‘JOINTMANSHIP’ FROM DATA-INFORMATION-KNOWLEDGE-WISDOM (DIKW) HIERARCHY PERSPECTIVE’

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Fuelled by the ubiquitous and myriad digital systems and panoplyof digital tools and services, the explosive growth in the quantity ofdata being generatedhas been matched by growth in the availability of computing resources and the facilities for data storage and transmission. The generation and processing of unimaginable quantity of data is a manifestation of ‘cyber Zeitgeist’. For almost all the agencies, organizations, institutions and individuals, data from a range of sources is a resource to be analysed and synthesised for decision making. In military domain, information distilled from data synthesis is an enabler, a “force multiplier,” a tool that endows with ability to shape the operational environment. With Net-Centric Warfare (NCW) concept picking up increasing momentum and adoption over the past two decades, information has emerged as an essential pivot point for success of NCW operations.

Today’s security environment is much more complex and unforgiving. Capturing the nuances of national security challenge require coordinated and multifaceted efforts by all entitieswith a role in ensuring the security of the state and its people. The myriad challenges of- securing sovereign rights, defending borders, combating global terrorism, deterring home-grown terrorism,countering espionageand subversion, physical security of critical assets-has made integration of information gathering capabilities irrevocably imperative and inescapably vital. The ‘jointmanship’ among all services, forged in the crucible of many challenges that have been met successfully, has strong underpinnings in terms of sharing of information and coherence in actions and decisions. A unified effort in sharing and synthesising data, interpreting and evaluating information and applying domain specific knowledge to produce predictable, specific and quantifiable results far outweighs any single organisational efforts. Some of the tenets of jointmanship become much more pertinent when evaluated within a Data-Information-Knowledge-Wisdom (DIKW) hierarchical frame of reference.

In one of the study, International Data Corporation research brought out that the world’s digital information is doubling every two years and will increase by fifty times between 2011 and 2020. The data is being generated in all conceivable form. Many factors have contributed to this

spectacular growth, including the creation of nearly all data in digital form, a plethora of sensors proliferating society and human activities and new data sources such as high-res¬olution imagery and video. The collection, storage, analysis and dissemination of synthesised data at national level are key drivers of economic competitiveness and a crucial element in accomplishment of national security objectives.

In military domain, the cognitive limits of intelligence analysists are strained and analytical systems routinely get overwhelmed by sheer volume and complexity of the raw data being collected. Although individual services may accomplish tasks and missions in information domain, thesynergistic fruition of efforts from the integration and synchronisation of operations accrue benefits far in excess of individual contributions. The results of joint efforts extend, beyond the operational environment, at the strategic and tactical levels where information is a key driver for decision-making processes. Ironically, data is being generated and captured in different forms and structures. This data is often stored in isolation without lateral exchange, deliberately or out of ignorance to arrest cross-fertilisation and exploitation. This acts as a hindrance to view the data coherently and inferences drawn from such analysis are either fragmented or inconclusive due to under-utilisation of collective expertise of the individual services. With emergence of new challenges to national security, changing nature of global terrorism and an ever-growing reliance on network-centric operations, military and intelligence agencies have to trawl through vast data to identify subtle and specific signatures to respond within a relevant time frame with magnitude commensurate with threat severity and susceptibility. A specific signature captured by one service might not be significantly relevant in eliciting an object-specific response but could be a valuable factor in evaluating overall threat scenario by other services.For intelligence analysts, the emphasis is switching increasingly to a more immediate response to fleeting signatures and away from the time-consuming monitoring of routine ‘pattern of life’ in order to find those signatures. The consequences of not sharing information are potentially profound.

Against this backdrop, the evaluation of the Data-Information-Knowledge-Wisdom (DIKW) Hierarchy also known as the ‘Knowledge Hierarchy’ becomes operationally useful, functionally utilitarian and intellectually stimulating construct in the context of ‘jointmanship’. The acquisition of raw data moves up the hierarchical ladder to transform into information. This relevant, usable significant, meaningful or processed data offers to answer to an enquiry. In consequence, the difference between data and information is functional, not structural.

The definition of data is largely contextual, based on values and criteria assigned to encapsulate results from a process. For example, Information system defines data as unprocessed information. Other processes produce data as a representation of objective facts. Data can be placed in databases or fill a repository. It is discrete, recordable and can bemanipulated,captured and retrieved. Data is a physical entity with an objective existence. Yet, despite the possibility of manipulation, there is a limited amount of actions that can be performed on raw data as it generally remains superfluous, lacks structural form and is devoid of relational depth. The data is transformed in information once it has acquired certain meaning to it. Information is quantifiable,adaptable and measurable. It can be processed and accessed, generated and created, transmitted, produced and consumed. Information can also be of different types with different attributes. It can be sensitive information, qualitative or quantitative information. In military context, the initiation and culmination of most of the actions are based on Information distilled from historical experiences, present realities andfutureaspirations. Information is an operational and tactical imperative. Information gives the data a cognitively assimilable form and accounts for the insightful decision making. Some neologisms have been introduced to capture the essential concepts which have emerged in the context of "Information warfare", such as:

i- Information assurance (IA): Information operations that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and nonrepudiation.

ii- Information-based processes: Processes that collect, analyse, and disseminate information using any medium or form. These processes may be stand-alone processes or subprocesses that, taken together, comprise a larger system or systems of processes.

iii- Information environment: The aggregate of individuals, organizations, or systems that collect, process, or disseminate information; also included is the information itself.

iv- Information security: The protection of information and information systems against unauthorized access or modification of information, whether in storage, processing, or transit.

In DIKW hierarchy, knowledge is often construed as know-how or skill in controlling role to transform information into instructions. Within the field of knowledge management, there exist two quite distinct and widely accepted types of knowledge: tacit and explicit. Tacit knowledge is knowledge that is hard to encode and communicate. It is ephemeral and transitory and "cannot be

resolved into information or itemised in the manner characteristic of information." Further, tacit knowledge is personal, context-specific and hard to formalize. Towards the other end of the scale, explicit knowledge is exactly that kind of knowledge that can be encoded and is transmittable in language.

Some of the tenets of jointmanship become much more pertinent when evaluated within a DIKW hierarchical frame of reference. Timely, complete and accurate information about the operational environment, particularly with regard to the adversary's forces, capabilities and intentions facilitate dominance in the information environment.

Information warfare challenges and trade-offs

Today's security environment presents complex challenges which need to be tackled with collective diligence, shared intelligence and joint efforts. A dominant position achieved by the all three services in conventional warfare on their respective domains, has given prospective adversaries , particularly non-state actors and their state sponsors, strong motivation to adopt asymmetric methods. Dealing with terrorism - a scourge that transcends the geographical borders and cuts across religious, sectarian and ethnic lines – is a herculean challenge. Similarly, attacks via cyberspace to disrupt critical infrastructures, cause economic damage, compromise sensitive and/or technical information and interrupt critical services is a real possibility. The application of dual-use technologies without attributability, particularly in the information technology industries, makes future technical assessments and estimates even more difficult. Further, the information gathering will also be affected by questionable veracity of data collected, imperfections in data processing methods and ability of adversaries to deny effective data collection. To meet these formidable challenges, the information gathering process and distillation of knowledge from gathered information must be coordinated, collaborated and supplemented at all the rungs of organisational hierarchy of three services. For deriving appropriate action-oriented inferences, the trust quotient amongst three services should be fairly significant for collective capability aggrandisement. The trust quotient is also necessary for measured responses to myriad anticipated and unanticipated requirements across the full range of military operations. The accuracy and temporal relevance of information will result in elicitation of more meaningful response capable of containing the susceptibility and severity of threat within acceptable levels.

The current information environment is characterised by complexities resulting from data deluge, information overload and widely distributed knowledge sources. The defence forces have also

stepped up efforts to meet these challenges by adopting state-of-art technology, enmeshing virtual operational capabilities with physical battlefield, relying on advance data processing methods, automating some of the critical military activities and enhancing cyber competency of troops. By assimilation and application of advances made in the field of information technology such as Internet of Things (IoT), artificial intelligence, Big data analysis and iterative search tools, the timelines of intelligence gathering operations been greatly compressed. Likewise, the traditional delineations among the various types of Information gathering operations have been blurred. Collective analysis and dissemination of information nearly simultaneously to all agencies for domain specific responses has strengthened the spirit of 'jointmanship' among three services. Moving from managing information in silos to more unified information architecture is a result of concerted efforts by all three services to treat information as a resource not to be lightly squandered over petty differences and missed opportunities.

A broad range of military activities such as operations, planning, surveillance, logistics, training etc. have evolved and are spurred by advances in information technology over the last decade. A growing percentage of manpower, technical resources and efforts in all the three services are dedicated to supporting information operations activities. For accruing commensurate benefits and ensuring cost-effectiveness in sharing of resources, expertise and manpower 'jointmanship' in true sense ofthe term entails ironing out differences and conflicting interests and effecting amalgamation of purpose, vision and commitment.

Senior Commanders in all three Services at all levels depend on timely, accurate information and intelligence on an adversary's dispositions, strategy, tactics, intent, objectives, strengths, weaknesses, values, capabilities, and critical vulnerabilities. The military intelligence process has been redefined and reformulated many times over the course of military history. The current intelligence system, in large part, comprisesof a wide variety of interrelated intelligence operations: planning and direction, tasking and collection, processing and exploitation, analysis and production, dissemination and integration, and evaluation and feedback. There is no clear delineation as to when each operation within the intelligence process begins or ends. The analysis, production, and dissemination of intelligence products must be accomplished in time to support the decision-making needs.

In this DIKW hierarchy, the first three rungs of hierarchical ladder which leads to wisdom depend on the underlying ones. Data can be supplemented with meaning to achieve information. Information can be interlinked to create knowledge. But, can everyknowledge be used to achieve wisdom? In several scientific communities, there is an explicit distinction made between general

knowledge and wisdom-related knowledge. In military context, acquisition of more and more information is not the same thing as the cultivation of wisdom and reducing the complexity of information in favour of critical and strategically useful information to accrue strategic leverage, tactical advantage and operational effectiveness. Thus, there might be interconnections of information that create knowledge - but that will not build a foundation for wisdom. Furthermore, the deeper understanding of the wisdom-related knowledge and to actually act upon this knowledge is the acme of military skill.

The recent psychological research on wisdom can be summed up in two main streams. The applicability of this research to today's military context offers some insightful observations not apparent when viewed through the traditional prism of military prowess and conquests:

i- The Berlin wisdom paradigm defines wisdom as "expert knowledge of the fundamental pragmatics" and narrows this pragmatics to a set of criteria: rich factual knowledge, rich procedural knowledge, relativism and the ability to understand and manage uncertainty.

ii- The Balance Theory of Wisdom extends the wisdom definition from a list of mere knowledge parameters to a balanced application of that knowledge based on personal values: Wisdom is defined as the application of successful intelligence over short and long terms, in order to achieve a balance among :

- Adaptation to existing environments
- Shaping of existing environments
- Selection of new environments

The intelligence provides the decision makers with a basis for deciding on a particular course of action as well as timely, complete, and accurate understanding of security environment, adversaries' capabilities and intentions. Wisdom helps in efforts to conjure up a detailed picture of future threat scenario, adversaries' future capacity to attack and likely targets. Wisdom helps us define guidelines and standards in order to prevent future attacks through deterrence, coercion or containment. From the true 'jointmanship" perspective, sharing of wisdom is a difficult proposition as compared to sharing of data, information and knowledge. Sharing of wisdom requires a deeper understanding of phenomena and events and requires competencies to distinguish between major, existential factors from secondarytemporary or specific factors. In his works towards computational wisdom, René V. Mayorga defines wisdom as," Wisdom: the ability to discern inner qualities and relationships and the exercise of good judgment/

knowledge.“ Mayorga also relates the concept of wisdom to the concept of intelligence. “Intelligence” would be the ability to choose a proper action by analysis of the situation and thus, attain a local goal; while “Wisdom” not only includes detailed analysis of the underlying conditions, but also proper synthesis to act in a way that leads to “the attainment of global objectives”

Wisdom is commonly seen as acme of human existence that is based on knowledge and judgmental capabilities. Though there are generic interpretations of what could be part of wisdom in military domain, there is no specific, widely accepted definition. It is universally agreed that a certain type of knowledge is needed to develop wisdom but the definite type is hard to portray. Wisdom is neither pure rationality, nor pure emotion based; it creates a certain kind of “intuition“. Solutions elicited by wisdom, approach a problem by using a creative interconnection of knowledge and experience. Wisdom is acquired based on experience and knowledge.

In the context of warfare, the war principles themselves embody practical wisdom built over the centuries. But,application of these principles require situation specific and contextual knowledge, discerning disposition and homogenized actions. Military leaders entrusted with the onerous responsibility of orchestrating warfare at strategic and tactical level, by careful training and experience, acquire practical wisdom to achieve set objectives during the course of military actions. The possession of this quality, either acquired through training or accumulated with experience, coupled with intuitive ingenuity and intuitional perceptions, are characteristics and qualifications of great military leaders.

The metaphorical analysis of the DIKW hierarchy in the context of ‘jointmanship’ provides a number of interesting insights. With deluge of data, the quantity of information generated increases beyond a manageable, manipulablesize resulting in loss of its relative structural relationships and its usefulness as knowledge. By adding structure to data to make information and structure to information, one can avoid generation of tacit knowledge and create knowledge which is explicit and unequivocal. The ‘Knowledge pyramid’ conceptualises distillation of large amounts of data to a manageable quantity of information, which is then aggregates to create more distilled, actionable and widely applicable knowledge. The cumulative and collaborative wisdom of decision makers, derived from knowledge and based on rationality as well as on experience ensure accomplishment of objectives in a particular domain. The domain-specific wisdom transcends other domains as well providing preliminary heuristics for decision making.

The prevailing strategic environment in which the three services operate is characterised by uncertainty, dynamism and complexity and demands far greater levels of agility, assertiveness and coordination. The defence forces have to constantly devise new and innovative ways for meeting the myriad challenges posed by regional volatility, potentially belligerent neighbourhood,terrorism, insurgency, asymmetric and Irregular Warfare. Some of the challenges can overwhelm the capabilities of a single service culminating in protracted operations, resource depletion to non-critical functionality, increased costs and stretched timelines. With focus on integrated actions of the three services in a unified effort will achieve and maintain operational coherence, resource optimisation, holistic responsiveness and individual and collective capability enhancements. A joint perspective of the challenge at hand is broader and more comprehensive than the individuals' due to sharing of collaborative wisdom, domain specific expertise and intelligence. The synergy that results from the integration and synchronisation of military operations in time, space, and purpose facilitate achievement of military objectives consistent with national strategy and conclude operations on favourable terms. The 'jointmanship' when viewed from the (DIKW) Hierarchy perspective, accrues advantages thatextend beyond the operational environment and across the range of military operations at strategic and tactical levels.