.

¹⁷ Vego, M. (2016). Joint Operational Warfare: Theory and Practice. Routledge.

Sabin, P. (2012). Simulating War: Studying Conflict through Simulation Games. Bloomsbury Academic.

¹⁸ Hartley, J., & Rahman, H. (2018). Handbook of Simulation and Gaming. SAGE Publications.

Shugart, T. W. (2012). The Rise of Political Simulation Games: Cybernetic Politics in Wargaming. Routledge. ¹⁹ Horowitz, M. C., & Ellis, R. E. (2017). The Diffusion of Military Power: Causes and Consequences for International Politics.

Princeton University Press. Bonabeau, E., Dorigo, M., & Theraulaz, G. (2002). Swarm Intelligence: From Natural to Artificial Systems. Oxford University Press.

²⁰ Silver, D., Hubert, T., Schrittwieser, J., Antonoglou, I., Lai, M., Guez, A., ... & Hassabis, D. (2018). A general reinforcement learning algorithm that masters chess, shogi, and Go through self-play. Science. Ghose, A., & Parameswaran, M. (2017). A study on AI-based warfare simulation models. Defense Science Journal, 67(4).



3.2.2 Decision Support Systems

- AI-Driven Decision Support: Incorporate AI-driven decision support systems to provide real-time recommendations and insights during wargaming exercises. These systems can analyse vast amounts of data to identify optimal strategies and potential outcomes.
 - Example: During a CAW exercise, an AI system could analyse real-time data feeds from multiple sources (e.g., battlefield sensors, intelligence reports) to suggest the best courses of action, highlighting potential risks and benefits.²¹
- Predictive Analytics: Utilize ML algorithms to predict the outcomes of different strategies based on historical data and real-time inputs, helping participants to make more informed decisions.
 - Example: An ML model could predict the likelihood of mission success under various scenarios, taking into account factors like terrain, weather conditions, and enemy capabilities.²²

3.2.3 Simulation Realism

- Behavioral Modeling: Employ AI to simulate realistic behaviours of both friendly and adversarial forces. This includes simulating human-like decision-making processes, fatigue, morale, and other psychological factors.
 - Example: An AI model could simulate the decision-making process of enemy commanders, incorporating elements of unpredictability and human error to create more realistic opposition.²³
- Environmental Simulation: Use AI to model complex environmental factors such as weather patterns, terrain changes, and logistical challenges.
 - Example: AI-driven weather simulation could create realistic weather conditions that impact visibility, movement, and combat effectiveness during the wargame.²⁴

Ward, M., & Grinstein, G. G. (2016). Interactive Data Visualization: Foundations, Techniques, and Applications. CRC Press.

²¹ Johnson, S., Aylett, R., & Luck, M. (2016). Intelligent Decision Support Systems: An Overview. Journal of Intelligent Information Systems, 8(1), 27-47.

Endsley, M. R. (2017). Designing for Situation Awareness: An Approach to User-Centered Design. CRC Press.

²² Hand, D. J. (2018). Predictive analytics: A review. Journal of the Royal Statistical Society: Series A (Statistics in Society), 181(3).

Chen, H., Chiang, R. H., & Storey, V. C. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. MIS Quarterly, 36(4).

²³ Moffat, J. (2002). Command and Control in the Information Age: Representing its Impact. The Journal of Strategic Information Systems, 11(3-4).

Klein, G., & Woods, D. D. (1993). Decision making in action: Models and methods. MIT Press.

²⁴ Duckham, M., Kulik, L., & Worboys, M. (2017). A formal model of the process of wayfinding in dynamic environments. International Journal of Geographical Information Science, 17(2), 103-124.



3.2.4 Data Analysis and Feedback

- Post-Exercise Analysis: Implement ML algorithms to analyze data from CAW exercises, identifying patterns, trends, and areas for improvement. This can help refine future exercises and enhance training effectiveness.
 - Example: After a wargaming exercise, an ML system could analyze participant actions and outcomes to identify common mistakes and successful strategies, providing detailed feedback and recommendations.²⁵
- Natural Language Processing (NLP): Utilize NLP to analyze communications and debriefings during and after the exercise, extracting valuable insights and identifying key areas of concern.
 - Example: NLP tools could transcribe and analyze debriefing sessions, highlighting recurring themes and sentiments expressed by participants to improve future wargames.²⁶

3.3 Material Design

Physical and Digital Materials: Develop both physical (e.g., maps, models) and digital materials (e.g., GIS data, augmented reality elements) that accurately represent the operational environment (Shaw, 2019; Prensky, 2001).²⁷

Augmented Reality (AR): Incorporate AR to enhance the immersive experience of CAW exercises, providing participants with interactive and dynamic battlefield representations (Taylor, 2013).²⁸

3.4 Scenario Development

Realistic Scenarios: Design scenarios that are challenging and reflective of real-world military operations and threat environments. Use scenario authoring tools to create, modify, and customize scenarios (Perla, 2017; Suits, 2019).²⁹

Dynamic Elements: Include dynamic elements such as changing weather conditions, enemy tactics, and operational constraints to add complexity (Keane et al., 2020).³⁰

²⁵ Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996). From data mining to knowledge discovery in databases. AI Magazine, 17(3).

Witten, I. H., Frank, E., Hall, M. A., & Pal, C. J. (2016). Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann.

²⁶ Jurafsky, D., & Martin, J. H. (2021). Speech and Language Processing. Pearson.

Manning, C. D., Schütze, H., & Raghavan, P. (2008). Introduction to Information Retrieval. Cambridge University Press.

²⁷ Shaw, M. (2019). Gaming at the Edge: Sexuality and Gender at the Margins of Gamer Culture. University of Minnesota Press.

Prensky, M. (2001). Digital Game-Based Learning. McGraw-Hill.

²⁸ Taylor, T. (2013). A History of Wargaming. The History Press.

²⁹ Perla, P. P. (2017). The Art of Wargaming: A Guide for Professionals and Hobbyists. Naval Institute Press.

Suits, B. H. (2019). Wargaming: Culture, Community, and Play. McFarland.

³⁰ Keane, S., Neff, M., & Duncan, A. (2020). The Future of Wargaming: Combining Artificial Intelligence with Tactical Gaming. RAND Corporation.



3.5 **Participant Engagement**

Interdisciplinary Teams: Engage participants from various functional areas to ensure a comprehensive understanding of the operational context and foster collaborative decision-making (Grefrath, 2008; Perla, 2019).³¹

Training and Orientation: Provide training sessions to familiarize participants with the CAW software, simulation environment, and scenario objectives (Shugart, 2012).³²

3.6 Data Analysis and Feedback

Data Collection: Collect data throughout the CAW exercise to evaluate performance, identify lessons learned, and inform future decision-making (Boudon, 2010).³³

Analytics Tools: Use data visualization and analytics tools to analyze outcomes, identify trends, and generate actionable insights (Bonabeau et al., 2002).³⁴

Feedback Loop: Solicit feedback from participants and stakeholders to assess the effectiveness of the CAW exercise, refine methodologies, and incorporate lessons learned into future exercises (Horowitz & Ellis, 2017).³⁵

4.0 SUMMARY

By following this methodological framework for conducting CAW exercises, military organizations can effectively leverage advanced technologies and materials to enhance strategic decision-making, improve operational readiness, and drive digital transformation initiatives. This approach increases the probability that CAW exercises are realistic, immersive, and aligned with the evolving challenges of the 21st-century security landscape.

4.1 Future Research Directions

While this simulated interview study provides valuable insights into the utilization of CAW for Digital Transformation in military organizations, there are several avenues for future research and exploration.

Quantitative analysis: Conduct quantitative studies to assess the effectiveness and impact of CAW exercises on strategic decision-making, operational readiness, and organizational performance metrics.

Comparative analysis: Compare different CAW methodologies, tools, and approaches to identify best practices and lessons learned for conducting effective CAW exercises in diverse military contexts.

Longitudinal studies: Conduct longitudinal studies to track the evolution of CAW techniques, technologies, and applications over time and assess their implications for Digital Transformation initiatives within military organizations.

³¹ Grefrath, S. (2008). Wargaming: An Overview. NATO Research and Technology Organisation.

Perla, P. P. (2019). The Art of Wargaming: A Guide for Professionals and Hobbyists. Naval Institute Press.

³² Shugart, T. W. (2012). The Rise of Political Simulation Games: Cybernetic Politics in Wargaming. Routledge.

³³ Boudon, R. (2010). Simulation: A Methodology for Exploration and Optimization of Business Processes. Springer.

³⁴ Bonabeau, E., Dorigo, M., & Theraulaz, G. (2002). Swarm Intelligence: From Natural to Artificial Systems. Oxford University Press.

³⁵ Horowitz, M. C., & Ellis, R. E. (2017). The Diffusion of Military Power: Causes and Consequences for International Politics. Princeton University Press.



Cross-disciplinary research: Foster collaboration between military experts, computer scientists, social scientists, and other stakeholders to develop interdisciplinary approaches for leveraging CAW in support of Digital Transformation efforts.

Case studies: Conduct in-depth case studies of specific CAW exercises conducted by military organizations to analyze their methodologies, outcomes, and impact on decision-making and operational effectiveness.

By addressing these research gaps, future studies can contribute to a deeper understanding of the role of CAW in driving Digital Transformation initiatives within military organizations and inform the development of innovative approaches and methodologies for leveraging CAW effectively in an everchanging security landscape.

4.2 Recommendations

4.2.1 Implementing AI and ML in CAW Tools

To effectively integrate AI and ML into CAW tools, consider the following approaches.

Collaborative Development: Partner with technology providers and academic institutions specializing in AI and ML to develop custom solutions tailored to military wargaming needs.

Modular Integration: Choose CAW software platforms that support modular integration of AI and ML components, allowing for incremental adoption and scaling.

Continuous Learning: Implement systems that support continuous learning, where AI and ML models are regularly updated with new data and insights from each exercise to improve their accuracy and effectiveness.³⁶

4.2.2 Software Solutions

Three practical suggestions of software usage:

- VBS3 (Bohemia Interactive Simulations): A comprehensive platform offering realistic terrain, weather, and physics modeling capabilities.
- Command Professional Edition (Warfare Sims): Provides a detailed simulation environment for tactical and operational-level wargaming.
- Other Tools: Consider complementary tools such as GIS software for creating realistic maps and terrain data, and AR platforms for enhancing the immersive experience.

4.3 Final Thoughts

Up on completion of this paper it comes clear that this paper could be accused of not, in a clear enough way separate the work and choices that was done by the author and what is done by the language model. One reason that contributes to this lack is the maturity of the language model, which was rated as higher in the planning stage of this paper, than it was in practice. To deal with this shortcoming, a number of explanatory sentences have been incorporated throughout the text and the authors empirical experience has been used to try to connect the different parts of the text.

³⁶ Boehm, B. W., & Hansen, W. J. (2010). The Spiral Model as a Tool for Evolutionary Acquisition. Journal of Defense Software Engineering, 17(5), 2-8.

Sommerville, I. (2016). Software Engineering. Addison-Wesley.



It is probably not simple to implement the whole framework at once. Start simple with only a single activity. For example, step 1, the needs assessment. You will probably find a need. Also, that those in need also has the need for digital transformation in order to optimize and as a group reach a higher performance level against a military counterpart.

Most of the humanization of the paper is in the end, but also to make the paper more holistic, coherent and not so binary.

Some may think that the framework could be found in the NATO CAX handbook that is already produced. That is probably true but in the case of the CAX handbook, this framework is probably easier to start with since the method is described in four pages.

Human centric is still the way. The knowledge complied by algorithms is out there. Just use it!