Business Transformation Projects: An Intelligence Driven Development for Enterprise Architecture and Asset Management-The Basics

Antoine Trad, Damir Kalpic

Abstract— This article's authors based their research on an authentic mixed multidisciplinary research method that is supported by intelligent neural networks and a heuristics module, named the Applied Mathematical Model (AMM) [1][2][3] [29]. Where the proposed AMM is similar to the human decision-making process. The AMM is supported by a real life case of a business transformation initiative in the domain of Enterprise Asset Management (EAM)[4]. The proposed AMM offers a set of solutions in the form of financial, technical and managerial recommendations, to be used by the target company's business analysts and enterprise architects to implement EAM solutions in the context of Business Transformation Projects (BTP). Heuristics is applied in real world problems that are very similar to transformation projects. The AMM is not influenced by any specific business domain and has a holistic approach that uses a neural networks processor. The AMM is based on a reasoning concept that is basically a qualitative research method that manages and qualifies Critical Success Factor (CSF) sets, actions and final solutions [5]. The AMM's underlined system supports the BTPs in integrating scenarios that are sets of interactive services.

Keywords—Applied mathematical model, Qualitative heuristics, Quantitavive, Decision making, Enterprise architecture and Business transformation.

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I. Introduction

The AMM is business driven and is agnostic to a specific architecture pattern, as shown in Figure 1; it is founded on a research framework that in turn is based on the Architecture Development Method (ADM) [6]. Enterprise architecture is a methodology to develop project(s) requirements, business architecture and its information technology components. The Business Transformation Manager (BTM) or enterprise architect can integrate an AMM in the development of an enterprise architecture and the BTP to support an EAM system [2][7][8]. This AMM proposal's aim is to deliver recommendations for managing EAM's integration. The applied research methodology is based on literature review, a qualitative methodology and on a proof of concept that is used to prove the related hypotheses.

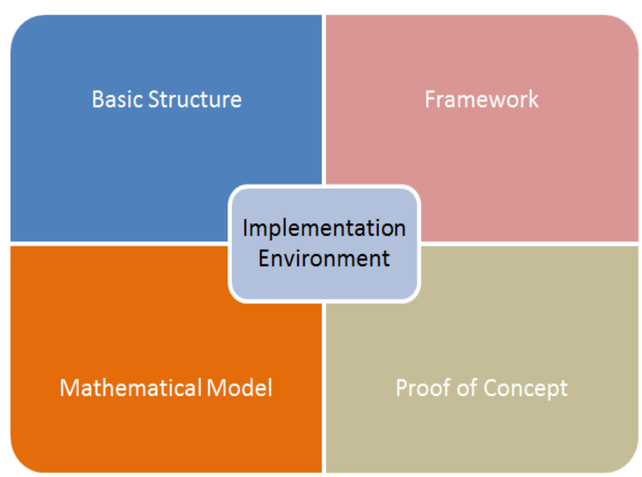

Fig. 1. The applied mathematical model [2][3].

II. The Research Question and Method

The global research question (hypothesis one (#1)) is: "Which architecture transformation pattern should support the implementation phase of a company's business and architecture transformation project?". And this phase's current cluster research question is: "Which basic structure is needed for an applied mathematical model in order to evaluate the enterprise's assets?".

This research article is a part of the decision module and the decision module is a part of the Selection management, Architecture modelling, Control monitoring, Decision making, Training management and Project management Framework (or the SmAmCmDmTmPmF, in further text the term *Environment* will be used), that supports various aspects of BTP's activities [9]. Adapting just the underlined existing silos of technologies is not enough and the main problem is related to the lack of the company's holistic management of enterprise assets [7][10].

III. Asset Management Based Transformation

Melvin Conway cited that: "...organizations which design systems ... are constrained to produce designs which are copies of the communication structures of these organizations", where the BTP produces a set of artefacts based on factors that map to the organization's structure and its information technology system [12]. This work's background combines asset management, enterprise architecture, mathematical models, heuristics, business transformation and business engineering fields. Building an AMM subsystem for an EAM system is the most strategic goal for business companies. Fast transformations and efficient business environments have to be supported by a holistic and intelligent EAM system [13].

A loose EAM concept can help in having a holistic and broad guide to non-predictive decision making operations that depend on various factors like finance, business, politics, etc. A BTP should be adapted to handle complex EAM requirements that can generate complex problems, randomness, unpredictability... Loose EAM system problems can be measured and weighted; while financial risk is not easily measurable. This explains the difficulty of estimating the financial risks of a consequential and rare EAM problem that could be fatal to the BTP. The *Environment* must evaluate the EAM risks through the use of the decision module and logged events. This article proposes an efficient approach to prediction, proactive risk management; that are the basic structures of an EAM model [11].

IV. A Holistic Model

The company's holistic business intelligence is a set of multiple coordinated intelligence models that correspond to various just in time processing schemes [13]. Intelligence is a holistic mental capacity of a human being as a combination of information management and function processing that can map to general intelligence activities. Information processing scans raw data, extracts and correlates them in both space and time to detect heuristic patterns for problem solving [25]. These patterns and their semantics are used to generate sets of weightings for possible actions that are called intelligence artefacts in the *Environment*. Weightings concept enables the AMM to find and select the optimal solution for a given EAM problem. In many cases, fast changing transformation requests may generate an important set of solutions that can be ambiguous and make the EAM actions uncertain and too complex to implement. The AMM is responsible for a rational heuristic approach for enterprise problem solving. The AMM is based on heuristic intelligence and is supported by dynamic memory capacity, performance of learning and the correlation of memorized patterns that are combinations of data states and heuristic functions that make nodes in a tree. The AMM capacities are measured by analysing the *Environment's* AMM tree, as shown in Figure 2. The AMM is a base for a rational decision process that produces and collects possible solution patterns in the *Environment's* memory management system. The AMM's concept is based on a holistic systemic approach to use all the *Environment's* components, being this chapter's main focus [14][15][16].

An EAM can give a company the most important competitive business advantages that may insure its future and it is not a secret that intelligent asset artefacts are the basis for such a system [10][17]. Major research and advisory firms like Gartner, confirm that asset services will leverage business information systems' components from various enterprise departments. Gartner confirms also that services are the dominating business enablers for Fortune 500 companies who need dynamic business intelligence support [18].

For the heuristics algorithm there is a need to define the unit of work. The *Environment* uses a limited and connected version of The Open Group Enterprise Architecture Framework (TOGAF) [19]; and is a detailed method and framework for the development of the AMM by using the choreography capacities. EAM's building blocks are based on asset artefacts and services that use a light version of the ADM [10]. This proposal's approach is based on the simplification of the architecture model, whereas TOGAF is too complex and archaic. Nevertheless, TOGAF's ADM is recommended to integrate various development environments like domain driven development that is optimal for EAMs [21].

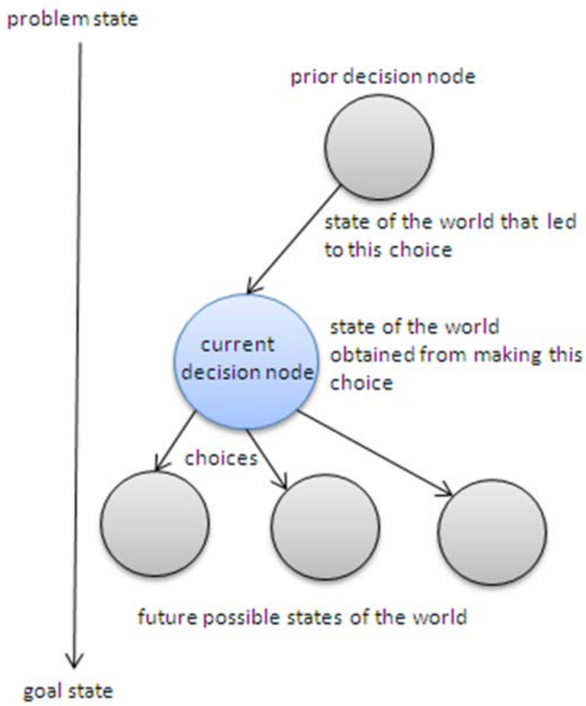

Fig. 2. The neural network enterprise architecture component tree

V. Resources and Factors

The one-to-one modelling concept is used to assemble the defined units of work. To manage autonomic EAM's resources in the implementation phase, a predefined enterprise architecture mapping concept has to be designed. This concept is based on a real world iterative model that maps all the BTPs resources in a sequential one-to-one manner that map to critical success factors [19].

The Critical Success Area (CSA) is a category of Critical Success Factors (CSF) where in turn a CSF is a set of Key Performance Indicators (KPIs), where a KPI corresponds to a single requirement. CSFs for a BTP or business environment are a limited number of business sub-areas in which values are satisfactory if ensuring successful competitive business performance. CSFs reflect performance areas that map to strategic goals and defined mathematical constraints. The BTP must select the right CSFs in order to survive and to prepare for competition. For that goal, the BTP must find the Critical Success Areas (CSAs) that require constant and particular care in real-time; added to that it needs important attention from the business environment's executive management. Therefore, CSFs reflect performance areas that must meet strategic goals and defined mathematical constraints; if the target business environment requires a sane business future. Measurements are used to evaluate performance in each CSA, where CSFs can be internal and/or external; like for example: 1) budget gap analysis is an internal CSF; and 2) percent of market share is an external CSF. The *Environment* method to select the CSA category and the corresponding CSFs is to audit the enterprise architecture vision and strategic planning process. Once the initial set of CSFs has been identified, then the BTP has to use the decision-making module to verify the CSFs and to give them the right weightings.

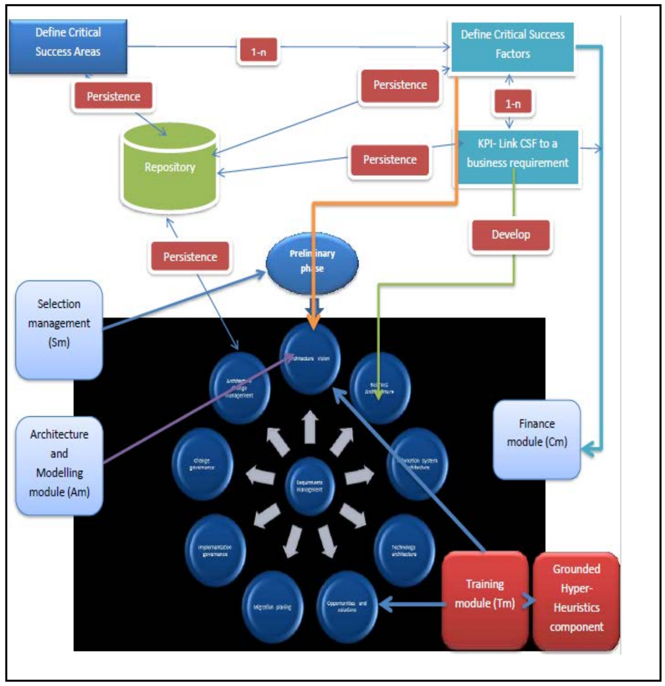

Fig. 3. The factors based framework

As shown in Figure 3, the BTP team has to identify the initial set of CSFs to be used for the performance measurement system. Hence CSFs are the most important mapping/relation between strategic planning, enterprise architecture vision and decision-making system's performance measurement systems; and an example of possible operational CSAs, CSFs and KPIs can be:

- Platform CSA: CSFs: 1) Efficiency; 2) Costs; 3) Production; and 4) Availability. CSF KPIs I) Performance; II) executed transactions; and III) scalability etc.
- Architecture CSA: CSFs: 1) Vision; 2) Deliverables; 3) Governance; and 4) Gap analysis; CSF KPIs I) Finished requirements; and II) Budget management; etc.
- Mathematical Model CSA: CSFs: 1) Problem solving; 2) Business efficiency; and 3) Success. CSF KPI's: I) Costs; II) Time management and scheduling; and III) Resources management, etc.
- Financial CSA: CSFs: 1) Audits; 2) Budget; 3) Feasibility; and 4) Sanity. CSF KPIs I) Performance; II) financial transactions; and III) currency unit etc.
- Assets CSA: CSFs: 1) Information Technology; 2) Financial; 3) Static; and 4) Deposits. CSF KPIs I) Value; II) Amortization; and III) Maintenance etc.

An EAM integration causes a major paradigm shift and is complex to implement; therefore, architects should understand transformation paradigm shift's management that can have disruptive impacts on BTPs that need an agnostic intelligence driven based decision system.

VI. Intelligence driven development

The decision system is supported by a real life case of a business transformation architecture in the domain of Intelligence Driven Development (IDD) [30]. An agile concept of IDD is optimal for such complex mechanisms [16]. In this research chapter the focus is on IDD and the manner it supports agile decision making systems. IDD can be also applied to many other fields in the Framework and it is a central part of its Architecture and modelling module (Am). The IDD components are managed by The Open Group's Architecture Framework architecture development method's phases, where each IDD component circulates through its phases. The IDD's contain their private set of CSFs that are managed by classical object oriented inheritance.

The IDD is a concept or approach that can be used to refine the BTP components' development cycles. An IDD component describes a common structure for a general design problem within a BTP implementation context by using the "1:1" concept or a holistic pattern. The IDD component is a set of idioms, where an idiom is a basic pattern that is not specific to any environment. An idiom describes the aspects of an artefact and its relationships with other BTP artefacts. IDD component s refer to patterns that are used to develop intelligence patterns in forms of libraries that support control and monitor the BTP instances.

An IDD microartefact expresses a fundamental structural organization or schema for system's implementations. It offers: 1) a set of predefined intelligence templates; 2) describes their responsibilities; 3) and includes the description of the relationships between these templates. An IDD microartefact is a schema that can be used to refine the IDD cycle. An IDD microartefact describes a common structure for a general design problem within a BTP implementation context by using the "1:1" concept or a holistic pattern. An IDD microartefact is a set of idioms, where an idiom is a basic pattern that is not specific to any environment. An idiom describes the aspects of an artefact and its relationships with other BTP artefacts. IDD microartefacts refer to patterns that are used to develop intelligence pattern for BTP modules.

Global enterprise agility is achieved by combining various methodologies that promote business and technological agility to be used on various levels of the BTP, in order to unbundle the existing business environment and glue its innovated parts using a dynamic Informations System's (IS) components and IDD microartefacts as shown in Figure 4. Using a bottom-up approach, the BTM can design a IS integration concept that can handle various types of subsystems to be used in intelligence driven microartefacts, as shown in Figure 4.

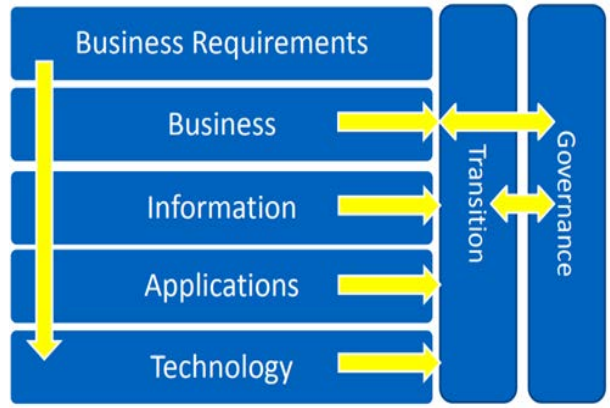

Fig. 4. The microartefacts driven components.

VII. Intelligence driven Microartefacts

IDD's microartefact is an instance of the IDD microartefact building block that can interact with other BTP's microartefacts in a traced and synchronized manner and uses TOGAF's ADM to assist it in the grouping of the needed services [6]. The IDD includes IDD microartefact scenarios that uses interactive services to make the integration more flexible [31]. DMS components support the BTP by offering IDD microartefact instances to handle various types of knowledge endpoints. The usage of knowledge endpoints provides some of the mechanisms needed to make DMS open to internal and external requests. The IDD microartefact is based on existing proven standards as shown in Figure 5. Standard architectures are based on service oriented architecture to support IDD. This research chapter presents a solution in the form of a proof of concept for such an approach, using existing standards and a mapping concept.

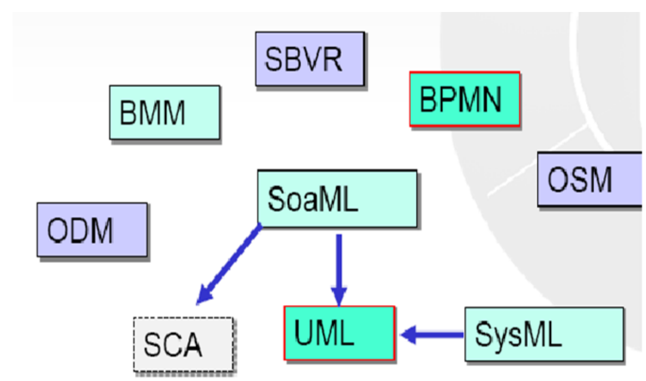

Fig. 5. Existing set of standards.

An important factor in the BTP is the role of the architectural blueprint; where the integration of IDD build artefacts are the base of the future business environment's IS. IDD microartefacts are crucial for the future of the intelligence based system and hence an adequate architecture strategy has to be established, by the choosing and application of an optimal modelling environment [34]. Architecture improves the quality of solutions to individual business requirements by simplifying their design, development and maintenance; that insures their business lifecycle. The business architecture of a business transformation process is based on a hands-on holistic approach [35].

Defining intelligence micro artefact's granularity is a very complex undertaking in the implementation phase and the complexity lies in the "1:1" mapping and classification of the discovered services in business environments with limited and optimized resources. This mapping concept uses complex messaging system to interact with the IDD microartefact's instances. Mapping of a requirement uses a range of IDD microartefacts that can be modelled using a heuristic function. This mapping function is based on a set of services where the IDD microartefact's functional language consists of building services to dynamically evaluate compound expressions, according to mathematical principles. The IDD microartefact's mathematical system model is to evaluate requirements and to deliver decision making solutions where requirements should be well-defined, so that the IDD microartefact enables a holistic model that can perform an evaluation that affects the final result [32][33].

VIII. Integrated Decision Making

The EAM integration process can adopt a concept resembling human decision-making processes, to overcome the traditional silo-like computer science approach. The EAM's integration achieves an agile holistic view of the BTP assets and this agility must be integrated in the enterprise's very light version of the ADM's business architecture through the use of various agile architecture engineering methods, like: 1) domain design; 2) Unified Modelling Language (UML); 3) development and operations conventions; and other; as shown in Figure 6 [19][10]; that all support an Agnostic Implementation Environment (AIE) [20]. The proposed AMM structure is based on the following definitions and prerequisites:

- The model of a specific object is a physical or conceptual representation of its appearance and its internal working mechanisms or functionalities; normally it is smaller and simpler than the original object itself.
- The mathematical model is an abstraction of a system like a business environment or a business process.
- The system is a way of processing, organizing or executing a set of activities that correspond to a defined plan and a related set of rules, where system refers to an organization or an enterprise. The system is concurrent and synchronized by using threading pools.
- The use of existing literature resources and credible references are prerequisites.

The proposed EAM integration concept supports classical assets' implementation constructs as well as advanced holistic techniques in order to support business intelligence based mathematical model [20].

IX. The Mathematical Model Formulation

The proposed mathematical model for business transformation projects, business engineering and enterprise architecture is based on the Open group's architecture development method that should be adapted to various standards. The EAM, as shown in Figure 7, is based on a light version of the ADM and is a part of the *Environment* that uses services architecture. Services architecture enables unprecedented agility, business benefits and infrastructure scalability. These facts can be formalized in a mathematical model that needs a nomenclature, as shown in Figure 6.

Model's nomenclature

mcEnterprise	A micro enterprise component
mcRequirement	A micro requirement
mcArtefact	A microartefact
action (or action)	An atomic service (or neuron) execution scheme
mcIntelligenceArtefact	A set that contains: dynamic basic intelligence + governance + persistence+ traceability + data_xsd + resources
mcArtefactDecisionMaking	A microartefact_decision making entity
mcArtefactScenario	A microartefact scenario

Fig. 6. The applied mathematical model's nomenclature.

The AMM nomenclature is presented in a simplified form to be easily readable on the cost of mathematical rigour. Each atomic service can represent an enterprise (e)neuron that respects the following Applied Mathematical Model:

AMM

mcRequirement	= KPI	(1)
CSF	= ΣKPI	(2)
CSA	= ΣCSF	(3)
Requirement	= ΣmcRequirement	(4)
(e)neuron	= action + mcIntelligenceArtefact	(5)
mcArtefact	= Σ (e)neurons	(6)
mcEnterprise	= Σ mcArtefact	(7)
(e)Enterprise	= Σ mcEnterprise	(8)
mcArtefactScenario	= ΣmcArtefactDecisionMaking	(9)
IntelligenceComponent	= ΣmcArtefactScenario	(10)
OrganisationalIntelligence	= ΣIntelligenceComponent	(11)
AMM	= ADM + OrganisationalIntelligence	(12)

Fig. 7. The applied mathematical model's nomenclature.

As shown in Figure 7, the symbol Σ indicates summation of all the relevant named set members, while the indices and the set cardinality have been omitted. The summation should be understood in a broader sense, more like set unions.

1.1. The enterprise model

The Enterprise AMM (EAMM) is the combination of an enterprise architecture methodology like the Open group's methodology and the AMM that can be modelled after the following formula:

EAMM = Enterprise Architecture + AMM (1)

1.2. A concurrent and synchronized mathematical model

The EAMM is based on a concurrent and synchronized infrastructure using threads that make various models run in parallel and exchange dynamically data through a mathematical choreography.

X. THE ROLE OF MATHEMATICAL CHOREOGRAPHY

Fig. 8. Types of asset management [28]

A BTP focuses on business transformation, assets management, business engineering, organizational design and enterprise architecture, where all these fields share some kind of choreography layer that is in turn based on the services artefacts with a 1 to 1 mapping relationship. A neural network perfectly corresponds to a heuristic tree that is an information processing paradigm inspired by the biological nervous systems, such as the human brain [26]. The key element of this paradigm is the novel structure of the information processing system that is the AMM. As already mentioned, AMM is composed of a large number of interconnected neurons to solve specific BTP problems. EAM units are connected to each other like nodes in a tree and there is a real number associated with each connection as shown in Figure 8, which are called weightings used in this article's proof of concept [22].

XI. THE PROOF OF CONCEPT

In this proof of concept, the authors have developed a model that corresponds to the *Environment's* general case study. In this proof of concept, the authors proved the possibility to have a holistic architecture and to manage risk with a neural networks-based heuristics system as shown in Figure 9.

This implementation environment depends on the business transformation framework that helps the BTP team to prototype a business transformation model and then to propose it to various teams of the business environment.

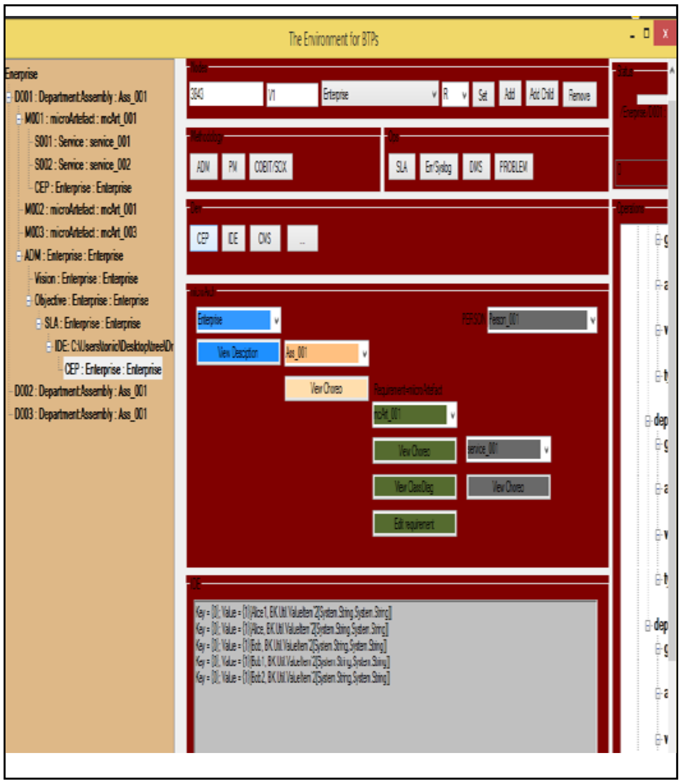

Fig. 9. The *Environment's* framework used to prototype the solution

XII. Conclusion and Recommendations

This is one in a series of articles that are a part of a specialized research cluster related to the implementation activities of a business transformation project. The authors based their business transformation project's research on a mixed research method that uses intelligent neural networks and action research reasoning support where both methods resemble to the human brain structure and manner of processing towards solutions. In this article the authors presented the main components that are needed to build an interactive EAM agnostic implementation environment. Business Transformation Projects' technical and managerial recommendations for an optimal EAM integration are:

1) Set up the basic structure and architecture for an EAM.

2) Use an adapted framework to prototype the needed EAM model [23].

3) Use the optimal adapted mathematical model to evaluate the EAM's risk model [24].

4) Develop a proof of concept to verify the EAM prototype.

5) Use the Environment's *Agnostic Implementation Environment to develop the EAM's artefacts [20].*

6) Use an Integrated Development Environment to develop the EAM's artefacts and services [21].

7) Define the interfaces for the EAM's main components [21].

The Applied Mathematical Model is based on a real-life case for detecting and processing an enterprise heuristic algorithm for business transformation and enterprise architecture projects. The proposed Applied Mathematics Model is business agnostic and generic; it also incorporates a decision-making subsystem that contains a qualitative research method that in turn is calibrated with critical success factors sets and actions. These actions result in a set of solutions for business transformation, business engineering and enterprise architecture projects. Enterprise architecture may serve as a methodology to support the interaction between project requirements and manage the project real-time problems. The EAMM is business driven and uses the Open group's architecture development method. In this research phase and cluster, the goal is to present how an enterprise architecture that produces transformational designs, can be formalized as a set of simplified mathematical formulas. These formulas describe the communication structures of the business environment. The EAMM offers a functional language development environment that can be used to implement various business and technology asset artefacts. The EAMM uses critical success factors sets, actions and applicable solutions for business transformation and enterprise architecture projects. The EAMM provides an understandable homogeneous mathematical and logical structure of building blocks for business systems engineering. The proposed EAMM main goal formulas are:

- (e)Enterprise intelligence = ΣmcArtefactScenario (2).
- AMM = Σ (e)Enterprise intelligence (3).
- EAMM = Enterprise Architecture + AMM (4).
- EAM is an instance of the EAMM (5).

This research proposes that the EAM's underlying enterprise architecture concept should be based on an applicable mathematical model that uses a heuristics motor and is tuned by critical success factors; and is bonded to the following articles:

- An Enterprise Architecture Mathematical Model's Background9 that discusses the basis and background of the EAMM.
- An Enterprise Architecture Mathematical Model's Architecture, presents the internals of the EAMM platform architecture and a concrete proof of concept.

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prepare this work. Now our greater hopes are for readers to receive some small measure of that pleasure.

REFERENCES

[1] A. Trad and. D. Kalpić. An Intelligent Neural Networks Micro Artefact Patterns' Based Enterprise Architecture Model. IGI-Global. USA. 2017.

[2] A. Trad and. D. Kalpić. A Neural Networks Portable and Agnostic Implementation Environment for Business Transformation Projects. The Basic Structure. IEEE. Annecy, France. 2017.

[3] A. Trad and. D. Kalpić. A Neural Networks Portable and Agnostic Implementation Environment for Business Transformation Projects. The Framework. IEEE. Annecy, France. 2017.

[4] A. Trad. The Business Transformation Framework and Enterprise Architecture Framework for Managers in Business Innovation. The Integration of Enterprise Asset Management Using Standards. The Open Group. London, UK. 2018.

[5] V. Capecchi, , M. Buscema, P. Contucci, and D. D'Amore, Applications of Mathematics in Models, Artificial Neural Networks and Arts: Mathematics and Society. Springer Science & Business Media. 2010.

[6] The Open Group . Architecture Development Method. The Open Group. USA. http://pubs.opengroup.org/architecture/togaf9-doc/arch/chap05.html. 2011.

[7] A. Thomas and A. Gartner, Innovation Insight for Microservices. https://www.gartner.com/doc/3157319/innovation-insight-microservices. Gartner. 2015.

[8] J. Tidd. From Knowledge Management to Strategic Competence, 2nd Edition, Imperial College, London, UK. 2006.

[9] A. Trad and. D. Kalpić. The Business Transformation Framework and its Business Engineering Law support for (e)transactions. IGI-Global. USA. 2016.

[10] A. Trad. A Transformation Framework Proposal for Managers in Business Innovation and Business Transformation Projects-Intelligent atomic building block architecture. Centeris. Portugal. 2015.

[11] N. Taleb. Antifragile : things that gain from disorder. LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA. Nassim Nicholas Taleb. 2012.

[12] D.James, H. Grinter, and R. Grinter. Splitting the Organization and Integrating the Code: Conway's Law Revisited. Bell Laboratories, Lucent Technologies. In Proceedings, International Conference on Software Engineering, 1999, Los Angeles, CA, pp. 85-95. USA. 1999.

[13] D. Cearley and M. Walker, and B. Burke, B. Top 10 Strategic Technology Trends for 2017. Gartner, ID: G00317560. https://www.gartner.com/doc/3471559?plc=ddp. 2016.

[14] A. Trad. The Transformation Framework's Resources Library. IBISTM. France. 2018.

[15] A. Trad. The Transformation Framework Proof of Concept. IBISTM. France. 2018.

[16] H. Daellenbach, D. McNickle, and Sh. Dye. Management Science. Decision-making through systems thinking. 2nd edition. Plagrave Macmillian. USA. 2012.

[17] A. Trad. A Transformation Framework Proposal for Managers in Business Innovation and Business Transformation Projects-An information system's atomic architecture vision. Centeris. Portugal. 2015.

[18] M. Clark., P. Fletcher, J. Hanson, R. Irani, M. Waterhouse and J. Thelin. Web Services. 2013.

[19] The Open Group. TOGAF 9.1. The Open Group. USA. 2011.

[20] A. Trad and. D. Kalpić. A Neural Networks Portable and Agnostic Implementation Environment for Business Transformation Projects-The Agnostic Implementation Environment. 2017.

[21] A. Trad and. D. Kalpić. The Selection and Training Framework for Managers in Business Innovation and Transformation Projects-The Profile of the Implementer of Adaptive Business Environments. AASCIT.

[22] Ch. Stergiou and D. Siganos, NEURAL NETWORKS. https://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html

[23] A. Trad and. D. Kalpić. A Neural Networks Portable and Agnostic Implementation Environment for Business Transformation Projects-The Framework. 2017.

[24] A. Trad and. D. Kalpić. A Neural Networks Portable and Agnostic Implementation Environment for Business Transformation Projects-The mathematical model. 2017.

[25] H. Gardner. Intelligence Reframed: Multiple Intelligences for the 21st Century, Basic Books, New York. 1999.

[26] Wikimedia Foundation. Quantum neural network, https://en.wikipedia.org/wiki/Quantum_neural_network. 2016.

[27] A. Trad and. D. Kalpić. Business Transformation Projects- An Enterprise Architecture Applied Mathematical Model-Proof of Concept. IEEE. Paris. France. 2018.

[28] STS (2018). Enterprise asset management. STS. http://www.stsolutions-global.com/enterprise-asset-management.html

[29] Gunasekare, U. Mixed Research Method as the Third Research Paradigm: A Literature Review. Volume 4 Issue 8, August 2015. University of Kelaniya. IJSR. 2015.

[30] A. Trad and. D. Kalpić. The Business Transformation Framework and Enterprise Architecture Framework for Managers in Business Innovation-Knowledge and Intelligence Driven Development (IDD). 2018.

[31] A. Trad and. D. Kalpić. An Intelligent Neural Networks Micro Artefact Patterns' Based Enterprise Architecture Model. IGI-Global. USA. 2017.

[32] Neumann, G. Programming Languages in Artificial Intelligence. Bidgoli (ed) Encyclopedia of Information Systems, Academic Press, San Diego, CA, ISBN 0-12-227240-4, 2002, pages 31-45. 2002.

[33] North, N. Behaviour-Driven Development Writing software that matters. DRW. 2010.

[34] MID. "Enterprise Architecture Modeling with ArchiMate". MID GmbH. Germany. 2014.

[35] Greefhorst, D. "Using the Open Group's Architecture Framework as a pragmatic approach to architecture". Jaarbeurs, Utrecht. KIVI NIRIA, afd. Informatica. Netherlands. 2009.