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Wise and Complex Enterprise Architecture for FMIS

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Abstract

Digital transformation, compliance to requirements and regulations, smart cyber-security, agility, data and information mesh, integration with convergent technologies, skill development and adapting to the socio-technical dynamics, Everyone benefits from a "adequately and sufficiently" sophisticated and complex platform of data-driven wisdom and its interaction with human experts. The realization of all these good goals and needs requires a good and innovative theory, method, framework, solution, and generally a good and innovative paradigm for enterprise architecture in the coming years, which seems to be slowly being experienced, evolving, and emerging. With such an approach and in this paper, a proposed conceptual architecture for the problem of "integrated and intelligent government Financial Management Information System (FMIS) " is presented (from the perspective of enterprise architecture and hybrid wisdom). This conceptual architecture establishes a dynamic and adjustable balance between centralization and distributedness, and with the help of the combination of computational data-driven and human wisdom, it is possible to improve the effectiveness of government resources, operational transparency, program adherence, and operational agility. It facilitates dynamic adaptability, in-depth reporting, support for analytical intelligence, and support for resolving budget discrepancies and disharmonies. Achieving the wisdom of cyber-human thinking in a systematic way in the field of FMIS will be one of the most distinctive achievements of such a conceptual architecture.

Keywords: Enterprise architecture, Computational wisdom, Hybrid wisdom, Government integrated financial system, Financial management information system, Complexity.

1 | Introduction

Responding to modern concerns in the field of enterprise architecture and grasping classical ideals in this field of engineering and innovation form a geometry of problems [1], which relies on the general principles of data-drivenness, versatility, positive complexity and intelligence (at the level of human and computational wisdom) which are inevitable for future paradigms in this field.

Big data is one of the important commercial, enterprise, organizational, national and even civilization resources in today's world. Therefore, it is natural that any new (and beyond) approach for enterprise

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architecture (and comprehensive intelligent society-sector-organizations) should use and support this technology in a general and complete way.

Versatility is an important feature for complex systems and organizations. Without relying on this feature, it is not possible to create and engineer complex and adaptable systems or organizations in a desirable way (for missions, objectives and missions in dynamic, changing and undulating environments which are prone to all kinds of errors and noises, ambiguities, uncertainties, complexities and so-called VUCA[2]) [2], [3].

Positive complexity expresses positive assets (and operational values in all dimensions and perspectives [4], [5]) in a system. Just as a simple biological organism has less positive complexity than a complex biological organism (and therefore represents simpler levels of biological complexity), a system or organization consisting of and has less positive reserves, layers, processes, components, and events, may face the poverty of complexity. Then, because of the resulting deficiencies, it is unable to play a correct, effective, and appropriate role in its field, problem or environment.

Intelligence, especially its highest levels that end in wisdom (both computational and human or natural), is the most value-creating part of a complex organization [1]. All data content, information, operation, process, structure and body, knowledge, procedures and methods, events and manifestations, and multifaceted and positive complexities of a system or organization could be placed in the service of hybrid wisdom (the result of the combination of computing and natural wisdom, with the integration of human and machine wisdom). in a two-way dialectical (or escalating) process, leading to the promotion of added value, promotion of operational efficiency, promotion of problem solving ability, promotion of the successful role playing, improving the level of goals and achieving of goals, that too in a "rank-breaking" and "grand record creation" way.

Therefore, these principles (or fundamental geometry) can be considered as the basis of a conceptual framework or architecture for new (and ultramodern) organizations in the coming recent decades: hybrid wisdom in the center and a solar-peripheral-system of big data, data-drivenness, multifaceted versatility, positive complexity and intelligent paradigms, around it (*Fig. 1*).

This importance should not be taken lightly because without adopting the correct basic and fundamental principles, it is not possible to reach concrete, technical and practical levels (*Fig. 2*).

These principles and foundations leave their impact in the form of cascading, exponential and sometimes butterfly effects in higher layers. Thus, the smallest deficiency or deviation in the basic principles and geometry of any organizational framework can limit the space for Creativity, limitation of space for innovation, sedation and locking in certain types, lead to incapacity, functional defects or physical and structural defects. Therefore, the most strategic (and most important) stage of designing any organization (or system) is to reflect the basic, essential and pure ideas within the basic principles and geometry of that organizational framework. This, of course, is not a negation of exemplary approaches (in the upper layers) and a harmony between examples and basic principles can (and should) be provided. Examples are previously found (or solved) solutions, approaches and methods. Smart adaptation and positive impersonation also occur in higher layers.

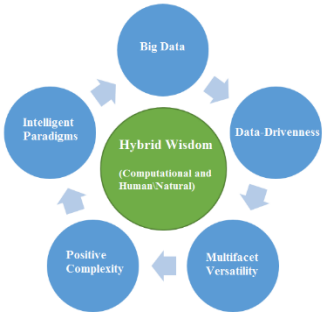

Fig. 1. Geometry and fundamental principles for ultramodern organizations and systems in the coming decades.

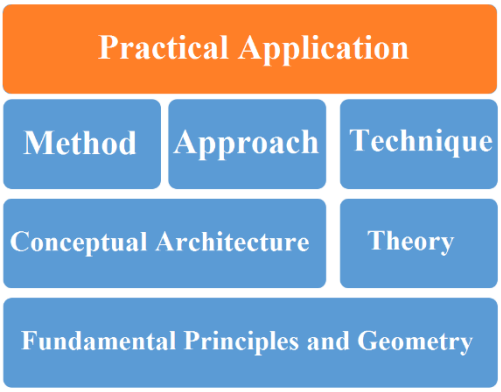

Fig. 2. A construction stack to achieve a "Practical Application" from the foundations of "Fundamental Principles and Geometery".

2|New Requirements of Enterprise Architecture and Hybrid Wisdom

Digital transformation, technology transition, compliance to requirements and regulations, smart cyber-security, structural and procedural agility, data and information mesh-networks, integration with convergent technologies, especially cognitive aspects in the organization, skill development and adapting to the dynamics of sociotechnical systems, all benefit from a "necessary and sufficient" complex cyber-human intelligent platform of data-driven wisdom which is interacting with human experts. The realization of all these good goals and needs requires a good and innovative theory, method, framework, solution, and generally a good and innovative paradigm for enterprise architecture in the recent coming years, which seems to be slowly being experienced, manipulated, evolved and in emergence.

Digital transformation

Digital transformation, both as a need and as a cutting edge in the competitive world, is at the forefront of large, medium and even small or traditional organizations developments today.

New-to-new technologies

Technology transition is not limited to previously new technologies, and cycles and processes (and even organizational upheavals) should be created for technology integration and transition for technologies that will be born "new to new" in the future. These cycles should be considered in the semantic and conceptual structure of organizations and systems.

Compliance checking and solving

Compliance to the requirements and regulations is an expanding style of E-Ggovernance (both at the micro level and at the macro level of systems and organizations) that its support and facilitation should be considered as a first-class concept.

Smart cyber-security

Today, computer security is beyond reactive and defensive security and should provide "security as an inherent and built-in characteristic (secure-by-construction)" for organizations and systems.

Agility

Structural and procedural agility is another attractive (and effective) feature for organizations. From the time of "small is beautiful" to the current era when "400-staff OpenAI wins over 1000-staff Google Gemini", only nearly 30 years have passed. But the level of competitive impact of agility has increased from several hundred million dollar victories to several hundred billion dollar markets.

Agility should show itself both in the structures and in the processes of a system, so that it could be prevented from solidification and freezing (both in the concrete physical levels and the implicit and hidden but very effective functional levels). This is not the only software that is dead if it doesn't change. Every order, every organization and every system, if it experiences immutability (especially due to heaviness), then it has received its dynamic death sentence. Therefore, Agility is very fundamental and vital in this viewpoint: the main characteristic that ends with evolvability and changeability is fluidity, and fluidity cannot be obtained without agility (especially, in human-technical fields).

Data and information mesh-networks

Data and information mesh-networks are the origin of a civilizational evolution as much as the invention of the Sumerian script in ancient Mesopotamia. But these changes that replace the poles of success (and power) in their influential environment (both organizational, business, economic, social and geopolitical), happen in just a few years instead of millennia. Without data and information mesh-networks (especially technical examples such as strategic upper-levels ontologies, ultra-large knowledge graphs and pre-trained domain-specific neural networks and models), we cannot expect "scholarship" and "knowledge" in enterprises in coming new era, in a competitive and effective manner at the edge of competence.

Integration with convergent technologies

Integration with convergent technologies, especially cognitive aspects in the organization, requires a proper combination of data-driven intelligence (to compute personas, events, and patterns) and human intelligence (to integrate with expertise, judgment, and even situational emotions). Although converging technologies were a contemporary concept and a generation that is relatively old and will soon be replaced by a newer paradigms, the integration of the previous new paradigm (i.e. converging technologies) with the requirements and organizational environment has not yet actually occurred in the business world. As an important example, the fact that the appearance of Industry 4.0 is less than expectations, could teach us to be gentle in paradigm making. Therefore, this previously new paradigm, in the case of our problem, will remain as a practically ready platform and practically a candidate for integration for solutions of the coming decades.

Skill development and adaptation to sociotechnical dynamics

Skill development and adapting to the dynamics of humans, machines, business and social needs is one of the most difficult (and most competitive) aspects of cyber-human systems. With the help of combined wisdom, it is possible to avoid false-dogmas, conflicts of interests, wastes, wasted opportunities, indiscretions and entanglements in organizations and systems.

Hybrid wisdom era

Hybrid wisdom should not (and cannot) be considered as "the key that opens any lock", but actually this driver will be one of the emerging drivers of organizational, enterprise and system changes in the coming decades.

In the following, we will examine the potential and proposed application of this engine (i.e. hybrid wisdom and its solar-peripheral-system of principals) in the conceptual architecture of the organization (and extended large system) for the integrated and intelligent government Financial Management Information System (FMIS).

3 | Integrated and Intelligent Government Financial Management Information System

Governments (with their structures, organization, assets, and both positive and negative complexities) are the most important terrestrial asset of any nation. The triangle of "nation, country, and government" forms the geopolitical, economic, human, social (and even in some aspects spiritual) core of existence for each component within the realm of human geography. Improving government performance (in each of their

functional dimensions) has a direct impact on the life of people in each of countries. Even on a broader horizon, improving supply in the East can enhance the responsiveness to demand in the West (as experienced in the China-Atlantic context). Therefore, the most critical and effective organizations are those that manage macro-systems for "governments".

Financial management constitutes an important part of the duties (and powers) of a government. This right to govern must be realized by governments and within the framework of traditional bureaucratic organization (or new systematization). Alternatively, at a more advanced level, a complex organization based on collective wisdom allows a country to establish (and regulate) the best levels of qualitative parameters for the government's financial management.

Components such as scenario mapping, spatial planning, programming, budgeting, resource allocation, expenditure, monitoring and feedback, adjustment, redesign, and then repeating the cycle are typical steps in government financial management (with a program and budget approach) [6]. This cycle is implemented at least once a year in most countries [7].

Global FMIS models (such as the World Bank model) effectively reduce the concept of this system to a classic notion of information systems, rather than a comprehensive new organizational structure. The components of this classic model for FMIS may be "necessary," but they are not sufficient for the coming years, especially in competing with powers in a VUCA world. Furthermore, lessons learned from previous experiences indicate that negative organizational complexities, complexities of human relationships, unmanaged complexities in the environment, the lack of architectural engineering for organizations and systems, and deficiencies in organization can hinder the creation, establishment, and evolution of such a mega-system.

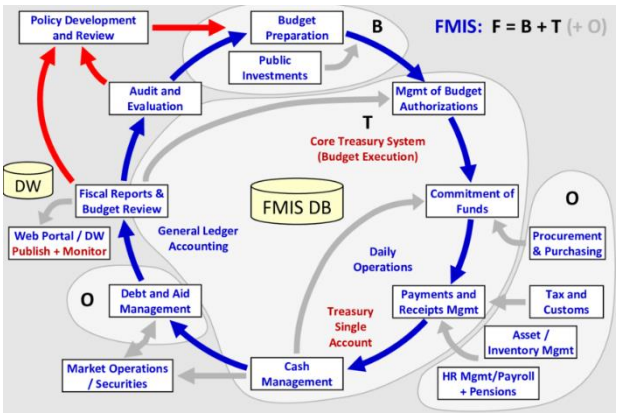

Fig. 3. The classic global financial management information system model is based on the framework presented by the World Bank [8].

5 | Proposed Conceptual Architecture for Financial Management Information System

With this approach, this section presents the essential elements of a proposed conceptual architecture for the issue of "Integrated and Intelligent FMIS of the Government" (from the perspective of enterprise architecture and computational intelligence). This conceptual architecture establishes a dynamic and adjustable balance between centralization and distribution, facilitating the enhancement of the effectiveness of government resources, operational transparency, programmatic compliance, operational agility, dynamic adaptability, in-depth reporting, support for spatial intelligence, and assistance in addressing budgetary imbalances. Achieving human-computer wisdom in a systematic manner within the context of FMIS will be one of the distinct achievements of such a conceptual architecture.

The core of the proposed architecture for FMIS (which we call Hakim-Financial Management Information System (HFMIS)) is based on the combination of classical FMIS architectural elements with: "intelligent

agents", "big data", "knowledge repositories", "hybrid wisdom engines", "programmatic compliance monitoring engines", "agile specialized operational teams", "smart spatial documents (based on digital twins)" [9], "crowdsourcing", "systematic crowdsourcing" [10], and "real-time economic imbalances notification dashboards".

In other words, just as we have witnessed the evolution of organizational complexity and systems in most organizations and technological products throughout the twentieth century (from its beginning to its end), it is expected that the advanced conceptual architecture for the integrated and intelligent financial system of the government for recent years, namely HFMIS, will be composed of more mature, diverse, multi-faceted, and complex elements (in terms of affirmative and potential aspects), based on big data and hybrid wisdom [11]. Additionally, reliance on the achievements of distributed multi-agent systems (such as the prominent example being the web) can lead to improvements in organizing HFMIS in a way that supports dynamic adjustment and establishes balance between distribution and adaptability.

Relying on hybrid wisdom (with repository and engine tools such as knowledge graphs, legal repositories, wisdom repositories, large language models, large computational and cognitive models, and semantic logics [12]) can lead to a "hybrid service-oriented wisdom with ExaFLOPS [13] capability at the government's disposal" in the upcoming years, serving as a true and comprehensive example of artificial intelligence application [14] for Iran.

5 | Conclusion

By relying on the fundamental principles of advanced organization for intelligent and complex systems, the HFMIS architecture can be presented for the integrated and intelligent FMIS of the government. This approach, based on the key and central concept of "hybrid wisdom," and utilizing specific components identified within the proposed conceptual architecture framework, aims to transcend the classical FMIS conceptual model in a "disruptive" and "satisfactory" manner, bringing a tangible application of the discourse on intelligence, complexity, and data-centricity to the country and nation of Iran. Just as nothing is more practical than a good theory [15], for engineering organizational and systemic architectures, nothing is more fundamental (and effective in outcome) than a correct, complete, up-to-date, successful, and efficient conceptual architecture.

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