Attaining Readiness by Developing a Data-Centric Culture

Lessons Learned from the 4th Infantry Division's Approach to Data-Driven Decision-Making

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Decision Dominance requires that the right people and the right systems that have access to as much of the right data as they can get at the right time.

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chieving "decision dominance" on the battlefield during multidomain operations requires all echelons to integrate within the dataspace so that we may "know ourselves, our adversaries, and the operational environment with greater clarity and precision to produce decision advantages."¹ However, preparing for the complexity of future tactical and operational environments requires today's Army to overcome the momentum of our own people, processes, and technology.² People need to understand their purpose. Processes need to be practical. Technology needs to be intuitive and interoperable. As the U.S. Army takes advantage of emergent capabilities and competencies to become more data-centric in operations and warfare, we must first steer our formations toward a culture that embraces data literacy.³

Data literacy is the "the ability to read, work with, analyze and communicate with data," and it lays the foundation for advancing in multidomain operations by equipping our soldiers with the skills to effectively interpret data and make informed decisions that span maritime, land, air, space, and cyberspace domains.⁴ A high level of data literacy enables military and civilian personnel alike to analyze information critically, identify patterns, and extract actionable insights that enhance situational awareness and operational effectiveness. Moreover, data literacy fosters collaboration and communication across different domains, facilitating coordinated efforts and integrated



Chief Warrant Officer 3 John Seeling (*left*), a network engineer, and Sgt. Anthony Gutierrez, a network technician, assigned to G-6, 4th Infantry Division, work to safely bring the network down so the rear command post can move forward to its next location at Fort Carson, Colorado, 18 August 2022. The operation was done during a command post exercise that helped ready Ivy soldiers and leaders for future deployments. (Photo by Spc. Tyler Brock, U.S. Army)

strategies that can bolster the effectiveness of soldiers and units at any echelon.

Framework for Leveraging Data

The 4th Infantry Division (4ID) initiated its data literacy campaign in support of the Chief of Staff of the Army's data-centric aims for facilitating his vision of developing fit, disciplined, cohesive, and lethal teams.⁵ To facilitate our formation's preparation for fighting the battles of the future, we leveraged the tenets of *Army Data Plan* to first prioritize the standardization and collection of critical data from our subordinate units.⁶ We hypothesized that by making our data visible, accessible, and understandable, we would enable our leaders to better see ourselves at baseline and subsequently understand the progress we would make through changes in systems and policies by further leveraging data tools for quantitative assessment.⁷ As we developed and executed our framework for data literacy, we made strides in developing visual tools using Army systems of record that enabled us to create our division common operating picture (COP), streamline serious incident report reporting and collection, and standardize utilization metrics to assess the effectiveness of our Army people programs. Our breakthroughs in creating tangible interim products were immediately adopted by Fort Carson, Colorado (FCCO), and shared with data analytics teams across Army Forces Command (FORSCOM) as a potential avenue for incorporation into their own data enterprise.

Subsequently, any change we adopted for the system was accompanied by a feedback mechanism for the stakeholders to ensure that the processes undergoing transformation were demonstratively beneficial rather than unnecessarily cumbersome. As we created quality of life improvements, our credibility and momentum



Soldiers assigned to Company C, 4th Battalion, 9th Infantry Regiment, 1st Stryker Brigade Combat Team, 4th Infantry Division, take cover while detonating a claymore mine 5 June 2024, on Fort Carson, Colorado. The soldiers conducted a platoon live fire as part of the division's week-long Ivy Mass exercise, which integrated multiple units and capabilities from the land, air, space, and cyber domains. (Photo by Sgt. Herbert Roberson, U.S. Army)

rose and caused mindsets to shift. As beneficial systems were put in place, new processes became routine, and new routines became our culture. While the methodology we used for assessing program successes are widely standardized, the specific products we created are unique to FCCO and thus should only be taken as "a way" to achieve the goal of data literacy throughout unique formations.

To expedite the commander's ability to make data-driven decisions, we worked to determine what data was valuable, what was expendable, and what stuck. In the realm of data management and analytics, the five Vs—volume, velocity, value, veracity, and variety—form a critical framework that underscores the complexities and opportunities inherent in data.⁸ Volume refers to the sheer amount of data generated daily that is transmitted from the platoon level up to the division headquarters in the realms of personnel, readiness, sustainment, and training. Velocity emphasizes the speed at which data is produced through Army systems of record that must be analyzed to extract real-time insights, driving agile decision-making. Value represents the actionable insights that data can provide when analyzed effectively, rather than becoming noise that does not contribute to the operating picture. Veracity addresses the reliability and accuracy of data, highlighting the importance of data quality and integrity in ensuring trustworthiness. Lastly, variety underscores the diverse forms of data that organizations must integrate and analyze to gain comprehensive insights. By navigating the framework of these five dimensions effectively, 4ID and our tenant units innovatively utilized data assets to standardize, enhance, and optimize our processes.

Data Literacy Campaign

As 4ID kicked off its data literacy campaign in October 2023, we quickly realized that the divergent priorities, conflicting objectives, and inadequate communication channels among stakeholders resulted in duplicated efforts, misaligned strategies, and inefficient resource allocation. Previously, there had been no consistent approach to educating and training individuals on data literacy, resulting in a disunity of systems and effort across the formation that was caused by a disparity of skill levels and understanding. Additionally, the absence of continuity due to the Army permanent change of station movement cycle further hampered collaborative efforts, as new leaders struggled to communicate insights and make data-driven decisions cohesively, leading to misinterpretations and errors in data handling. These frictions not only slowed down decision-making processes but also led to missed opportunities for synergy and innovation. By creating a unified data literacy framework centered on continuous and consistent data literacy training for everyone at FCCO, we hoped to open communication channels between our stakeholders to uniformly apply best practices, maintain operational efficiency, and foster a culture of informed decision-making.

To achieve a united culture, 4ID invited Schuyler Moore, the chief technology officer of U.S. Central Command, to FCCO. Moore conducted a culture panel on data literacy and held group discussions with U.S. Army Garrison (USAG) Fort Carson, the 4ID division staff, and all six 4ID subordinate brigades, outlining her lessons learned and best practices from developing a data-centric framework at U.S. Central Command. Based on Moore's insights and the commanding general's guidance, the stakeholders at FCCO built and collaborated toward the same focused goal. Following the event, the division prioritized three tenets to maintain as the keys to success: criticality, senior leader intent, and interested teammates.

Encouraging Broader Support

Criticality in data refers to what an organization determines as their most valuable information assets to be prioritized for protection or management. For FCCO, this priority resides in our ability to link the negative or positive trends for our personnel that can be directly or indirectly attributed to the people programs we employ to support them.

By focusing on consumer-relevant data focused on our soldiers, we enabled our stakeholders to tailor their requirements, services, and assessment metrics more effectively. With their input, we ensured that visualizations within the data were not noise, with each component of the visual answering a pertinent question while flowing in a way that was intuitive and logical for the user. This targeted approach improved the experience of our consumers by delivering personalized interactions and solutions that let them immediately see the optimization of time-consuming tasks into streamlined automated processes. The confidence we built among our stakeholders resulted in an amplification of momentum from individuals becoming engaged and invested in the vision. Successful programs became data advocates, sharing their excitement with adjacent programs across the formation and further amplifying the momentum. Consequently, fostering critical data literacy not only improved our decision-making processes but also enabled organizational efficiency and innovation by ensuring that all data-driven initiatives are grounded in sound, ethical, and transparent practices, refined from bottom to top.

Command Emphasis

Senior leader intent is crucial for fostering data literacy within an organization as it sets the tone and direction for its importance and implementation. When senior leaders actively prioritize and advocate for data literacy, it signals to the entire organization that understanding and utilizing data is a strategic priority. This top-down emphasis helps to allocate necessary resources for training programs, tools, and support systems, ensuring that personnel at all levels are equipped to handle and interpret data effectively. Moreover, senior leader commitment to data literacy fosters a culture of continuous learning and improvement, encouraging personnel to develop their skills and stay current with emerging trends and technologies. It also helps in aligning data initiatives with the organization's operational goals, ensuring that data-driven decision-making becomes an integral part of the decision-making process. Ultimately, senior leader intent acts as a catalyst for embedding data literacy into the organizational fabric, driving better performance, innovation, and competitive advantage. Finally, the senior leader must understand their intent to transform the organization must be a campaign with a combination of short-term wins, long term



Maj. Gen. David Doyle, 4th Infantry Division commanding general, briefs company commanders and first sergeants during a leader professional development event on 21 March 2024 that focused on data-centric command tools, data literacy, and culture. (Photo by Lt. Col. Joseph Payton, U.S. Army)

results, and continued emphasis to ensure that the momentum of the movement is not lost.

Maj. Gen. David Doyle, the 4ID commanding general and FCCO senior mission commander, took command in July 2023 and immediately communicated his intent to automate processes using Army systems of record. The 4ID data team created the first minimum viable products by October 2023 using Microsoft Power BI with the assistance of the Power BI Premium Workspace leveraged by FORSCOM. The focus quickly shifted to revamping our weekly commander's update assessment presentation to be briefed through dashboards rather than PowerPoint slides. Between October and January, we built and iterated on numerous dashboards across the staff, resulting in the first live commander's update assessments viably briefed in mid-January 2024. As of June 2024, we currently maintain 173 active dashboards for the division with ninety that can be filtered down to the company/troop/battery echelon (see figure 1A–C).

Stakeholders

Interested teammates are pivotal for the successful promotion and integration of data literacy within an organization. Their interest and active participation are essential for building a robust and effective data-literate formation. When stakeholders are genuinely engaged and enthusiastic about enhancing their data skills, they become proactive learners and advocates for data-driven practices. This intrinsic motivation fosters a collaborative environment where individuals are eager to share knowledge, support one another, and collectively solve data-related challenges. Interested teammates also drive innovation by experimenting with new analytical tools and techniques, thereby uncovering insights that can lead to improved decision-making and strategic initiatives. Their enthusiasm can be contagious, inspiring others to embrace data literacy and contribute to a culture of continuous improvement. Additionally, having a team of data-literate individuals ensures that



The 4th Infantry Division (4ID) Ivy common operating picture is anchored by the 4ID commanding general's four priorities and encapsulates collaborative efforts across the division. Each selection icon links to a submenu (see figure 1*b*) within the library that further delves into the combined efforts of a specific staff function and their subordinate counterparts. (Figure by authors)

Figure 1a. Ivy Common Operating Picture

the formation can respond swiftly and accurately to data needs, iterating with invested participants who then maintain buy-in to the process.

At FCCO, the 4ID data team collaborated closely with the USAG Fort Carson team to standardize utilization metrics for all people programs employed at the post. Within the effort, our interested teammates at Army Community Services (ACS) developed the breakthrough that streamlined a way to collect demographic data through the A365 Forms QR code function. The practice was subsequently adopted by other ACS programs as well as our Army wellness center under the defense health agency. The USAG team can now link program utilization to assessed crime and corrosive behaviors trends from directorate of emergency services crime and serious incident report data against ACS programs and Army emergency relief utilization. The ACS correlation dashboard (see figure 2) provides unit commanders and the installation team a framework to assess installation-wide data to drive commanders' decisions on improving unit readiness. Commanders

can identify specific trends within their formation using the assessment tool and understand which ACS or other installation programs have resulted in increased readiness in adjacent units. Following initial success with the ACS correlation dashboard, FCCO has modeled the same data-driven framework to drive decisions in installation housing, Army substance abuse program utilization, and the transition assistance program.

Processes

Creating standardized frameworks and methodologies for data input and analysis enables consistency and comparability across different echelons and staffs (see figure 3). Training programs and workshops tailored to various skill levels help personnel develop the necessary competencies in data interpretation and application. Additionally, fostering a culture that values data-driven decision-making encourages collaboration and knowledge sharing, further reinforcing the importance of data literacy throughout the organization.

Select the 4ID Patch to return to this navigation page 🚸



For example, selecting the G-1 common operating picture leads to additional submenu options that displays all pertinent metrics related to personnel functions at the division, which is then filterable down to the brigade, battalion, and company/troop/battery echelons. (Figure by authors)

Figure 1b. G-1 Common Operating Picture

The Challenge of Optimizing Systems: Technical Expertise and Beyond

The biggest challenge to optimizing systems is technical expertise. Overhauling how commanders consume data requires technical expertise to develop minimum viable products with a long-term vision of educating stakeholders on how to leverage these products, communicate insights, and ensure their accuracy. The following are the key aspects we considered:

- Technical proficiency: Data analysts must possess a profound grasp of programming languages, database management, system architecture, data mining, data wrangling, data modeling, and statistical analysis.
- . Emerging technologies: Staying up to date with emerging technologies is critical. Applying this knowledge allows for the creation and optimization of information systems.
- Value delivery: Systems should deliver maximum 4 value to support organizational goals. Domain knowledge paired with technical expertise ensures that technology investments align with strategic objectives.

- Analytical and problem-solving skills: Operations research and systems analysis analysts excel at analyzing complex data and processes. Paying attention to details helps uncover hidden inefficiencies and bottlenecks.
- Continuous learning and adaptability: For an organization to become data-centric, we must invest in our people by teaching them skills necessary to proliferate data analysis across echelons.

Leaders within a data centric organization must take a holistic approach that combines technical skills, military domain knowledge, analytical skills, and adaptability. By addressing these challenges, organizations can create efficient, effective systems that drive success and maximize human capital.

The 4th Infantry Division's Data Strategy: A Phased Approach to Success

4ID recognized the importance of data-driven decision-making and devised a comprehensive strategy to achieve widespread adoption. To demonstrate



Selecting the Army Structure (ARSTRUC) Memorandum 25-29 submenu from the G-1 common operating picture provides subordinate units a snapshot of their ongoing effort to manage personnel in support of the ARSTRUC 25-29 plan. Categories for soldier movements were developed from commanding general's guidance and feedback from brigade commanders to provide a holistic metric for all personnel affected by the ARSTRUC 25-29 plan. (Figure by authors)

Figure 1c. Unit Personnel Inactivation Plan

capabilities and gather feedback, operations research systems analysis (ORSA) personnel rapidly created minimum viable products (MVPs) for various data projects. This data strategy emphasized collaboration, rapid refinement, and strategic alignment leading to sixty-three MVPs within just three months. Additionally, this inclusive strategy set the foundation for effective data utilization across staffs and subordinate units by incorporating the investment of our stakeholders into the process on the ground floor of its development (see figure 4).

4ID adopted a five-phase process to facilitate adoption of the division's data strategy:

- Phase I. Develop MVPs
 - The ORSA team swiftly created MVPs for various data projects.
 - These MVPs showcased essential features and allowed for early feedback from stakeholders.
- Phase II. Achieve Early Adoption
 - By demonstrating capabilities through MVPs, the division encouraged early adoption among users.

- Feedback during this phase informed subsequent development and enhanced functionality.
- Phase III. Educate
 - ORSAs focused on educating stakeholders about the value of data-driven tools.
 - Training sessions and communication efforts ensured users understood how to leverage and build these products effectively.
- Phase IV. Lay the Groundwork for Mainstream Adoption

This phase involved several steps:

- Product expansion. Scaling up successful MVPs to broader use. Providing division, brigade, battalion, and company level views.
- *Bottom-up refinement*. Gathering feedback from end-users and refining the products iteratively.
- Overall refinement. Ensuring accuracy, usability, and alignment with organizational goals.
- Phase V. Innovate and Iterate
 - The organization must remain agile, continuously improving data tools.



When an individual unit is selected, the dashboard displays a by-name, rank, military occupational specialty, and category visualization with pertinent remarks. The data is compiled by brigade and battalion personnel officers on the division SharePoint site with the dashboard itself refreshing automatically every hour to provide the most up-to-date information for individual movement. (Figure by authors)

Figure 1d. 2nd Squadron, 1st Cavalry Division Personnel Inactivation Plan

Innovation and adaptation were key to staying ahead of evolving requirements.

Phase I. Develop Minimum Viable Products

Developing MVPs for data involves creating prototypes or early versions of data-driven solutions that are designed to test hypotheses and validate concepts with minimal resources and time. These MVPs typically focus on demonstrating core functionalities and key insights derived from data, rather than comprehensive features. By prioritizing essential components and functionalities, teams can quickly iterate and gather feedback from stakeholders to refine and improve the product. This approach not only accelerates the development process but also reduces risks associated with larger-scale implementations. Moreover, MVPs enable organizations to assess market demand, feasibility, and user acceptance early in the development cycle, guiding subsequent investments and strategic decisions. Ultimately, developing MVPs fosters innovation,

enhances agility, and increases the likelihood of delivering impactful solutions that address real-world challenges effectively.

The 4ID commanding general prioritized the production and presentation of MVPs during battle rhythm events as a means to win over culture. Staff estimates were automated to maximize human capital while standardizing datapoints that drive decisions. However, optimizing systems remains ineffective if the culture doesn't support its ongoing maintenance. Additionally, cultural shifts are hindered when users find the tools clunky, ineffective, and unintuitive. Leaders at all echelons must address this challenge.

Phase II. Achieve Early Adoption

Achieving early adoption for data literacy involves engaging stakeholders across the organization to recognize the strategic value and practical benefits of data-driven decision-making. This begins with cultivating a culture that promotes curiosity and continuous learning about data. Providing tailored training



The installation data team correlates unit utilization of Army emergency relief education against the total assistance allocated to that unit. Although leaders can conceptualize that more Army emergency relief education would equate to less assistance required, the dashboard enables the visualization of data to confirm experiential knowledge. (Figure by authors)

Figure 2. Army Community Service Utilization Tool

programs and workshops that cater to different roles and skill levels helps demystify complex concepts and instill confidence in interpreting and leveraging data effectively. Additionally, showcasing success stories and tangible examples of how data literacy has positively impacted operations can inspire others to embrace these practices. Implementing accessible tools and resources for data analysis empowers employees to apply their newfound knowledge in practical scenarios, fostering a sense of ownership and engagement. By prioritizing early wins and demonstrating the transformative potential of data literacy, we accelerated adoption, cultivated a data-driven mindset, and paved the way for sustained success in leveraging data for informed decision-making.

Phase III. Education

During this critical phase, the 4ID ORSA team focused on empowering stakeholders with the knowledge and skills needed to harness data effectively. The Ivy Data Academy was developed to provide three learning options for students. Students could attend the beginners course, the more advanced Ivy data manager course, or the self-paced distributed learning course. The distributed learning course ensured maximum accessibility and scalability. Students are provided course lecture materials, datasets, and access to a repository of course videos. The intent of the Ivy Data Academy is to serve as a catalyst for data innovation across organizations on FCCO. Students immersed themselves in Microsoft Power BI, Lists, SharePoint, Teams, Forms, Power Apps, and Power Automate. Students learned how to leverage these tools for data management, visualization, automation, and seamless collaboration.

Additionally, students learned how to access data from systems of record using Vantage. These connectors optimized data projects by providing a singular point of access to over thirty thousand unique datasets. Students leveraged all these skills to complete a capstone project, publishing their first data analytics project and integrating their work across Power BI workspaces, SharePoint, and Teams.

Phases IV and V. Mainstream Adoption and Continued Iteration

Phases IV and V of the 4ID's data strategy are crucial for successful implementation and continuous improvement. MVPs are scaled up during this phase

Where the the the type of the

Echelon	Key Resonsibilities
Division	 Create the tools(dashboards, databases, KM architecture) Facilitate (teach, and build capacity) Assess unit performance and effectiveness
Brigade	 Understand data Plan and decide using data Assess unit performance and effectiveness
Battalion	 Report accurate data Understand data Make decision with data
Company	 Report accurate data Understand data Execute

Defining roles, standardizing formats, and creating intuitive templates simplifies the work subordinates need to execute. The easy-to-follow templates also streamline the framework for data visualization products, which provide results that enable subordinates to quickly see the fruits of their labor. (Figure by authors)

Figure 3. How We Use Data

to provide value to battalion and company leadership teams. Unit feedback is actively sought and rapidly incorporated. This iterative process encourages maximum adoption. By involving multiple echelons, the division gains broader support for data tools. Insights from MVPs are quickly disseminated across projects. This knowledge sharing optimizes subsequent efforts and supports the end goal of automation. Products are set to automatically refresh, minimizing manual inputs. These tools communicate vital information directly to commanders, freeing up division and brigade staffs to tackle nuanced and complex challenges while better supporting subordinate units. Phases IV and V drive continuous improvement, ensuring efficient data utilization and enhancing operational effectiveness.

Technology

4ID anchored its data visualization framework using the FORSCOM Power BI Workspace due to its accessibility and availability. At 4ID, any Department of Defense member with an A365 account was able to leverage Power BI's powerful tools, enabling them to view dynamic dashboards and reports that made data insights easily accessible and comprehensible. This visual approach to data analysis helped demystify data for users who may not have had strong analytical backgrounds, and allowed them to learn to grasp trends, patterns, and anomalies at a glance. Interactive features, such as drill-downs and filters, enabled users to explore data more deeply and answer specific questions on the fly, fostering a hands-on learning experience. Additionally, Power BI visualization significantly enhanced our data literacy by transforming complex data sets gathered through Army systems of record, SharePoint collaborations, or A365 lists, into intuitive and interactive visual representations. As this was our platform of choice, we now have a bench of capable Power BI users that continue to impart their expertise to new members of the team. Whether Power BI remains 4ID's program of choice, or becomes a bridging solution to greater innovative tools, the data-driven culture we have developed and the lessons we learned to portray data that drives decision-making will endure.



By understanding the adoption curve of new systems, processes, or technologies, the unit was better able to manage leader expectation for the time it would take from the spark of initial adoption to the subsequent acceptance by the majority of the formation. "Crossing the chasm" is defined as the phase in which battalion and company command teams and staffs incorporate data visualization projects into their own decision-making cycles. (Figure by authors)

Figure 4. Crossing the Chasm

Limitations to Continued Progress

As eagerness and momentum build for adopting data systems within the Army, we must also recognize the limitations of the system from both human error during data entry and the restrictions to interoperability due to the developing information infrastructure. Without properly managing expectations for inevitable inaccuracies and inconsistencies, the data literacy campaign risks potential loss in the faith of the transformation process. Additionally, inadequate training and a lack of understanding among users can result in improper use of data systems, reducing their effectiveness and efficiency. Resistance to change is another human-related limitation, as personnel may be reluctant to adopt new technologies or processes, hindering the full integration and utilization of data systems. Furthermore, biases and subjective judgments can influence data interpretation and decision-making, leading to skewed outcomes. Addressing these limitations requires comprehensive training programs, fostering a culture

of data literacy, and implementing robust security protocols to mitigate human-related risks and enhance the overall performance of data systems.

Conclusion

Data literacy is a critical competency for the military, essential for enhancing decision-making, operational efficiency, and situational awareness. As modern warfare increasingly relies on data-driven technologies, the ability to interpret and utilize data effectively becomes indispensable. Data literacy enables military leaders to make informed decisions, optimize resource allocation, and improve cybersecurity measures. It also fosters innovation and adaptability, ensuring that military operations can keep pace with rapidly evolving technological advancements. By prioritizing data literacy, the military can better prepare its personnel to handle the complexities of contemporary and future battlefields, ultimately leading to more effective and efficient mission outcomes.

Notes

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