Business, Economic, and Common Transformation Projects-The In-House-Implementation of The Polymathic Transformation Framework (IHIPTF)

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Abstract

Iterative Business (economic, financial, or common) Transformation Projects (BTP) are fundamental for the enhancements of enterprises' performances and in insuring their longevity. But BTPs are very complex, because of the hard reality in inter-linking various domains and the lack of the adoption of a polymathic and holistic approaches that are needed to finalize such BTPs. Such an objective tries to achieve intangible goals and not only extreme gains dictated by stakeholders. A polymathic and holistic approach's privilege are interdisciplinary concepts for the implementations of various BTP's phases, sub-domains, and components. This chapter uses the authors' Applied Holistic and Poly-Mathematical Model (AHMM) for IHIPTF (AHMM4IHIPTF), which is a variant of the authors' generic and polymathic AHMM which also includes enhancements and findings from their previous research articles and works, which are added to the IHIPTF. TheAHMM4IHIPTF supports the Polymathic Enterprise MetaModel (PEMM) which needs the IHIPTF to manage BTP's modules discovery, implementation and to evaluate its status(es), gap analysis, and to check its integrity. The PEMM, Polymathic Ratings and Weightings Concept (PRWC), and IHIPTF combine various fields that can include industrial engineering, organizational engineering, business engineering, transformation initiatives, enterprise architecture, rating concepts, weighting mechanisms, Artificial Intelligence (AI), mathematical models, algorithms, and other. This chapter is a new brick in the authors' Research and Development Project (RDP), and this

RDP is the continuation of their previous works and findings that are used to prove IHIPTF's feasibility and integration in BTPs.

Keywords: Implementing Business Transformation Framework, Ratings/Weightings Concepts, Polymathics, Meta Models, Enterprise Architecture, Enterprise Agile Methods, Organizational Engineering, Mathematical Models, Artificial Intelligence, Critical Success Factors, and Performance Indicators.

INTRODUCTION

This chapter has a proprietarymulti-dimensional approach to RDPs and BTPs(simply Project), and this approachcontains: 1) An innovative and adapted research concept; 2) Presents how to create an IHIPTF; 3) Uses the IHI Methodology, Domain, and Technology Common Artefacts Standard (MDTCAS) that is basedon Enterprise Architecture (EA) and other existing methodologies; and 4)The The Management Systems Factor (FMS)(FMS). The PRWCuses the FMS that includes:Critical Success Areas (CSA), Critical Success Factors (CSF), Key Performance Indicators (KPI), VARiables (VAR) used to interface the Information and Communication Systems (ICS) and Decision-MakingSystem (DMS). The IHIPTF interfaces the PRWCwhich is based on linking and evaluating of sets of CSAs, CSFs, KPIs, and VARs (simply Factors). Most of theProjectshave an eXtremly High Failure Rate (XHFR) that is mainly due the lack of a Holistic or Polymathic concepts that are suited for the IHIPTF. This chapter is intended for architects, auditors, project managers and engineers to present how to implement an IHIPTF for Projects and can serve requests for DMS and Knowledge Management System (KMS) (simply Intelligence) activities.The IHIPTFforenterprises or organizations (simply Entity*),*needs an agile and collaborative Methodology, Domain, and Technology Common Artefacts Standard (MDTCAS) thatthrough Intelligence offerstheAction Research (AR) based Learning Process (ARbLP). The ARbLPcan learn and persist Project and traditional operations' experiences from any type of encountered problems.

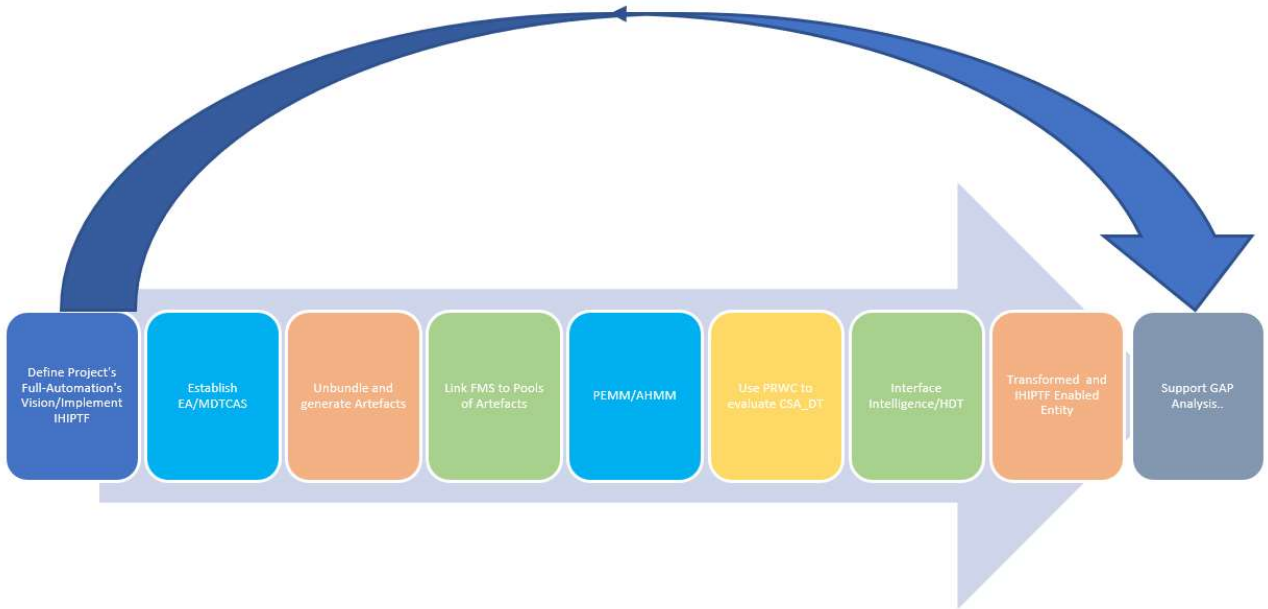

Figure 1. PRWC's sequence of phases

The IHIPTF interfaces 1) The PRWC; 2) A common and limited version of EA that has the form of the MDTCAS (Pushpakumara, Jayaweera, &Manjulan, 2021); 2) Heuristics Decision Tree (HDT) based DMS, and Intelligence; 3) The AHMM4IHIPTF or any other Mathematical Model (MM) (Trad, & Kalpić, 2020a); 4) A unbundled Pool of ICS services (Trad, 2015a, 2015b); and other IHIPTF modules and phases, as shown in Figure 1.A Project can be defined as set of CSAs to be analysed and this chapter starts with its first CSA which is the RDP.

THE RESEARCH DEVELOPMENT PROJECT

An Innovative and Unique Concept

A Projectcan have many Viewpoints, that can include:

- "A" for EA and ICS based transformations.
- "C" for complete transformations that combines all Viewpoints.
- "G" for Generic transformations.
- "W" for the IHIPTF, which is this article's focus.
- "M" a Meta or Meta-Meta Model.
- "F" for Asset, and financial transformations.
- "I" for Infrastructural transformations.
- "O" for Organizational, Enterprise and Business transformations.
- "S" for Security based transformations.

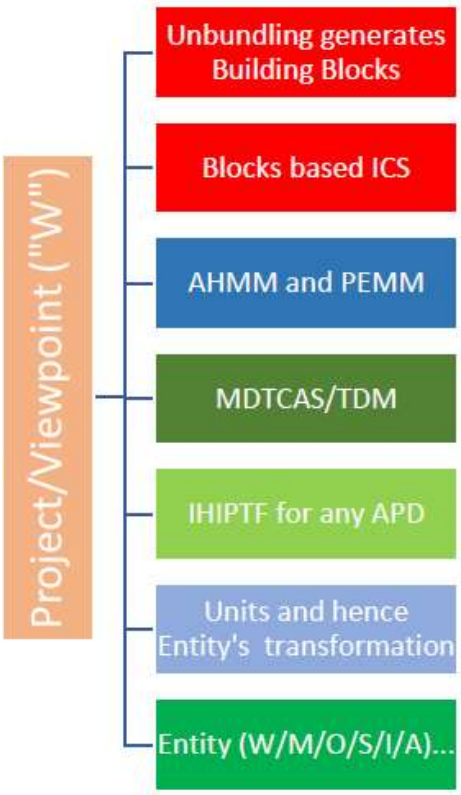

Figure 2. Viewpoint's "M" evolution roadmap

Viewpoint's "M" combines various Viewpoints and has a structured evolution's roadmap for the PRWC, as shown in Figure 3.The presented IHIPTF and RDP follow an iterative and recurrent concept, in which each research work (like this chapter), is just a brick in its wall. The authors'main concern is that important subjectslike Projects and the PRWC can be considered as unclear, complicated, and unconventional…And that they are not to be aligned with standardized primitive quantitative academic or educational constraints, which is in fact one of the main problems.Observing the rate of 95% of Projects' XHFRs, we can assume that such conventional standards are not adapted for Projects (Krigsman, 2008.Therefore, this chapterreusesIHIPTF,RDP, and other authors'research concepts and modules. This reuseconcept of approaches, resources, and keywords, can be considered by some simplistic automated/robotized tools as a kind of duplication or cases of similarities, which is definitely not,because such an approach privileges XHFRs; and the authors' approach justifies the search for some other complex methods and approaches. Why shouldn't researchers build their own research innovation, vision, research/methods, transformation IHIPTF, and reuse some parts to deliver a coherent overall PRWCconcept? (Trad, 2024c). By just using directed standards, there is no creative innovation, especially in complex domains which desperately need new approaches and renewed methodologies approach to Polymathic research initiatives. Otherwise, all academic, business and common domains will be dictated by the anti-intellectual Google, Amazon, Facebook, Apple, and Microsoft's (GAFAM) stakeholders. Therefore, there is the need to identify an anti-GAFAM(or Anti-Locked-In/ALI) Polymathic Researched Literature Review (RLR) and Gap Analysis (GAPA).

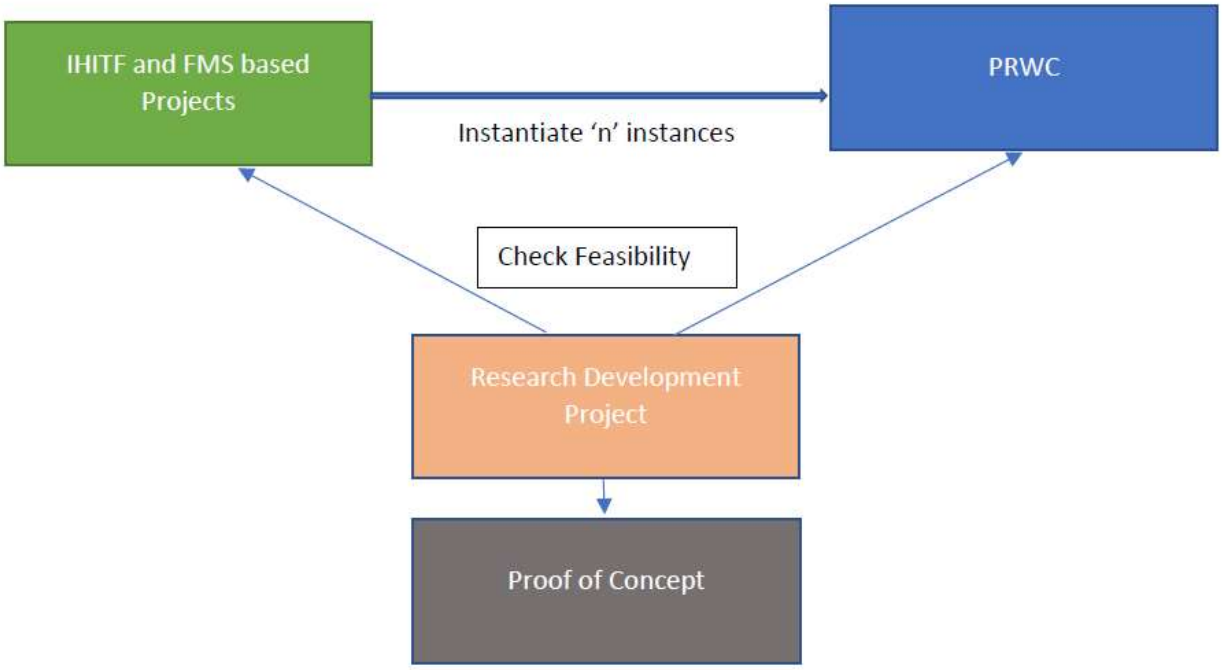

Figure 3. The interaction between the Project (hence IHIPTF) and the RDP

The PRLR and the Research/ProjectGAPA

Project's complexities and their XHFRsare mainly due totheincapacities in the integration of Polymathic/cross-functional domains and GAFAM's monopolistic attitudes.The IHIPTFneedsthe AHMM4IHIPTFand ARbLP based HDT, to supportIntelligence's operationsto offer solutions (Trad, & Kalpić, 2014a). This chapter's Research Question (RQ) is: "Which IHIPTF characteristics and capability are needed to support Projects?"The PRLR is mainly based on IHIPTF's and authors'related works, like:

- The Business Transformation Project's Holistic Agile Management (Trad, & Kalpić, 2022a).
- The Selection, and Training Framework selection and training framework (STF) for Manager's in Business Innovation Transformation Projects–Educational Recommendations (Trad, & Kalpić, 2014b, 2014c).
- Educational Transformation Project's Remote Group Work (ETPRGW) (Trad, & Kalpić, 2023a).
- Enterprise Transformation Projects- The use of the Polymathic Rating and Weighting Concept (Trad, 2024c).
- The business transformation enterprise architecture framework for innovation: The role of artificial intelligence in the global business education (RAIGBE) (Trad, 2021b).
- Business Transformation Projects: The Role of Psychology-Based Resistance (RPbR) (Trad, 2023b).
- Organizational and Digital Transformation Projects-A Mathematical Model for Building Blocks based Organizational Unbundling Process (Trad, 2023d). Where The Unbundling Process (UP) that is followed by a Refinement Process (RP) (simply Disassembling) are Project's critical phase.
- … and many others.

This RDP has identified an important research gap that is due to the fact that there isn't: 1) Any identical Polymathic approach to a Project and IHIPTF (Trad, 2024c); 2) Projects' XHFRs; 2) Any existing mixed-method like the authors' Quantitative-Qualitative Research Mixed Model (QQRMM); 3) The use of Team's profiles; 4) A concept that takes into account long-term intangible objectives; 5) Concrete FMS and Factors that link to the ICS and IHIPTF; and 6) CSA-DTs processing capabilities, as shown in Figure 4.

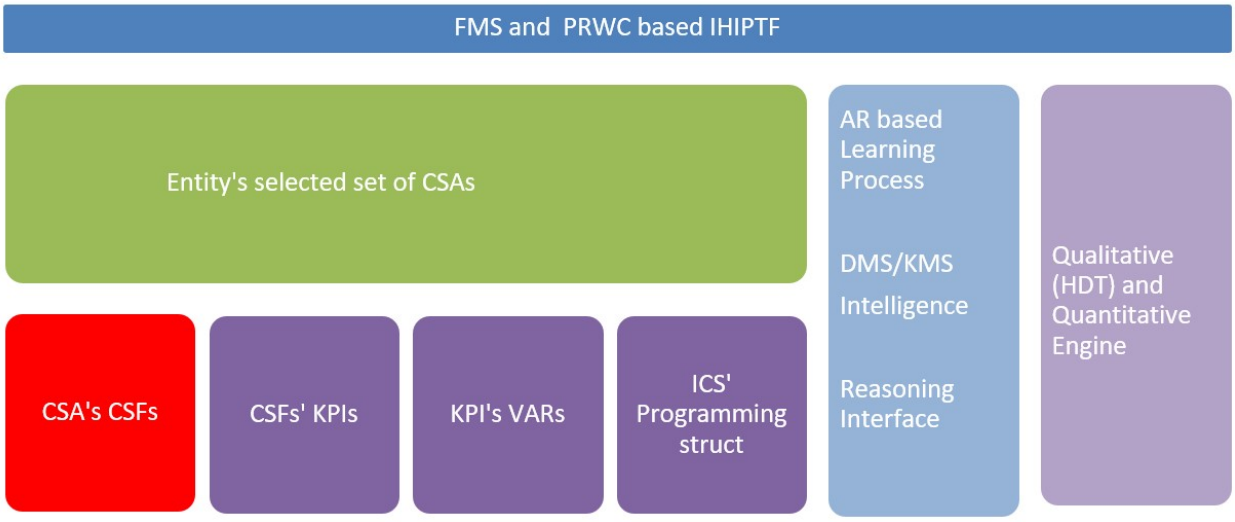

Figure 4. The FMS and PRWC IHIPTF that processes CSA_DTs

RDP's related Proof of Concept (PoC) uses the following Applied Case Studies (ACS): 1) The insurance domain (Jonkers, Band, &Quartel, 2012a), which is used for ICS, modelling, and EA topics; and 2) PoCs from previous works. An RDP has to setup the PRWC a set(s) of Enumerators (PRWCE), which for this chapter has the following values: 1) Proven (that is equal to 10); 2) Possible (that is equal to 8 or 9); 3) Feasible (that is equal to 7 or 6); 5) Complex (that is equal to 5); 6) Very_Risky (that is equal to 3 or 4); 7) Very_Complex (that is equal to 1 or 2); and 8) Failure (that is equal to 0). Enumerators are to be used in all chapter's CSA/CSA_DT processing and resulting findings.

RDP's Pattern

This chapter like all the authors' works use the same pattern which has the following sections (Trad & Kalpić, 2020a):

- An introductory part that explains the overall subject related to the phase's RQ.
- The RDP part that explains the research concept.
- The ACS and PoC related to the final experiment.
- The ICS, ADM, decision making system, represent sections in the work's RQ specific context and integration.
- A specialized part, like in these casesof the PRWC and IHIPTF.
- Each part (or CSA) contains a table of selected and weighted Factors.
- The conclusion and recommendations that summarizes and concludes the research work.

The RDP CSA/CSA_DTProcessing and Resulting Findings

For this CSA'sresultant Factors and processing procedure that is shown in Figure 4, are:

- The resultant set of CSA's related CSFs are: 1) Innovative_Concept_Feasibility; 2) Gap_Analysis_Defaults; 3) Gap_Analysis_Value; 5) Mixed_Methodology_Basics; 6) Mixed_Methodology_HDT; and 7) IHIPTF's integration.
- The resultant set of CSF'srelated KPIs that has the form of an PRWCE.

- The resultant set of KPI's related VARs are: 1) Innovative_Concept_Feasibility_VAR; 2) Gap_Analysis_Defaults_VAR; 3) Gap_Analysis_Value_VAR; 5) Mixed_Methodology_Basics_VAR; 6) Mixed_Methodology_HDT_VAR; and 7) IHIPTF_Integration_VAR. All these VARs are concrete ICS application variables, like for example Mixed_Methodology_Basics_VARMicrosoft's C# language structure as shown in Figure 5 which is a concrete programming languagestructure (which links Factors to a concrete ICS module):

```
publicstructIHIPTF_Integration_VAR
{
    publicIHIPTF_Integration_VAR(
                                        int  APDType,
                                        int  APDStat
                                    )
    {
        ….
    }
    publicintcAPDType{ get; }
    publicintcAPDStat{ get; }
    publicstringToString() =>$"({cAPDType},{cAPDStat})";
    }
```

Figure 5. The IHIPTF_Integration_VAR structure

CSA's CSFs	Related KPIs	Weightings
CSF_RDP_Polymathic_Innovative_Concept	Proven	From 1 to 10. **10 Selected**
CSF_RDP_Gap_Analysis_Defaults	Proven	From 1 to 10. **10 Selected**
CSF_RDP_Gap_Analysis_Values	Complex	From 1 to 10. **08 Selected**
CSF_RDP_QQRMM_Basics_EERM	Feasible	From 1 to 10. **09 Selected**
CSF_RDP_QQRMM_Basics_HDT	Feasible	From 1 to 10. **09 Selected**
CSF_RDP_IHIPTF_TRADf	Feasible	From 1 to 10. **09 Selected**

valuation

Table 1. The CSA_DT outcome is 9.20.

This CSA Decision Table (CSA_DT) uses the defined CSFs and KPIs (and relate VARs), as shown in Table 1,the resulting value is 9.20 that corresponds to "Mature". The details on how the CSA_DT was processed is AHMM and PRWC CSAs/sections. A Project is made of many Phases and CSAs, and the first analysed CSA is about how to establish the Project's Managers and members (simply Team, that includes also other types of specialists).

THEPROJECT'S TEAM

Managing Complexities

Projects are challenging but have also many complexities, which most important ones lie in the conversion and transformation of the Legacy ICS' heterogenous components to offeran agile, secured, and unbundled ICS. The IHIPTF uses the PRWC to evaluate:1) Project's GAPA (or statuses); 2) Toabstract the usage of EA and other methodologies; and 3) To support Team's integration, capacities, and skills. The authors' previous RDP related articles and works, havelocalized an important research and Project gap related to complex transformations. The gaps show in existing sources on Project's complexities and the resultantXHFRs. And the main reason for such XHFRs is the lack of Polymathic capabilities in management and coordination of Projects, that need a well-defined role and profile like the Architect of Adaptive Business Information System (AofABIS). These crucialProject profiles are todayrepresented exclusively by business managers profiles (basically financial accountants), which is the main reason for XHFRs(Trad, & Kalpić, 2021a).

Needed Skills, and Polymathics

Projects need knowledge related to the structure, design, development, and implementation of effective IHIPTF solutions. These solutions enhance ARbLP based ELPs (Crittenden, 2005). Complex Projects' Managers need to coordinate Polymathic Teams who are capable of developing and integratingthe needed modules (Satterlee, 1996). The Project Team needs cross-functional/Polymathic skills that are based on common (or generic skills) andhas to have the capability of quickly getting specialized in needed domains and technologies. This characteristic can be found in a limited number of Team members and peoplein general. Polymathic skills can be built on a variant of *Technocrat's*profile; that includes skills in: 1) Lean business architectures; 2) Integrated Development Environments (IDE); 3) Business analysists' integration, 4) Agile Project Management (APM), and 5) Coordination of ICS engineers. Projects influence the wayBusiness Processes (BP) are integrated and how they influence the IHIPTF. The use of BPs will enhance the management of Intelligenceand help in the selection of the Team and its APM application.

APM's Application and a Polymathic Team Profiles

The Business Transformation Project's Architect's Profile (BTPAP) that super-classes the already mentioned AofABIS, has to have an adequate set of skills which contains also how to integrate the IHIPTF with APM in an EA context and roadmap (Trad, & Kalpić, 2021a; Trad,2023c). The IHIPTFoffers the Architecture Development Method (ADM) based Transformation Development Methodology's (TDM) approach. The IHIPTF and its TDMand its fundamental Business Processing Modelling (BPM) comply with that "…ability to apply versatile and extensive methodological skills in managing business processes is the number one business priority for successful entrepreneurial activities" and Projects; according to Gartner (Gartner, 2005). Project's main difficulties lie in its duration that can last many years and meet ever-changing technology landscapes, which destabilizes the Project and provokes XHFRs. One of the main complexities is how to synchronize the IHIPTF, APM, ADM based TDM, and the Disassembling of the legacy ICS and the capacity for infrastructure's integration in a scalable ICS (Farhoomand, Lynne, Markus, Gable, & Khan, 2004;

Trad, & Kalpić, 2021a). APM's integration can include: 1) Business architectures that includes BP and their BPMimplementation; 2) Automated Project's processes (Krigsman, 2008); 3) APM's interfaces to ADM and TDM or other; 4) Unification of Project's integration processes; 5) Organizational (re)engineering; 6) Polymathic Intelligence's implementation; 7) TDM's phases synchronization and GAPA's insertion; 8) Separating EA and APM tasks and responsibilities; 9) IHIPTF use as a central framework; and 10) Other. Therefore, the Project Team needs Polymathic skills and agile affinities, who can transform the Entity, and this is ageneric profile as shown in Figure (The Open Group, 2011d; Trad, & Kalpić, 2021a).

IT Architect Roles	Architecture Board Member	Architecture Sponsor	IT Architecture Manager	IT Architecture Technology	IT Architecture Data	IT Architecture Application	IT Architecture Business	Program or Project Manager	IT Designer
Enterprise Architecture Skills									
Business Modelling	2	2	4	3	3	4	4	2	2
Business Process Design	1	1	4	3	3	4	4	2	2
Role Design	2	2	4	3	3	4	4	2	2
Organization Design	2	2	4	3	3	4	4	2	2
Data Design	1	1	3	3	4	3	3	2	3
Application Design	1	1	3	3	3	4	3	2	3
Systems Integration	1	1	4	4	3	3	3	2	2
IT Industry Standards	1	1	4	4	4	4	3	2	3
Services Design	2	2	4	4	3	4	3	2	2
Architecture Principles Design	2	2	4	4	4	4	4	2	2
Architecture Views & Viewpoints Design	2	2	4	4	4	4	4	2	2
Building Block Design	1	1	4	4	4	4	4	2	3
Solutions Modelling	1	1	4	4	4	4	4	2	3
Benefits Analysis	2	2	4	4	4	4	4	4	2
Business Inter-working	3	3	4	3	3	4	4	3	1
Systems Behavior	1	1	4	4	4	4	3	3	2
Project Management	1	1	3	3	3	3	3	4	2

Figure 5. BTPAP's specific skills(The Open Group, 2011d)

Managing the Continuum, Repository, and Reference Models

The Team has the responsibility that includes the integration of the IHIPTF, architectural design, and documentation at a technical reference model level. The IHIPTF includes various types of architects' profilelike (The Open Group, 2011d): 1) Leading an Industry Architects group; 2) System Architect has the responsibility for architectural design and documentation; 3) Industry Architect has the responsibility for EA/TDM design; and 4) Organization Architect has the responsibility for architectural design of a specific Entity.

The TEAM CSA Processing and Findings

```
publicstructUsing_TDM_VAR
{
  publicUsing_TDM_VAR(
                                    int  TDMype,
                                    int  TDMStat
                                  )
```

```
        {
            ….
        }
        publicintcTDMType{ get; }
        publicintcTDMStat{ get; }
        publicstringToString() =>$"({cTDMType},{cTDMStat})";
        }
```

Figure 6. The Usingof_TDM_VAR structure

The resultant Factors are:

- The CSFs are: 1) Polymathics_Managing_Complexities; 2) Polymathic_Profiles; 3) Managing_Contiuum; 4) Using_TDM; and 5) HumanFactor_Resistance.
- The VARs are: 1) Polymathics_Managing_Complexities_VAR; 2) Polymathic_Profiles_VAR; 3) Managing_Contiuum_VAR; 4) Using_TDM_VAR; 5) HumanFactor_Resistance_VAR; and 5) Interfacing_Existing_Methodologies_Environments. All these VARs are concrete ICS application variables, like for example Using_TDM_VAR Microsoft's C# structure as shown in Figure 6:

This CSA_DT uses the defined Factors, as shown in Table 2, and the result is 8.5 that corresponds to "Risky".

Critical Success Factors	AHMM4CBB enhances: KPIs	Weightings
CSF_Team_Managing_Complexities	Complex	From 1 to 10. **08 Selected**
CSF_Team_Polymathics	Feasible	From 1 to 10. **09 Selected**
CSF_Team_APM	Complex	From 1 to 10. **08 Selected**
CSF_Team_IHIPTF_TDM_Exisiting_Methodologies	Feasible	From 1 to 10. **09 Selected**

Table 2. The CSA_DT outcome is 8.50

The Project starts with the complex UP and RP (simply Disassembling), that delivers the needed sets of BBs.

DISASSEMBLING PHASE

Disassembling Entity's Legacy

Projects are complex and have XFHRs because they depend on Composite BBs (CBB) creation process. CBBs are created by Disassembling process. Where the Organizational UP (OUP) is a sequential set of Disassembling processes that transforms the Entity's: Legacy ICS structure, ICS' administration, Assets/Resources, Applications/Services, BPMs, and Internal/external collaboration models. Disassembling processes, as shown in Figure 6, deliver a Pool of heterogenous CBBs that are (re)used to build Architectural BBs (ABB). Disassembling (that is Automated RPs-ARP) faces difficulties because of the following facts: 1) Entity's heterogenous legacy environments and various types of resistances that are related to: Human profiles/cultures, ICS different viewpoints,

financial ambitions, and Project's limited time/budgets; 2) Projects' innovation methods are monopolized for achieving only immediate tangible financial goals, and this is the main reason for XHFRs; 3) Inability to create an IHIPTF; and 4) Difficulties in interfacing the various crucial transformation modules like GAPA, PRWC. The Disassembling Strategy is the Project's first and major step challenge, because it faces the XHFR. If it fails,the Disassembling process should restart (or the Project is stopped), until it delivers the feasible Entity's Pool of refined BBs, CBBs and a central Entity's Polymathic Dictionary and Glossary (EPDG) (Trad, 2023d).

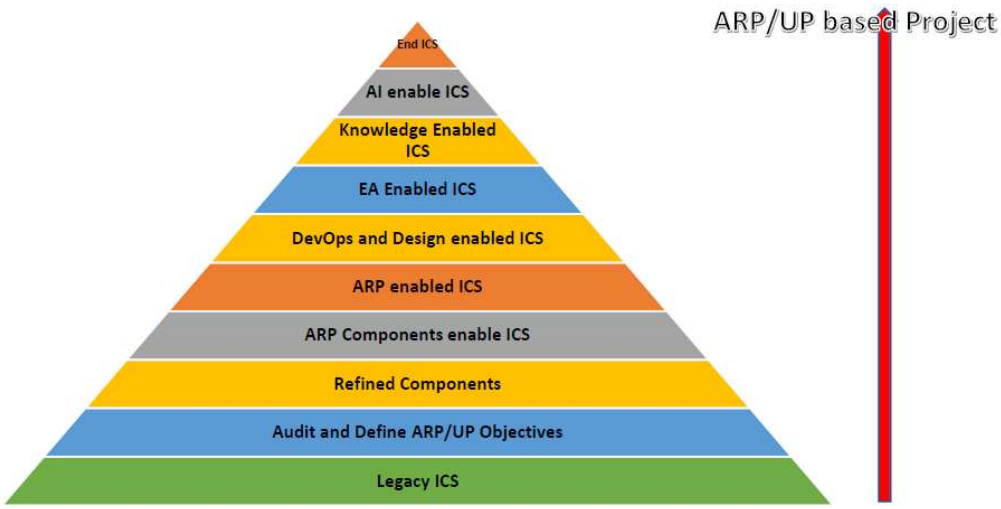

Figure 6. Disassembling based Project's Approach(Trad, 2023d)

The EPDG

Implementing the EPDG in an IHIPTF and Entity offers (Shrivastava, 2023):

- Better chances for success and especially in TDM's activities as shown in Figure 7.
- Improves BPMs coherent developments.
- Optimized common data and terms vocabulary that is needed for business and common definitions.
- A data catalogue that enables common vocabulary for development processes.
- Collections of related terms, definitions, and other properties; defined with an IHIPTF and PRWC conventions.

It defines a common Project's language, clears, and defines governance/quality standards.

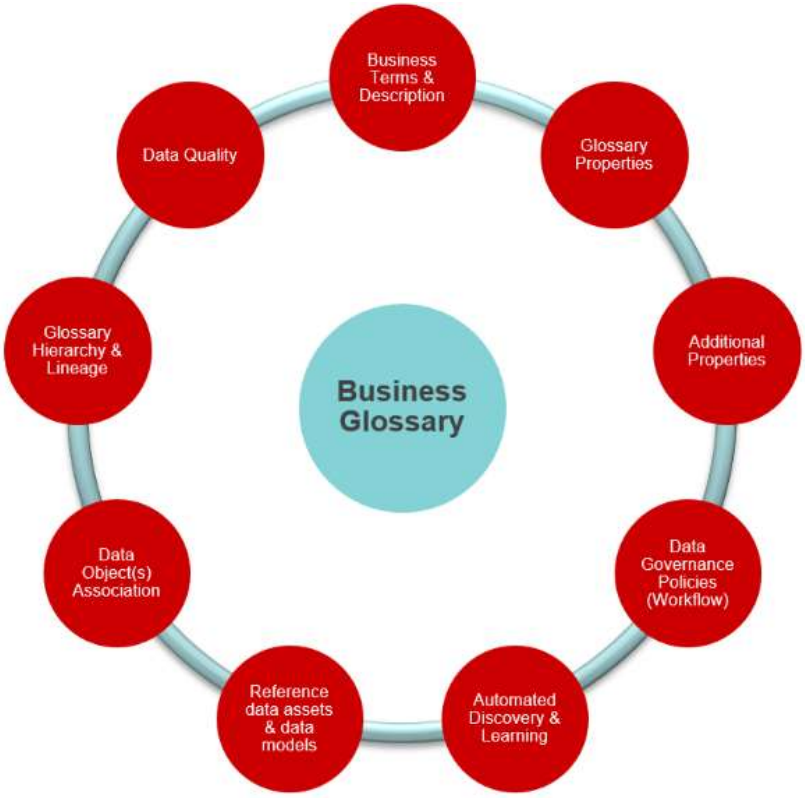

Figure 7. EPDG's components (Shrivastava, 2023)

The Pool of Refined CBBs

Projectsrefined CBBs and ABBs,use existing services' architecture frameworks and standards; and they are managed by the TDM which synchronizesDisassembling processes. ABBs are existing templates that are used for instantiating Solution BBs(SBB) that is APplication Domains' (APD)agnostic. The TDM uses The Open Group's (TOG) Architecture Framework, like TOGAF that includes a generic BBs, CBBs, ABBs, and SBBs guidelines that (The Open Group, 1999): 1) Manage packages, functionalities; 2) Standardizes interfaces that can be used for the PRWC; 3) Offers interoperability; 4) ICS awareness; 5) Uses the ADM based TDMto manage CBBs and BBs as shown in Figure 8.

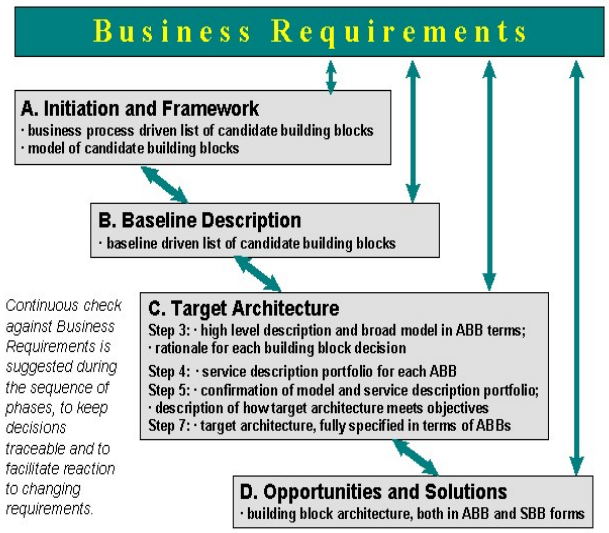

Figure 8. TOGAF's BBs are managed (The Open Group, 1999)

Entity's Reference Models

The IHIPTFand TDM use the Technical Reference Model (TRM) that offers a generic concept for CBBs, ABBs, BBs. (simply Block) and its services, which makes Blocks are interoperable, as shown in Figure 9. Blocks and services' interoperability is ensured by the communications infrastructure and is leveraged by the transformed ICS and Pool. The The MDTCAS offers in the common methodological language the "1:1" mapping concept. The TDM depends on requirements, CBBs/BBs, and ABBs that are based on refined services, interfaces, and standards (The Open Group, 2011c). Disassembling activities for (Trad, 2023d): 1) is Breaking-down legacy components into a set of classified Blocks; 2) Simplifies the implementation phase and IHIPTF's interfacing; 3) Aligns Blocks by using the "1:1" mapping concept; and 4) Enables the development of IHIPTF patterns, templates, and EA/TDM models.

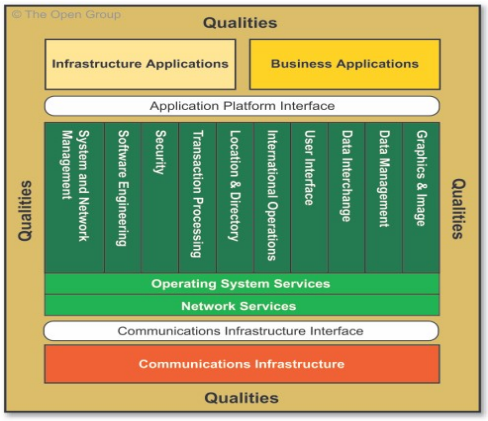

Figure 9. The TRM's services' categories (The Open Group, 2011c)

Disassembling Models and Procedures

Disassembling extractsAPD and standard/common resources and models that are included in the MDTCAS that can include (Trad, 2023d): 1) Object Management Group's (OMG)Decision Making Notation (DMN)that can be usedfor modelling operational decisions like in (RedHat, 2022; The Open Group, 2021): 1) Adapting BPMs; 2) CSA_DTs evaluations; and 3) Supporting Disassembling to deliver needed artefacts.

The Disassembling CSA Processing and Findings

This CSA's resultant Factors are:

- The CSFs: 1) Legacy_Transformation; 2) EPDG_Implementation; 3) ARP_Capacities; 5) Reference_Models; and 6) IHIPTF's integration.
- The VARs: 1) Legacy_Transformation_VAR; 2) EPDG_Implementation_VAR; 3) ARP_Capacities_VAR; 5) Reference_Models_VAR; and 6) IHIPTF_Integration_VAR. And a related structure as shown in Figure 10:

  publicstructEPDG_Implementation_VAR

```
        {
        publicEPDG_Implementation_VAR(
                                                    string    key,
                                                    string    value
                                                )
        {
                ....
        }
        publicintcKey{ get; }
        publicintcValue{ get; }

        publicstringToString() =>$"({cKey},{cValue})";
        }
```

Figure 10. The EPDG_Implementation_VAR structure

This CSA_DT uses the defined Factors, as shown in Table 3 that is 8.25 that corresponds to "Risky". The details are on how the CSA_DT was processed in the PRWC section.The Disassemblingprocesses depend on the established PEMM.

Critical Success Factors	AHMM4CBB: KPIs	Weightings
CSF_Disassembling_Legacy_Transformation	Feasible	From 1 to 10. **09 Selected**
CSF_Disassembling_EPDG	Mature	From 1 to 10. **10 Selected**
CSF_Disassembling_CBB_BB_ABB	VeryComplex	From 1 to 10. **07 Selected**
CSF_Disassembling_Reference_Models	Complex	From 1 to 10. **08 Selected**

valuation

Table 3. The CSA_DT outcome is 8.25

THE PEMM

Basics

There are many ways to builda PEMMfor the IHIPTF and its modules. PEMM depends on the Entity's ICS components and structure, as well as on its organizational structure. APEMMshould be theEntity's, IHIPTF, ICS,Projects'point of reference, and itestablishes a method-relational/modelon how to avoid commercial-only ICS/AI products, promotes XHFRs detection, and the synchronization of Project's activities.To build a PEMM there is the need to (Trad, & Kalpić, 2020a, 2020b; Trad, 2023e): 1) Implement an EPDG, IHIPTF, TDM, Pool, and MDTCAS; 2) Implement thevariant of the AHMM; 3) Use Entity's (and external) data-sources like Relational Data Bases(RDB) and Entity RDBs (ERDB) as shown in Figure 12; 3) Use an Asset Management System (AMS); and other.

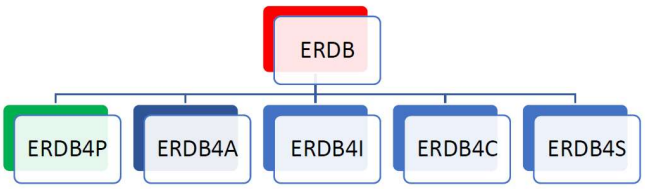

Figure 11. The ERDB based PEMM (Trad, 2023e)

The ERDB is the basis of Intelligencethat needs Entity Meta-Base (EMB) for storage purposes.

The EMB

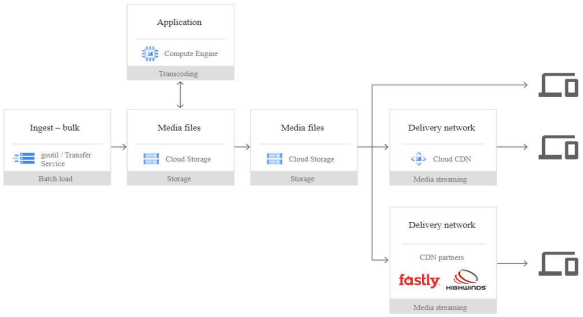

Figure 12. The EDM (Google 2022a)

The IHIPTF uses an EMB that can use the ERDB or any other support to persistence and cross-Entity checking activities (Codd, Codd, and Salley 1993), as shown in Figures 11 and 12. Besides the popular ERDB, the EMB can use: 1) An AMS that integrates various types of subsystems like the: Information Technology AM (ITAM), Hardware AM (HAM), and Software AM (SAM); 2) External/Commercial environments like the Enterprise Data Management (EDM) as shown in Figure 12. The EMB is supported by the PEMM.

The PEMM Construct

The PEMM as shown in Figure 13, is the Entity's, IHIPTF's, and Projects' ultimate reference model, and supports all IHIPTF's modules.PEMM is the result of the Disassembling phase and is long-term circular process where the Blocks, AHMM, APM, PRWC, and Project evolve and diverge togetherto an end-solution. Project's complex EA and TDM models use the PEMM to link various types of artefacts(Schmelzer, 2021; Della Croce, T'kindt 2002).

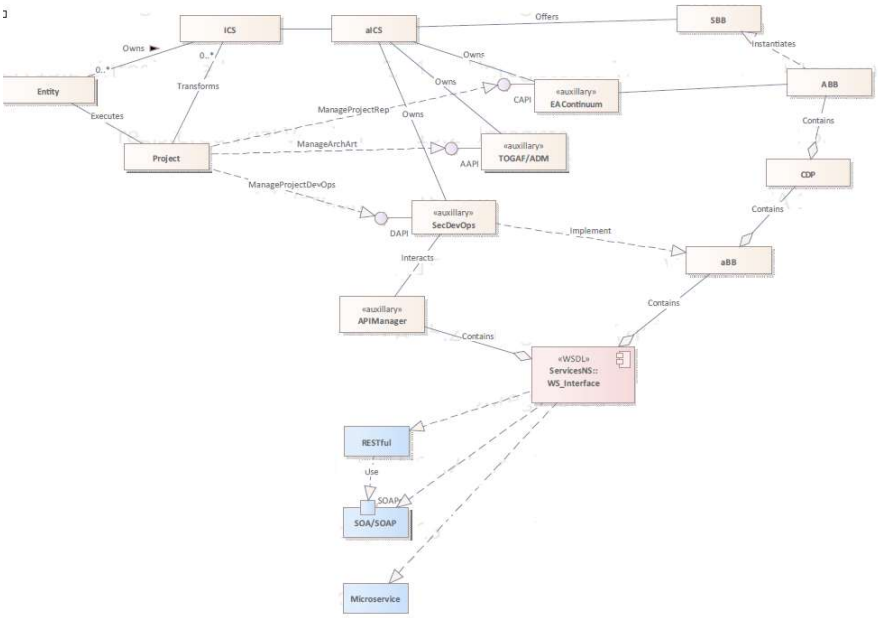

Figure13. A version of aPEMM.

The PEMM CSA Processing and Findings

The resultant Factors are:

- The CSFs: 1) PEMM_Feasibility; 2) Fundements_Conept; 3) Disassembling_Sync; 4) Global_Construct; and 5) IHIPTF_Integration.
- The VARs: 1) PEMM_Feasibility_VAR; 2) Fundements_Conept_VAR; 3) Disassembling_Sync_VAR; 4) Global_Construct_VAR; and 5) IHIPTF_Integration_VAR, like theIHIPTF_Integration_VARexample shown in Figure 14.

```
publicstructIHIPTF_Integration_VAR
{
    publicIHIPTF_Integration_VAR(
                                    int  BB_Interface_Type,
                                    int  BB_Interface_Adr
                                )
    {
        ....
    }
    publicintBB_Interface_Type{ get; }
    publicintBB_Interface_Adr{ get; }

    publicstringToString() =>$"({BB_Interface_Type},{BB_Interface_Adr})";
    }
```

Figure 14. The IHIPTF_Integration_VAR structure

This CSA_DT uses the defined Factors, as shown in Table 4which is 8.25,what corresponds to "Risky". The PEMM depends on the FMS' integration.

Critical Success Factors	KPIs	Weightings
CSF_PEMM_Basics	Complex	From 1 to 10. **08 Selected**
CSF_PEMM_EMB_Meta_Modelling	Possible	From 1 to 10. **09 Selected**
CSF_PEMM_Relate_Disassembling	VeryComplex	From 1 to 10. **07 Selected**
CSF_PEMM_IHIPTF_Construct	Possible	From 1 to 10. **09 Selected**

valuation

Table 4. The CSA_DT outcome is 8.25

THE SET OF FACTORS AND THE FMS' INTEGRATION

Integrating Factors

The FMSis used to integrate various levels of Projects' risks and the FMS is based on CSAs and other categories of Factors, where (Myers, Pane, & Ko, 2004; Neumann, 2002; Trad, & Kalpić, 2018a): 1) Each CSA corresponds to an Entity APD or common functional domain, like for example, logistics, finance; 2) Each CSF maps to a set of requirements and problems, like for example, accounting activities; and 3) Each KPI corresponds to a uniqueEntity's ICS item that is linked to a VAR. Entity's FMS and ICS' libraries and resources are synchronized by the TDM (Lankhorst, 2009).A Factor is evaluated and mapped to the PRWC that is initially estimated in the first TDM iteration and then tuned through all the TDM's iterations; and all these processes are supported by the IHIPTF (Morrison, 2016). Once the initial set of CSFs has been identified, then the *Project* can use the FMS to tune the next iterations' CSFs. The FMS cyclically links to Project's: Requirements, Architecture blueprints, Intelligence items, ICS components, and aligns Blocks (Syynimaa, 2015). All IHIPTF related worksare based on empirical engineering models.IHIPTF's FMS delivers a set of Factorsthat are aligned withthe Project'sobjectives and the defined/selected CSAs(Trad & Kalpić, 2018a).

The CSAs

IHIPTF'srepository contains and maps to Project's selected CSAs (which in turn map to CSFs, and other types of Project'sIntelligence resources, like services, architecture models, requirements) as shown in Figure 15.

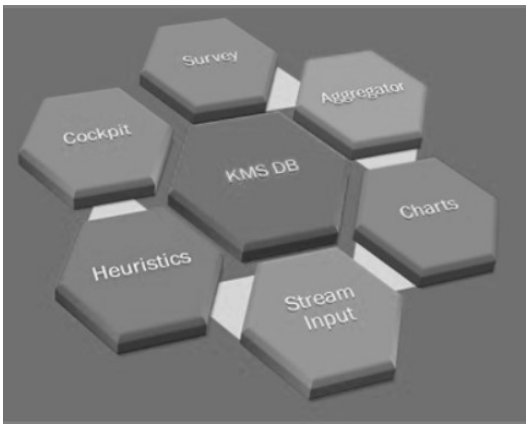

Figure 15. Intelligence subsystem that contains CSAs' information.

The CSA maps to CSFs and other Project's resources is supported by the TDM (The Open Group, 2011a; Trad, & Kalpić, 2018a). A Project contains sets of Factors that are selected in the Project's initial/vision phase, where CSAs have: 1) A static view has a similar static structure like the relational model's structure that relates sets of CSAs and CSFs; knowing that integrity checks can be applied on them (Lockwood, 1999); and 2) A dynamic view which is the real-world implementation of IHIPTF'srepository.

The CSFs

A CSF is a set of integrated KPIs, and a KPI related/maps to a uniqueProject requirement and/or problem type as shown in Figure 16. The Project Team identifies the initial set of Factors to be managed by the FMS (Peterson, 2011).

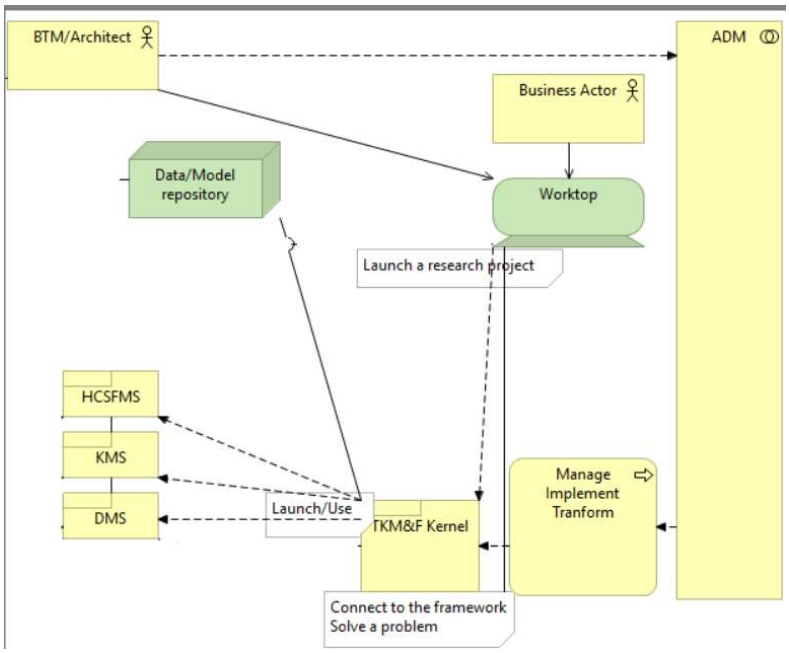

Figure 16. The TDM's architecture method's interaction

Therefore, CSFs are important for the mapping between Project's and/or IHIPTF's problem

types(simply Problem), Intelligence constructs, and other Entity's items and resources. A CSFs reflects a Problem with its predefined constraints. The PRWC evaluates performances of CSAs, where CSFs (their corresponding KPIs and VARs) can be internal or external to the frameworks, like (Trad & Kalpić, 2018a, 2020a; Visual Paradigm, 2019): 1) A Project problem type or GAPA is an internal CSF; 2) Intelligence is a real-time engine that uses Factorsthat correspond to problem type solution(s). The TDM manages the Project'siterationsand FMS'interactions; 3) TDM's preliminary phase selects Factors and sets up the PRWC; 4) The TDM vision and business architecture phases calibrates PRWC's constraints and Objective Functions (OF); 5) ICS' (technology) architecture phase selects technology's sets of Factors; and 6) TDM's requirements management (and test) phase use the PRWC for the evaluation of Factors like KPIs.

The KPIs and VARs

A CSF is a set of KPIs, and a KPI related/maps to a unique Project requirement and/or problem type(s). FMS's default CSFs/KPIsneed a detailed PRWC interaction, where a KPI is used for the mapping between Project's objectives, business requirements, VARs, organisational structure (Putri,& Yusof, 2009).

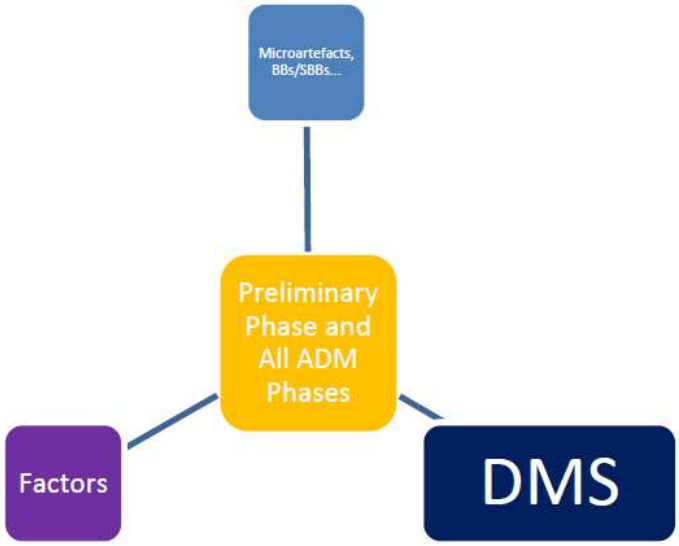

Figure 17. The relations between ADM based TDM's phases and FMS/Factors.

A Project establishes and links initial sets of Factorsthat is a complex process and that is based on:

Analysis = ∑ Factors, abstracts the risk and GAPA on the level of a Project.

Factors = ∑ CSAs, abstracts the risk and GAPA on the level of a subsystem or a sub-Project or APD.

CSA = ∑ CSFs, abstracts the risk and GAPA on the level of a APD component or topic.

CSF = ∑ KPIs, abstracts the risk and GAPA on the level of Blocks or a bundle of services.

KPI = ∑ Variables (VAR), abstracts, and attributes of ICS service(s).

The symbol ∑ relates to processing of a series of Project transformational equations, and not to the definition of ***sumof***. Decisions based on GAPA(s) for formulating a Project's strategy and status, are based on the analysis of the external and internal CSAs and hence CSFs and KPIs (and VARs). CSFs and KPIs are key elements in Projects and their planning. A CSA is a category (or set) of CSFs where in turn a CSF is a set of KPIs, where a KPI maps (or corresponds) to a single requirement and/or software artefact or a service, where a service can be Service Oriented Architecture (SOA) or Micro Services Architecture (MSA) based. For a Project requirement, feature, or problem type, the Team selects Factors that can interface high-level environments/methods like the Strengths, Weaknesses, Opportunities, Threats (SWOT) as shown in Figure 17 (Trad, & Kalpić, 2018a).

Factors Patterns and Rules

Factors pattern(s)are persisted in IHIPTF's repository like Blocks and are (re)used by the FMS and PRWC because they offer: 1) Predefined set(s) of Factorsto be usedby Intelligence and GAPA; 2) Defined responsibilities, relationships,best practices, and content; 3) Relationships betweenBlocks and other artefacts; 4) Default Factors' values; and 5) Interfaces to evaluation rules.A Projectstarts with TDM's initial phase which is also the feasibility checking phase. This phase checksifthe Project is feasible and the possibilities of XHDRs (Što je to?); andFMS offers the following set of rulesto check Factors (Trad, & Kalpić, 2018a):

- R1: Checking of References evaluates their credibility and that can be done by the Team. That should take into account that existing rankings are less important. Referencesrelate to various types of literature and other resources which are linked to CSFs.The credibility of these references is estimated by KPIs that are related to Project requirements. References are empirically weighted as follows (Azadfallah, 2018): 1) The Team's or researcher's experiences that add up to 20% of the estimation value; 2) Existing statistical checkers like Gartner, Forester and others make 20% of the estimation value; 3) Various company's and specialists' surveying yields 20% of the estimations value; 4) Factors resultant from prototyping of application-sources provide 20% of the estimation value; and 5) Usinga PoC and Project's statuses build the final 20% of the estimation value.
- R2: Projects result in organisational changes and success of these changes is measured by Factors using GAPA or similar concepts.
- R3: Applied modelling language which modifies the diagrams and artefacts, can help in the estimation.

- R4: The Meta-Model which provides changes in the diagrams and artefacts can help at the estimation.
- R5: The TDM which is matureand the diffs between phases can help the estimation.
- R6: If the aggregations of all Project'sCSA_DTs are positive and exceed the defined minimum, the Projectcontinues to its PoC (or phase 2) where it is attempted to solve the problems.

The Factors and FMS CSA Processing and Findings

The resultant Factors are:

- The CSFs: 1) FMS_Feasibility; 2) Factors_Defaults; 3) KPI_VAR_Interface; 4) Patterns_Collection; 6) Sets of Rules_; 5) FMS_HDT_Processing; and 6) IHIPTF's integration.
- The VARs: 1) FMS_Feasibility_VAR; 2) Factors_Defaults_VAR; 3) KPI_VAR_Interface_VAR; 4) Patterns_Collection_VAR; 6) Rules_Sets_VAR; 5) FMS_HDT_Processing_VAR; and 6) IHIPTF's integration_VAR; and the related example is FMS_HDT_Processing_VAR structure, as shown in Figure 18:

```
publicstructFMS_HDT_Processing_VAR
{
    publicFMS_HDT_Processing_VAR(
                                    int  cInterfaceType,
                                    int  cReturnStat
                                )
    {
        ….
    }

    publicintcInterfaceType{ get; }
    publicintcReturnStat{ get; }

    publicstringToString() =>$"({cInterfaceType},{cReturnStat})";
    }
```

Figure 18. The FMS_HDT_Processing_VAR structure

This CSA_DT uses the defined Factors, as shown in Table 5 that is 8.5,what corresponds to "Risky".

Critical Success Factors	KPIs	Weightings
CSF_FMS_PRWC_Integration	Mature	From 1 to 10. **10 Selected**
CSF_FMS_Factors	Possible	From 1 to 10. **09 Selected**
CSF_FMS_IHIPTF_ICS_VARs	Complex	From 1 to 10. **08 Selected**
CSF_FMS_Patterns_Rules	Complex	From 1 to 10. **08 Selected**

valuation

Table 5. The CSA_DT outcome is 8.50

THE AHMM

The Kernel Model's Basics

The model has a composite structure and content that can be viewed as follows:

- The statical view, which shows definitions, artefacts, and relationships.
- The behavioural view, which is an instance(s) of the statical view.
- As the skeleton of theIHIPTF and its modules like the FMS, PRWC.
- IT defines the interface to external frameworks.
- It defines QQRMM's usage and integration.

The QQRMM

The initial set of Project problem types and their selected/related Factors are initialized in TDM's preliminary phase (or initial iteration). Then, IHIPTF's HDT inputs various sets like: Constraints, Rules, Datasets, Configurations, and other, which are stored in IHIPTF'srepository. The use of simplistic quantitative analysis is very limited and there is the need for a qualitative method that enriches the Entity's Learning Process (ELP). The QQRMM based HDT evaluatesProjects' problem types and proactively detects violations of the defined constraints and applied rules. The ARbLP based ELP is suitable for complex Projects, because AR is helpful in education and can be defined as the process of learning and improves the quality of transformational and implementation processes. AR provides the Team with valuable experiences and knowledge improving the ELP and supports the resolvingof Project problems and PRWC tuning processes. AR uses a systematic process and offers solutions to the problem types, wheresolutions can include bridging/interfacing the gap between PRWC related theory, recommendations, and practices (Hine, 2013). The QQRMM based HDT and related ARbLP based ELP enhance the transformational model and structure.

The Transformational Model and Structure

The adoption of a holistic, cross-functional, and Polymathic modelling approach is supported by the AHMM and its AHMM4IHIPTF variant, which uses a multi-level Disassembling process. The HIPTF identifies and assesses strategic and critical Factors and hence risks,in order tosupport and guaranty Entity's operationsand business coherencies, by using the AHMM4IHIPTF, which constitutes its structure. For a given Project and HIPTF requirement (or Problem), the AHMM4IHIPTF based Intelligence identifies the initial sets of Factors and related sets of actions, to be used by the ARbLP based HDT/ELP. There is an immense lack of a Polymathic-holistic approach to Projects and thePRLR used the following resources: 1) Articles and resources related to Projects, FMS, Factors' evaluations, ICS (re)engineering, AI/HDT, …; 2) The authors' RDP/PRLR works, and IHIPTF; 3) Project's and HIPTF's feasibility concept; 4) Initial sets of Factors; and 5) RDP's use of the Empirical Engineering Research Model (EERM) (Easterbrook, Singer, Storey, & Damian, 2008). A Polymathic-Mathematical Model (PMM) is a subset of real-world system's

behaviours, capabilities, and possibilities, where the PMM is description of a limited and precisely defined reality, which can be abstracted to support a Project and PRWC(Polderman& Willems, 1998). The AHMM is a PMM variant because:

- A PMM provides abstractions of a real-world of a physical system or module (Hinkelmann, 2016).
- Modelling is a descriptive EA/design process, which validates PMM principles (Sankaralingam, Ferris, Nowatzki, Estan, Wood, & Vaish, 2013).
- The usage of EA, AI, and HDT can be used by a PMM.
- The gap between the PMM based Project's adoption and its usage is still very important today (Syynimaa, 2015).
- A PMM optimizes Projects by using FMS, Factors, and PRWC (Dogan, Çalgici, Arditi, & Gunaydin, 2015).
- A generic variant of the PMM, is the proposed AHMM4IHIPTF (Giachetti, 2012; Kim & Kim, 1999).
- An applied PMM is the description of an Entity, Project, and PRWC, using MMs, and languages (Sankaralingam, Ferris, Nowatzki, Estan, Wood, & Vaish, 2013).
- Multi-criteria or a multi-Factors model for Intelligence needs a QQRMM and ARbLP based ELP (Zandia,& Tavana, 2011).
- An PMM is optimal for an EERM based RDPs (Easterbrook, Singer, Storey, & Damian, 2008).
- The PMM is the base of a Project's Meta-Model (Morawski, 2013).
- The PMM is the base structure for Project's and Entity's Viewpoints.

PMM based Viewpoints and Evaluations

The Requirements Viewpoint "R" and "W":

mcREQ = m KPI (R1)

mcMappingmcArtefact/mcREQ = mcArtefact + mmcREQ (R2)

FTR = mcREQ (R3)

PRB = mPRB (R4)

REQ = mCSF = UmcREQ (R5)

REQ = U FTR + U RUL + U CNT + U DIA + U REL (R6)

The Viewpoint "M"':

sMA = ∑ aBB + ∑ sBB + ∑ aMVC (C1)

sBB = ∑ UP+ ∑ sMA + ∑ sOPM (C2)

sCBB = ∑ sBB + ∑ sABB + ∑ SBB (C3)

sIBB = ∑ sCBB (C4)

Unit = ∑ sIBB (C5)

…

sUnit = ∑ sSUPL (C10)

……

WGT	€ {1 … 10}	(B1)
mcENT	= UmcArtefact	(B2)
OU or Sector	= APD[n]	(B3)
ENT	= U OUs (or Sectors	(B4)
CSA(OU or APD)	= ∑ CSF	(B5)
OU_Element	= OU[n or element], € {1 … k}	(B6)
CSF(OU_Element)	= ∑KPI	(B7)
KPI	= ∑VAR	(B8)
TVR	= FUN(VAR/ARG)	(B9)
FUN(ARG)	= WGTxQNT(ARG) v/&WGTxQLT(ARG)	(B10)
CSA(i)	= CSF(i)*WGT(i)+ CSF(i+1)*WGT(i+1)+…	(B11)
CSF(i)	= KPI(i)*WGT(i)+KPI(i+1)*WGT(i+1)+…	(B12)
KPI(i)	= VAR(i)*WGT(i)+VAR(i+1)*WGT(i+1)+…	(B13)
VAR(i)	= Call to ICS struct…	(B14)
∑ WGT	= 1 (or 100 % max)	(B15)
∑ CSF	= 1 (or 100 % max)	(B16)
∑ KPI	= 1 (or 100 % max)	(B17)
∑ VAR	= 1 (or 100 % max)	(B18)

Factors define Project's initial nodes that are defined as vital for its success and targets to be reached. AHMM4IHIPTF's basic element are used in IHIPTF, which is a specific model. The AHMM4IHIPTF nomenclature is presented in Figure 19:

- The symbol ∑ indicates summation of IHIPTF's actions, denoting the relative importance of the set members selected as relevant. Ratings and weightings are integers ranging in ascending importance from 1 to 10.
- The symbolU indicates sets union.
- The AHMM4IHIPTF defines the Project and IHIPTF as models.

Basic AHMM's Elements and Artefacts

Basic Mathematical Model's (BMM) Nomenclature

Iteration	= An integer variable ***"i"*** that denotes a *Project/ADM iteration*	
microRequirement	= (maps to) KPI	(N1)
CSF	= Σ KPI	(N2)
Requirement	= (maps to) CSF = ⋃ microRequirement	(N3)
CSA	= Σ CSF	(N4)
microMapping microArtefact/Req	= microArtefact + (maps to) microRequirement	(N5)
microKnowledgeArtefact	= ⋃ knowledgeItem(s)	(N6)
neuron	= action->data + microKnowledgeArtefact	(N7)
microArtefact / neural network	= ⋃ neurons	(N8)
microArtefactScenario	= ⋃ microartefact	(N9)
AI/Decision Making	= ⋃ microArtefactScenario	(N10)
microEntity	= ⋃ microArtefact	(N11)
Entity or Enterprise	= ⋃ microEntity	(N12)
EnityIntelligence	= ⋃ AI/Decision Making	(N13)
BMM(*Iteration*) as an instance	= EnityIntelligence(*Iteration*)	(N14)

The Generic AHMM's Formulation

AHMM	= ⋃ ADMs + BMMs	(N15)

AHMM's Application and Instantiation for IHIPTF

Domain	= PRWC	(N16)
AHMM4(*Domain*)	= ⋃ ADMs + BMMs(*Domain*)	(N17)

Figure 19. AHMM's nomenclature (Trad, & Kalpić, 2020a)

The Applied Transformation Mathematical Model

The AHMM4IHIPTF is composed of: 1) A static view; 2) A dynamic (or behavioural) view; and 3) A pool of reusable ARbLP based scenarios. The AHMM4IHIPTF can be modelled using following formula for Entity Transformation Mathematical Model (ETMM) that abstracts the Project:

$AHMM4IHIPTF = Weigthing_1 * AHMM4IHIPTF\_Qualitative + Weigthing_2 * AHMM4IHIPTF\_Quantitative$ (N18).

$AHMM4IHIPTF = \sum AHMM4IHIPTF$ for an Project iteration (N19).

$ETMM = \sum AHMM4IHIPTF$ instances (N20).

$Weigthing_1$ and $Weigthing_2$ are delivered by the PRWC. ETMM'sOF optimization is done by using constraints and extra variables that need to be tuned. These variables (for maximization or minimization) can be, for example: Team's Polymathic capacities, costs, or another Factor. For

IHIPTF's PoC the success will be the main and only constraint and success is quantified as a binary 0 or 1, where the objective function minimizes ETMM's risks and identifies IHIPTF's efficiency. The ETMM is a combination of used methodologies and AHMM4IHIPTF. The AHMM4IHIPTF is a part and the skeleton of IHIPTF that used scenarios to support FMS and PRWC requests (Kim,& Lennon, 2017). Theinitialization phase generates Problems and cross-functional aspects to be analysed by using the IHIPTF (Agievich, 2014).

The AHMM CSA Processing and Findings

```
publicstructQQRMM_Feasibility_VAR
{
 publicQQRMM_Feasibility_VAR(
                                        Array   QQRMM_List,
                                    )
 {
        ….
 }
 publicintQQRMM_List{ get; }
 publicstringToString() =>$"({QQRMM_List})";
 }
```

Figure 20. The QQRMM_Feasibility_VAR structure

The resultant Factors are:

- The CSFs: 1) QQRMM_Feasibility; 2) Elements_Sets; 3) Transformational_Model; 4) Viewpoints; 5) ETMM; and 6) IHIPTF_Integration.
- The VARs: 1) QQRMM_Feasibility_VAR; 2) Elements_Sets_VAR; 3) Transformational_Model_VAR; 4) Viewpoints_VAR; 5) ETMM_VAR; and 6) IHIPTF_Integration_VAR, like for example QQRMM_Feasibility_VAR structure as shown in Figure 20:

This CSA_DT uses the defined CSFs and KPIs, as shown in Table 6 that is 9.40 that corresponds to "Mature".

Critical Success Factors	KPIs	Weightings
CSF_AHMM4IHIPTF_Basics_QQRMM	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4IHIPTF_Transformational_Model	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4IHIPTF_Elements_Blocks_Artefacts	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4IHIPTF_Viewpoints	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4IHIPTF_ETMM	Possible	From 1 to 10. **09 Selected**

valuation

Table 6. The CSA_DT outcome is 9.40

THE PRWC

The Role of the PEMM, AHMM4IHIPTF, IHIPTF, and PRWC

PEMM which is a genericMetaModel has the following characteristics:

- Has a static and dynamic form.
- Is AHMM's (and hence AHMM4IHIPTF) basic structure and its integrity checker.
- It defines Rules, Constraints, HDT, Intelligence, and other basic structures and their integrity checkers.
- Is FMS' basic structure and its integrity checker. Which ensure that Factors are measurable and mapped to a ratings and weighting.
- It aligns Factors and Project's Unit of Work (UoW) that needs the needed level of granularity and responsibility. There also the need to implement The "1:1" mapping, implementation and classification concept.
- Is IHIPTF's structure.
- Is the Project's GAPA enabler.

The ADM based TDM synchronizes MetaModel's implementation and evolution.

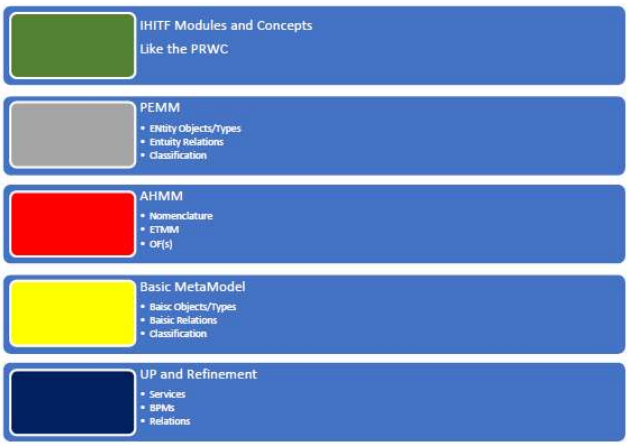

Figure 21. The IHIPTF layers of models

TDM'sRole

The TDM manages the Project's implementation phases that coordinate use of the IHIPTF, which supports(Visual Paradigm, 2019):

- The preliminary phase defines the relevant Factors and their evaluation by the PRWC.
- The architecture vision and business architecture phases define rules, constraints, and OF(s).
- The information system architecture phase selects the ICS's related Factors.
- The technologies architecture phase selects the technology's related Factors.
- The requirements management and tests phases manage the PRWC based evaluations.
- The coordination of its and external modules to finalize the Project.

The Project's first phase (or the feasibility phase) uses the IHIPTF to define, check the selected Factors (that are stored in CSA_DTs) and needed modules. These checks verify if objectives were reached and proposes a set of next HDT actions.

HDT's Actions

For a Project requirement (or problem type), the IHIPTF identifies the related Factors, to be processes by the HDT based Intelligence. HDT's actions in the form of scenarios are dynamically evaluated (Neumann, 2002). Factors are important for the mapping between the requirements, CBBs, ICS, and Intelligence (Peterson 2011).

A Project can use a standard/commercialPRWC(s) or like in IHIPTF, it builds its own one, which functions as follows:

- The weighting for each CSA is CSA_WGT ϵ { 0.00% … 100.00% } which is a floating-point value/percentage value, which are derived from CSA_DT as one CSA_DT and a set of CSFs).
- The selected corresponding weightings to CSF ϵ { 1 … 10 } are fixed integer values.
- The selected corresponding ratings to CSF ϵ { 0.00% … 100.00% } are floating point percentage values.
- A weighting is defined for each PRWC CSF, and a rating for each KPI.
- The selected corresponding ratings for a KPI is KPI_RAT ϵ { 0.00% … 100.00% } and is derived from: 1) An ICS application/module variable(s) (simply VAR); 2) Estimated by the IHIPTF or a domain specialist; or 3) An external concept.
- CSA_WGT = ∑CSF*CSF_WGT.
- CSF_WGT = ∑KPI*KPI_RAT.
- KPI_RAT = ∑VAR*VAR_RAT.

Interfacing the System

It interfaces the system by:

- The AHMM4IHIPTF applies the HDT, which uses the PRWC.
- PRWC (Project-iteration i) = ∑CSA*CSA_WGT.
- The AHMM4IHIPTF applied a research mixed model, which uses a PRWC.
- Intelligence uses the HDT which is mainly qualitative method and has specific calls to quantitative methods.
- Can use external solutions.

The PRWC can use standard/commercial solutions like:

- The Object Management Group's (OMG) (OMG, 2022): 1) The DMN to support CSA_DTs' evaluations; 2) For implementing business decisions and business rules; and is optimal for Project's status checking; and 3) For HDT's operations.
- The weighted criteria matrix that supports: 1) Intelligence to evaluate Projects; and is based on the evaluation criteria (that has weighted by ratings). By evaluating alternatives based on KPIs with respect to defined criteria; and 2) A decision-making module that evaluates projects based on defined evaluation criteria weighted by ratings.

Interfacing Intelligence and the Evaluation Process

The Intelligence and PRWCuse the HDT which is a QQRMM (mainly a qualitative concept that

uses targeted quantitative methods).The PRWC needs to be supported by the ARbLP based ELP and Intelligence to solve various problems. The PRWC has the objective to use critical thinking-based concept that combines: 1) ELP; 2) AHMM4IHIPTF, and HDT based decision making; 3) FMS; 4) Provides a Polymathic approach; 4) Usesthe TDM; 5) Supports the usage of the IHIPTF; and 6) Uses success metrics and rules.The Project's evaluationstarts with phase 1 (PHASE_1) called the feasibility phase, which checks if the whole Project is feasible. Then it tries to evaluate the success rate, using the most important Factors, which are evaluated using the following rules:

- Rule 1: labelled the reference checker, all types of used references, they should be credible and are estimated by the authors; the notions of official ranking is less important and are ignored.
- PRWC-related references must be credible and are estimated by the authors, Intelligence and have to conform to IHIPTF's classification concept.
- Rule 2: labelled the change launcher, Projectslike GA are the result of *Entity* or organisational changes in regions, the references are evaluated as presented in the previous point (Rule 1).
- Rule 3: labelled the logic checker, an applied modelling language or Natural Language Programming (NLP) should be used in a limited manner, to make the Project'sGA manageable and not too complex.
- Rule 4: labelled the organisational construction, the ADM is considered to be mature, unfortunately that does not mean that Projects'phases are successful and in fact their success rate is very low.
- Rule 5: labelled the Project iteration management, the ADM is appropriate for any *Project's* GA iterative management and interface with IHIPTF'siterations.
- Rule 6: labelled the aggregation phase, if the aggregations of all the ProjectGA'sCSA/CSF tables are positive and exceeds the defined minimum the Project'sGAcontinues to execute the PoC and can be used for a problem solving.
- Project's iterationsare the result of evaluated Factors.
- TDM's modelling language capacities and their mappings to KPIs.
- To estimate if the TDM can be used to manage the PRWC and Project, using KPIs.
- The TDM manages IHIPTF's iterations and Factors' tuning.
- If the aggregations of all Project's CSA_DT are positive (the result is stored in the final Table) and exceed the initially defined minimum, then the Project continues to PoC's execution, which uses the selected ACSs.

Evaluating GAPA

GAPA is used to evaluate performances of the Project and its modules. Where it can be also used for each Entity's CSA, where CSFs can be: 1) A status for a resource like a requirement; 2) Mapping levels of UPs BBsand PRWC outcomes; 3) GAPAs storage and comparison; 4) Synchronization of TDM phases; and 5) HDT based Intelligence requests calls. KPIs relate to VARs from BBs, so HDT based evaluation processes can automatically estimate the values of CSAs, and CSFs. Therefore, GAPA for ???:

- For a TDM Iteration (ITR) (G1)

- A Project is done on all CSAs (G2)
- Project(ITR)=CSA(1)*RAT(1)+CSA(2)*RAT(2)+… (G3)
- GAPA(ITR)=Project(ITR)-Project(ITR-1) (G4)
- Risk=∑ GAPA(ITR) (G5)

The PRWC CSA Processing and Findings

The resultant Factors are:

- The CSFs: 1) PEMM_AHMM_Application; 2) TDM_Usage; 3) HDT_FMS_Usage; 4) Intelligence_Integration; and 5) GAPA_Exec.
- The VARs are: 1) PEMM_AHMM_Application_VAR; 2) TDM_Usage_VAR; 3) HDT_FMS_Usage_VAR; 4) Intelligence_Integration_VAR; and 5) GAPA_Exec_VAR, like for example Mixed_Methodology_Basics_VAR structure as shown in Figure 22:

```
publicstructGAPA_Exec_VAR
{
 publicGAPA_Exec_VAR(int  GAPAValue)
 {
      ….
 }
 publicintGAPAValue{ get; }
 publicstringToString() =>$"({GAPAValue})";
 }
```

Figure 22. The GAPA_Exec_VAR structure

This CSA_DT uses the defined Factors, as shown in Table 7 that is 9.0 that corresponds to "Feasible".

Critical Success Factors	KPIs	Weightings
CSF_PRWC_PEMM_AHMM	Complex	From 1 to 10. **08 Selected**
CSF_PRWC_TDM	Possible	From 1 to 10. **09 Selected**
CSF_PRWC_HDT_FMS	Proven	From 1 to 10. **10 Selected**
CSF_PRWC_Intelligence	Possible	From 1 to 10. **09 Selected**
CSF_PRWC_IHIPTF_GAPA	Possible	From 1 to 10. **09 Selected**

valuation

Table 7. The CSA_DT outcome is 9.0

THE ADM BASED TDM

Selecting the Viewpoint for the TDM

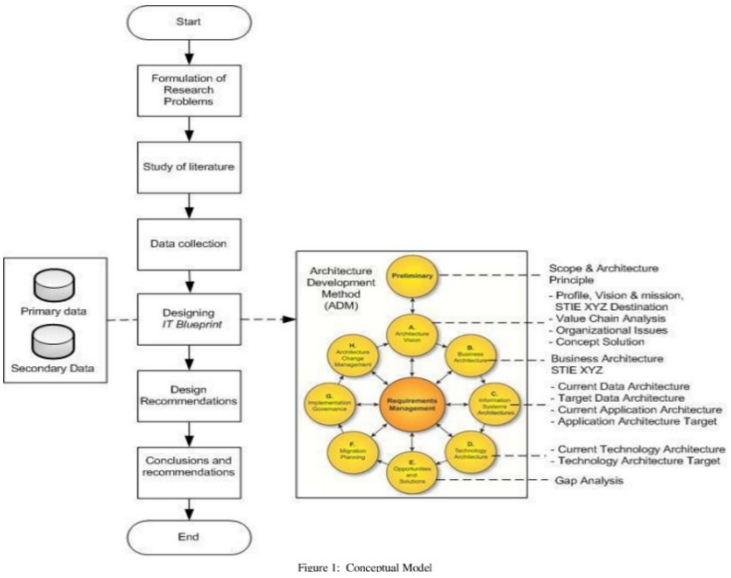

Figure 23. ADM's phases (The Open Group, 2011a, 2011b; Holilah, Girsang, &Saragih, 2019)

Projects depend on Entity's structure which needs the application of selected Viewpoint(s) which for this RDP is Viewpoint "R", "C" and "W", where"W"is the main "W". The TDM synchronizes Project's phases and manages RDP, IHIPTF, PRWC, and the HDT to solve Problems as shown in Figure 23 (Markides, 2011).Projects are Polymath which needs cross-functional knowledge and expertise to solve complex APD problems. For modelling the TDM can use existing frameworks like TOGAF/ADM, Unified Modelling Language (UML), or other. Where modelling designs the transformed Entity that includes thePRWC and the TDM manages Project's implementation, and maintenance processes.The TDM supports the IHIPTFin pointing to the: 1) Right vision(s)/Viewpoint(s); 2) Principles; 3) FMS/Factors; 4) Standards/Frameworks; 5) PEMM and AHMM4IHIPTF; 6) Team's skills; 7) GAPA/Intelligence; and 8) MDTCAS and Blocks.

The MDTCAS

TheIHIPTFintegrates the MDTCAS and TDM to manageBlockswhich can be used in APD modelling activities and support a Digital Transformation (DT) (Chaione 2022). The MDTCAS supports UPs to integrate standard methodologies, like TOGAF/ADM. The MDTCAS, as shown in Figure 23, is a mixture of existing methodologies like (Trad, 2023d):

- Legacy methodologies, like the Structure Analysis and Structured Design (SA/SD).
- Object Oriented (OO) Methodology (OOM),UML And ArchiMate.
- The Entity Relationship Diagrams (ERM) for data-modelling.
- DMN that is similar to the PRWC.
- BPM Notation (BPMN).

- …

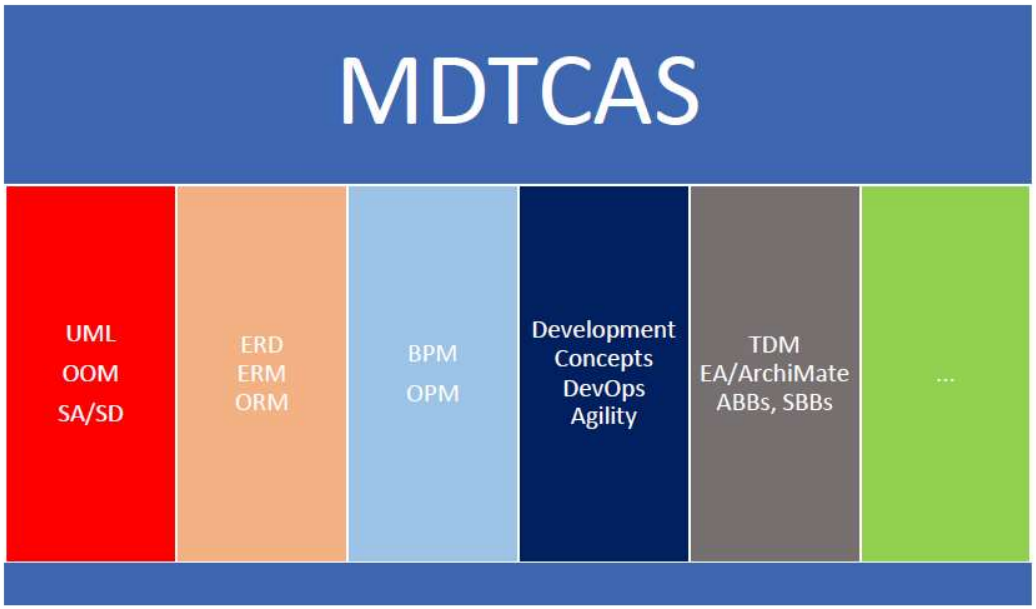

Figure 23. MDTCAS'Layers (Trad, 2023d)

MDTCAS can use methodologies based on OOM features inherited from three OOM: Rumbaugh, Booch, and Jacobson methodologies (Liu, 2022). The MDTCAS is non-locked-in methodology that supports: 1) The transformation of Mainframe/legacy-code/system to SA/SD models and basic OOM/UML entity-class(es); 2) To transform existing OOM/UML models/diagrams based modules/components to designed/mapped UML/Choreography models, using classes, sequences, communication models, ERM, and BPMN diagrams; 3) Implement the TDM on Spiraled/UML, ADM, DevOps , or other; 4) Use requirements engineering to specify Use Case (UC), Analysis, Design, Implementation, and Testing diagrams; 5) UCs support the Disassembling process; 6) Assembles refactored CBBs that represent behaviour (the functionalities) (Hosiaisluoma, 2022); and 7) Use the PEMM as a reference (Trad, 2023d).

Entity's Cartography and Reference Models

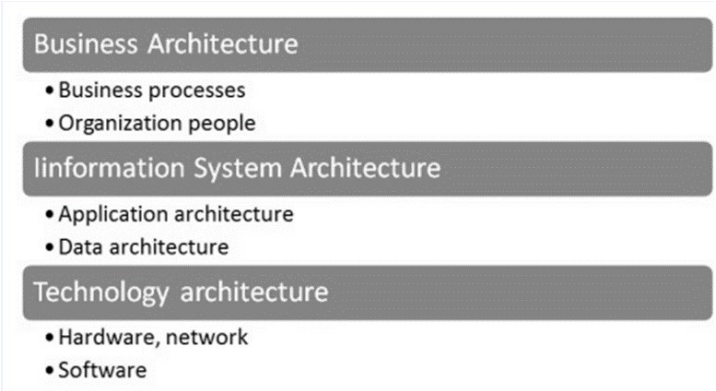

Figure 24.EA and TDM layered concept

The generation of Entity's EA diagrams, catalogues, and matrixes needs various conditions to be fulfilled first (Trad, 2023a):

- The success of the Disassembling process and the establishment of an MDTCAS.
- The establishment of a central Pool of Blocks.
- Factors to be selected and tuned.
- The Project is agnostic to any APD and methodology/ICS.
- The EA models and TDM map to Entity's and Project's cartography of applications which are classified.
- Classifications can be done using TOGAF's Application Communication Diagram (ACD).
- The ACD depicts related models and mappings that respect PEMM.
- An ACD represents an existing applications' cartography, or a logical architecture of the transformed ICS.
- A dimension of the applications' cartography should be dedicated to TDM's and IHIPTF's usages.
- The PEMM supports Entity's application's cartography which part of EA layered concept as shown in Figure 24.

The EA layered concept includes: Business Architecture, Data Architecture, Application Architecture, and Technology Architecture (Bizzdesign, 2022).

PRWC based Continuous Improvements and GAPA

The Project can use the PRWC for continuous improvements and ELP enhancements that can include topics like: Evolutive quality, Teams' philosophy, Cross-functional Teams, PEMM as a reference, XHFRs,Governanceand renewal, Transformation techniques, Linking PRWC to Project's and IHIPT's modules, Managers' education ICS' evolutions, Societal changes, Project experiences, … (Satterlee, 1996).

The TDM CSA Processing and Findings

The resultant Factors are:

- The CSFs are: 1) Viewpoints_Establishement; 2) MDTCAS_Usage; 3) Cartography_Generation; 4) PEMMIntegrity; and 5) IHIPTF's integration.
- The VARs are: 1) Viewpoints_Establishement_VAR; 2) MDTCAS_Usage_VAR; 3) Cartography_Generation_VAR; 4) PEMM_Integrity_VAR; and 5) IHIPTF's integration_VAR. An example is PEMM_Integrity_VAR, shown in Figure 25:

```
publicstructPEMM_Integrity_VAR
{
    publicPEMM_Integrity_VAR(
                                        int  IntegrityValue,
)
```

```
        {
            ....
        }
        publicintIntegrityValue{ get; }
        publicstringToString() =>$"({IntegrityValue})";
        }
```

Figure 25. The PEMM_Integrity_VAR structure

This CSA_DT uses the defined Factors as shown in Table 8 that is 8.75 that corresponds to "Feasible".

Critical Success Factors	KPIs	Weightings
CSF_TDM_Viewpoints	Complex	From 1 to 10. **08 Selected**
CSF_TDM_MDTCAS	Proven	From 1 to 10. **10 Selected**
CSF_TDM_Cartography	Complex	From 1 to 10. **08 Selected**
CSF_TDM_UP_CBBs	Possible	From 1 to 10. **09 Selected**
CSF_TDM_PEMM	Possible	From 1 to 10. **09 Selected**

valuation

Table 8. The CSA_DT outcome is 8.75

INTELLIGNCE

Basics

All IHIPTF's modules like the FMS, HDT, GAPA, and PRWC interface Intelligence which supports complex problem-solving activities. Project's and Intelligence's Polymathic/holistic concepts that are based on the building of complex systems need a systemic approach (Daellenbach,& McNickle, 2005). The Project and its IHIPTFare supported by Intelligence that is based on various components like the HDT, ELP and other. Intelligence provides just-in-time solution(s) for pre-defined Problems. Possible solution(s) propose sets of actions, recommendations on changes and their implications. Intelligenceintegrates the QQRMM, HDT, KMS, and DMS to solve problems and enrich ELPs. PRWC's integration risks' management is an important pre-requisite to finalize a Project (Hussain, Dillon, Chang,& Hussain, 2010).

QQRMM and the Scope

The AHM4IHIPTF is mainly a qualitative beam-search heuristic tree (Della Croce, &T'kindt, 2002), and in each of its nodes a quantitative call/functions can be executed, with the scopes: 1) Precision or objectivity referring to used data, constraint (or rules); 2) Time (or timestamp) of execution for the tracing system; 3) Space, related to the Entity's space; and 4) Scope of the HDT and hence PRWC. The HDT uses IHIPTF's NLP that can be used for any APD and in general for hard systems' thinking that integrates scripting subsystem (Moore, 2014). The NLP uses heuristics/rules, EA models QQRMM Blocks (Simonin, Bertin, Traon, Jezequel& Crespi, 2010). NLP's are (Clancy, 2019): Efficiency, Simplicity, Less bugs, In-built concurrency constructs, High-level of memory and

speed drawbacks, Improves testing…

The HDT

The IHIPTF is based on the PEMM and AHMM4IHIPTF and uses the FMS to interface the ARbLP/ELP based HDT. The proposed RDP use is intentedand optimal for cautious and evolutive Projects, where AR can be used to improve ELPs (Trad & Kalpić, 2017a, 2017b; Aksoy, & Ceylan, 2021). The HDT problem-solving process is supported by the ELP based Intelligence. The HDT uses: 1) ANNs that has a set of connected tree-nodes named Artificial Neurons (AN); 2) ELPs based on algorithms; 3) Intelligence is based on a set of AHMM instances based mainly on beam-search based heuristic processing (Della Croce, &T'kindt, 2002); 4) The PRWC support the HDT; 5) AR is as a set of continuous beam-search heuristics processing steps (Järvinen, 2007); 6) Supports fast changes; and 7) The AHMM4IHIPTF is responsible for the QQRMM for problem solving and synchronizes a set of AHMM4IHIPTF instances that support dynamic tree algorithm, as shown in Figure 26 (Nijboer, Morin, Carmien, Koene, Leon, & Hoffman, 2009) that manages HDT's nodes.

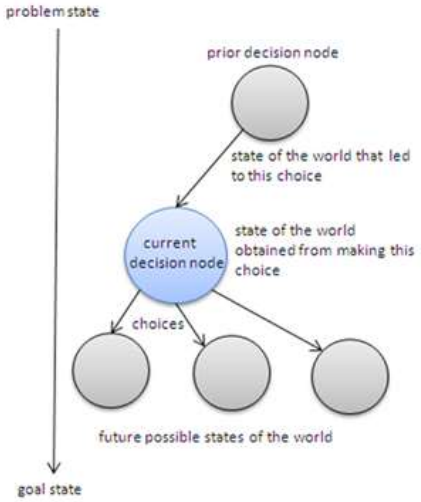

Figure 26. The applied heuristics tree algorithm (Nijboer, Morin, Carmien, Koene, Leon, & Hoffman, 2009)

Therefore, ARLP based ELP enables reflective practices that are the basis of a Polymathic/holistic approach to develop Projects and developing an IHI Intelligence(Leitch, & Day, 2006).

Implementing the IHI KMS and DMS-Intelligence's Kernel

The ELP manage Entity and Project's Knowledge Items (EPKI) that are related-linked to Entity's/Project's resources and modules like PRWC, Intelligence...The IHIPTF supports the Entity's Legay KMSwhich can be transformed to manageEPKIs that are in turn linked to PRWC and FMS/Factors. Intelligence supports Project's enhancements and interfaces all the IHIPTF's modules and uses the PRWC to evaluate Factors. The KMSpart of Intelligence, identifies theconcerned Factors their PRWC evaluation processes,whichalso estimates the XHFR (Rockart, 1979). The KMS interfaces the FMS that links a Factor (like a CSF) to one or more EPKI that in turn corresponds to various NLP scenarios. IHI NLP scenarios manage Intelligence's requests and control various IHIPTF's modules activities-actions. The PRWC enables FMS' patterns to

enhance-modify the KMS, which delivers information-answers in the form of EPKIs and the needed set of actions. A Project'schange request can generate a large set of actions and solutions, whose implementations can generate a new set of problems. A successfully integrated KMS with the FMS can give major advantages in generating automated decision making for dynamic business services' eco-systems (Clark, Fletcher, Hanson, Irani, Waterhouse & Thelin, 2013). Such services are also used by the IHI DMS.For aFMS-PRWC based DMS, the Team selects and tunesFactors, which are then orchestrated by the NLP scripts. The DMS is used in all Project's processes which contain sets of Factors that are mapped to Blocks (or sets of actions/services); like the ones that are presented in this chapter's PoC. Intelligence is the most important module for DTs and Projects in general.

DT's Implementation

As shown in Figure 27, DT's goal is to have a common platform of Blocks, BPMs and other artefacts which improve Entity's Time-to-Market (TtM). DTs are strategic objectives, but Projects' digitizations are complex and have XHFRs (Eira, 2022). The DT uses the IHITF to disassemble legacy systems and enable the use of TDM, MDTCAS, and EA digitized models and to define DT's scope (Bizzdesign, 2022). A successful DT is the base of a successful Project that needs Polymathic skills as shown in Figure 28.

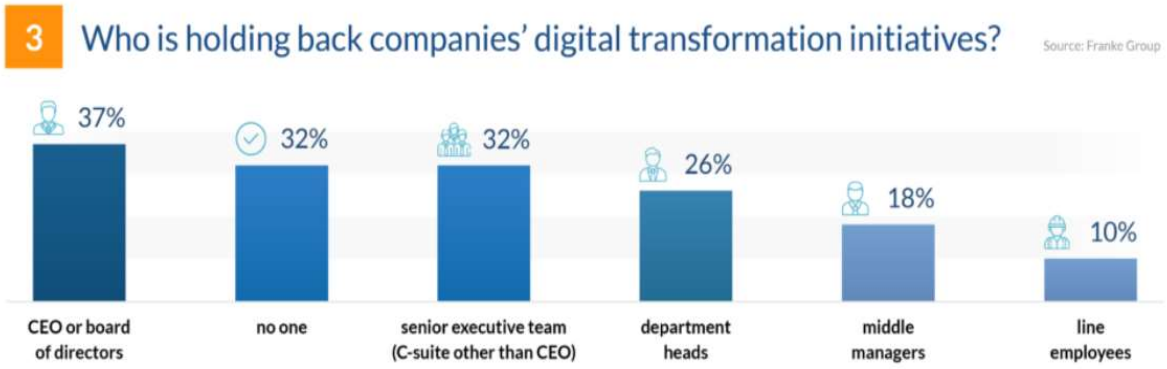

Figure 27. An APD viewpoint on the rejection of DTs (Eira, 2022)

This chapter's section (like this RDP) is a Project CSA, and the PoC is based on PRWC focused ACSs, which are combined with a common EA based ACS that originates from the Open Group (Jonkers, Band, &Quartel, 2012a). The EA based ACS covers Project ICS, EA, modelling, linking KPIs, and basic transformation scenarios.

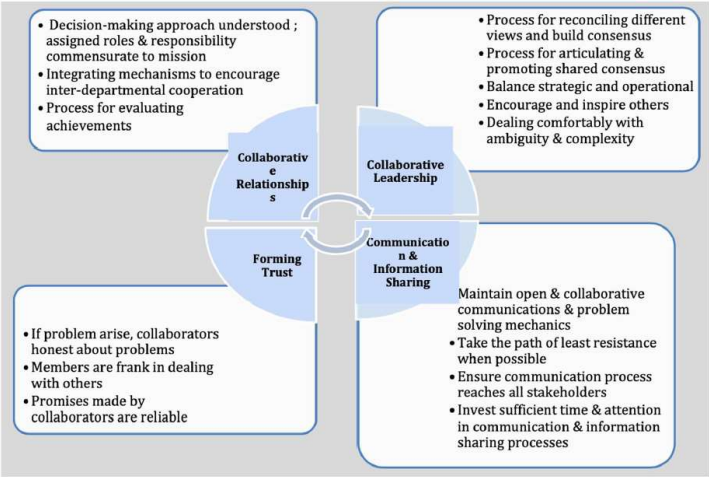

Figure 28. Four dimensions of cross-functional/Polymathic collaboration (Morse, 2020).

The GAPA

GAPA is done by the DMS which uses the HDT to narrow the Project's gap by using local GAPAs for the: AHMM, FMS-Factors, Pool of Blocks, PEMM-MDTCAS, TDM… The PEMM enables GAPA's execution in various Project's levels, phases, and on various ICS components. GAPA can be done on TDM's phases, to show if there were improvements, regressions, and eventual XHFRs.

The Intelligence CSA Processing and Findings

The resultant Factors are:

- The CSFs are: 1) QQRMM_Application; 2) HDT_Access; 3) KMS_DMS_Integration; 3) GAPA_Processing; and 4) IHIPTF's integration.
- TheVARs are: 1) QQRMM_Application_VAR; 2) HDT_Access_VAR; 3) KMS_DMS_Integration_VAR; 3) GAPA_Processing_VAR; and 4) IHIPTF's integration_VAR, like theHDT_Access_VAR structure example as shown in Figure 29:

```
publicstructHDT_Access_VAR
{
  publicHDT_Access_VAR(
                                int  HDT_Access_Args
                            )
  {
        ….
  }
  publicintHDT_Access_Args{ get; }
  publicstringToString() =>$"({HDT_Access_Args})";
  }
```

Figure 29. HDT_Access_VAR structure

This CSA_DT uses the defined Factors as shown in Table 9 that is 9.25 that corresponds to "Mature".

Critical Success Factors	KPIs	Weightings
CSF_Intelligence_Basics	Proven	From 1 to 10. **10 Selected**
CSF_Intelligence_QQRMM	Proven	From 1 to 10. **10 Selected**
CSF_Intelligence_HDT	Possible	From 1 to 10. **09 Selected**
CSF_Intelligence_DMS_KMS	Possible	From 1 to 10. **09 Selected**
CSF_Intelligence_IHIPTF_GAPA	Complex	From 1 to 10. **08 Selected**

valuation

Table 9. The CSA_DT outcome is 9.25

THE PROOF OF CONCEPT

Introduction and ACS

Factors deduced from an ACS, that is used in Projects to evaluate success rates and they are managed by a FMS that are used in this PoC, which tries to show how the IHITF's modules, like the PRWC estimates Project's success or failure(Lebreton, 1957; Ronald, 1961). The ACS/PoC select and tune Factors with this question in mind: "What are the essential Factors that guarantee success?" (Spencer, 1955). The ACS is an insurance management system (ArchiSurance) that wants to transform its legacy system that has a mainframe, claim files-services manager, and a customer file-services manager. The ACS explains how to manage, register, accept, valuate, and invoice claims-related activities (Jonkers, Band, &Quartel, 2012). The ArchiSurance is undergoing a merger where the legacy systems are siloed and use multiple formats and ICS. For this PoC, a holistic approach is tested to structure the sets of Factors and evaluate them with the PRWC. The transformed ICS has to improve data-quality and Factors evaluations, as shown in Figure 30.

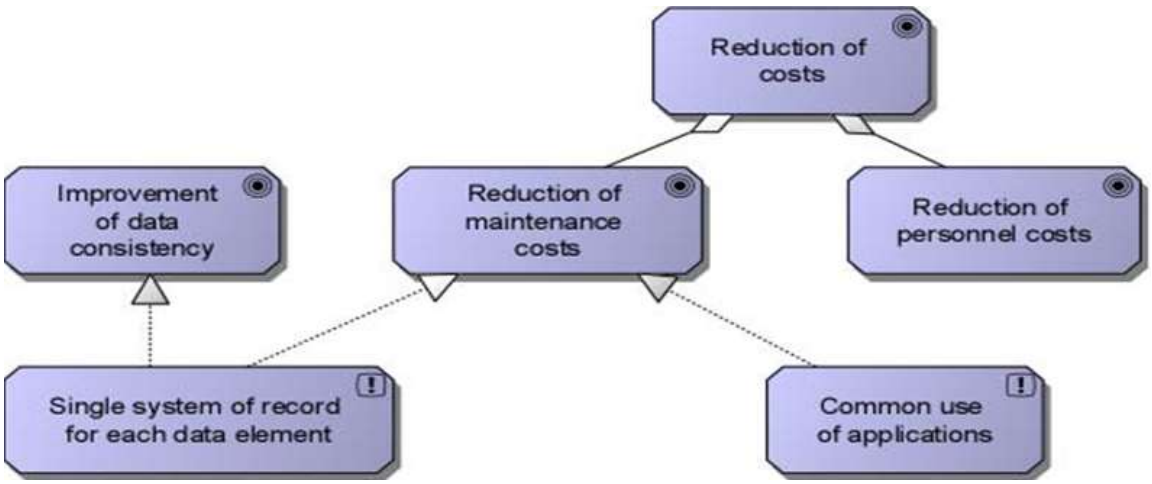

Figure 30. Project's transformation goals (Jonkers, Band, &Quartel, 2012)

FMS' and TDM's Interactions

The setup of FMS's implementation phases looks as follows:

- Phase A or the Architecture Vision phase, establishes an architecture effort and initiates an iteration of the architecture development cycle by setting its objectives/scope, constraints, and goals, which all are translated into sets of Factors for the FMS and hence the PoC.
- Phase B or the Business Architecture phase shows how the Project's target architecture implements key requirements and relate them to the IHIPTF, FMS and PRWC.
- Phase C or the GAPA phase shows and uses the ACD, which shows the modelled target application landscape.
- Phase D or the Target Technology Architecture and GAPA phase shows the final Project's infrastructure.
- Phases E and F, Implementation and Migration Planning; the transition architecture proposes possible intermediate situation and evaluates (with the IHIPTF and PRWC) the Project's status using defined Factors.

Evaluating RDP's CSA_DTs

The PRWC interfaces the Intelligence and its Factors which are presented and evaluated in Table 10 and using the CSA_DT's Tables Weighting and Rating Enumerator (CTWRE) that is shown in Figure 31.

CTWRE Label	Limit's Value	Description	Color
Proven, Mature	9.01-10.00	Success	Green
Possible, Feasible	8.51-9.00	Success	Green
Risky	8.01-8.50	Important Risk	Yellow
Complex	7.01-8.00	Unclear	Red
VeryComplex	5.01-7.00	Will probably fail	Red
Impossible	0.00-5.00	Failure	Red

Figure 31. The CTWRE's values

The PRWC-required skills have mappings to Project's resources and the PRWC defines relationships between the Project and Projects.

CSA Category of CSFs/KPIs	Transformation Capability	Average Result	Table
The RDP's Integration	Mature	From 1 to 10. 9.20	1
Team's Setup	Risky	From 1 to 10. 8.50	2
Disassembling Process	Risky	From 1 to 10. 8.25	3
PEMM's Implementation	Risky	From 1 to 10. 8.25	4
FMS' Integration	Risky	From 1 to 10. 8.25	5
AHMM's Integration	Mature	From 1 to 10. 9.40	6
PRWC's Integration	Feasible	From 1 to 10. 9.0	7
TDM' Integration	Feasible	From 1 to 10. 8.75	8
Intelligence's Integration	Mature	From 1 to 10. 9.25	9
IHIPTF/Phase's 1 Outcome	Risky	From 1 to 10. 8.80	10

Evaluate First Phase

Table 10. The PRWC RDP's outcome is (rounded) 8.80

The PoC was implemented using *IHIPTF* and the initial activity was to setup Factors, then the scripting interface was launched to implement the needed programs to process the Factors/CSAs. After initializing *IHIPTF's* client, Factors/CSFs were linked to a specific node of the ARbLP/HDT. The programs linked the AHMM4IHIPTF instance to the set of HDT/Intelligence actions which uses Intelligence actions. Table 10 presents Phase's 1 results that the PRWC and Projects are "Risky". PRWC is not an independent component and is linked to all IHIPTF's modules. The AHMM4IHIPTF's main constraint to implement the PRWC is that CSAs having an average result below 8.0 will be ignored. This work's conclusion with the result of 8.80 implies that PRWC's integration is "Risky" and due to various types of complexities. As Phase 1 is not a "Failure", the PoC continues to IHIPTF's setup.

IHIPTF's Setup and Configuration

The PoC configures the FMS and Factors, then these Factorsare mapped to Projects resources and artefacts. The FMS contains the relationships thatlinkProject's requirements, CBBs, NLP scripts,Factors, and Global Unique IDentifiers (GUID). IHIPTF'sclient's interface that is shown in Figure 32 sets up all the Project's operations like NLP scenarios development and linking scripts to Factors and CBBs.

Figure 32. The IHIPTF*'s* graphical interface

NLP scripts are the backbone of Intelligence and contain the define sets of actions to be processed. The AHMM4IHIPTFensures PRWC's integrity and HDT's tree configuration as shown in Figure 33.

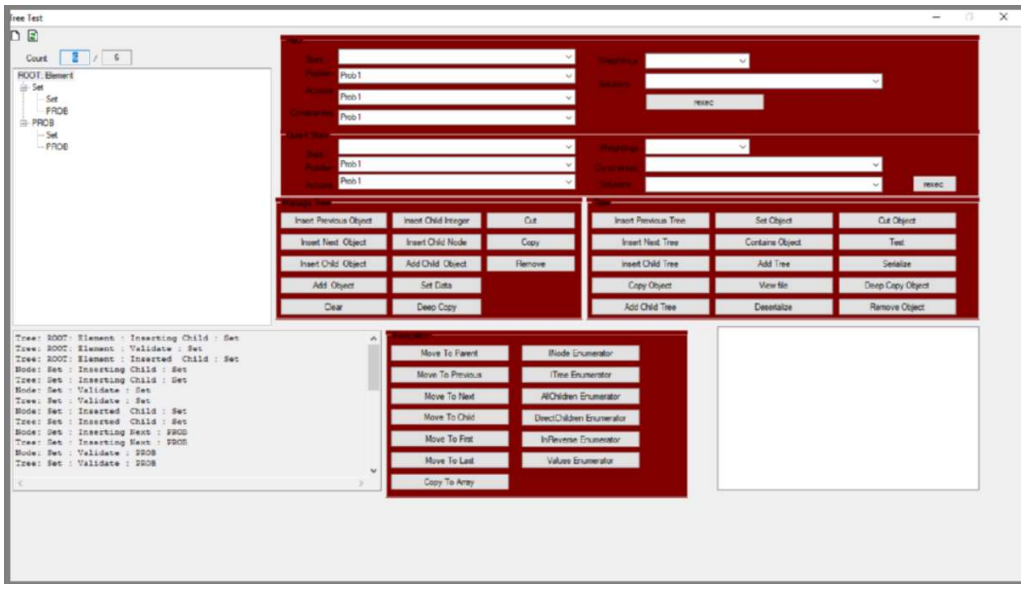

Figure 33. The heuristics tree configuration

Phase 2-Solving a Concrete Problem

Phase 2 contains the following TDM's steps and operations:

- TDM's setup and its integration with the FMS, GAPA, and PRWC.
- Sub-phase A establishes the PEMM, Disassembling approach and its goal.
- Sub-phase B establishes IHIPTF's target models.
- Sub-phase C shows and uses the ACDand describesIHIPTF's activities.
- Sub-phase D shows the needed IHIPTF'sand Project's infrastructural landscape.
- Sub-phases E and Fpresents intermediate Project's situation(s) and evaluates PRWC; and updates the list of Problem (or PRB) to be solved.

PRBs Solving for aconcrete HDT Node:

- Intelligence solves PRBs, where Factors to defined set of actions which are processed in a selected/concrete HDT node. For this aim the action CSF_IHIPTF_Integration_Procedure(from the Intelligence CSA) was executed and offers sets of solutions(SOL). Solving PRBs involves the execution of actions and delivering SOLs for multiple Project's activities, where each action can deliver a new PRB and that generates the HDT tree. The HDT uses the QQRMM and contains a dual-OF that contains: 1) In Phase 1 the IHIPTF has implemented NLP scripts to process CSA_DTs, and related PoC's resources to theCSF_IHIPTF_Integration_Procedure; 2) Intelligence is configured and uses the PRWC support the HDT; 3) LinkingHDT's node to data-contents; and 4) The HDT executes the CSF_IHIPTF_Integration_Procedure and delivers SOL(s).

SOL Nodes activities:

- NLP scripts are called by the IHIPTF's modules like the PRWC.
- These scripts are processed in the background to deliver IHIPTF's modules value(s).
- These values are translated into actions, conclusions, and recommendations.

CONCLUSION AND RECOMMENDATIONS

This RDP proposes a set of recommendations on how to implement a IHIPTF for Projects in any APD. The IHIPTFuses FMS, PRWC, GAPA, and Factors to iteratively assert Project's feasibility and because of the low score of8.80 (Table 10)implies that it is "Risky", and the resultant recommendations are:

- IHIPTF shows how to implement an Anti-Locked-In (ALI) transformation framework.
- This RDP uses a QQRMMconcept.
- The PRLR proved the existence of an important knowledge gap and XHFRs.
- The AHMM4IHIPTF and ELP based HDT support Intelligence.
- The HDT supports IHIPTF's modules reasoning, like in the case of the PRWC.
- Cross-functional/Polymathic skills are needed.
- The IHIPTF uses and interfaces existing frameworks, standards, and methodologies, like TOGAF, SWOT, Six Sigma...
- The GAPA and PRWCevaluateProjects' progress.
- The PoC checkedIHIPTF's feasibility.
- The IHIPTFintegration is complex and "Risky".

REFERENCES

Agievich, V. (2014). Mathematical model and multi-criteria analysis of designing large-scale enterprise roadmap. PhD thesis – Mathematical modelling, numerical methods and complexes of programs.

Aksoy, M., & Ceylan, T. (2021). An Action Research on Improving Classroom Communication and Interaction in Social Studies Teaching. Volume 2021 | Article ID 9943194 | https://doi.org/10.1155/2021/9943194.

Azadfallah, M. (2018). A New Entropy-Based Approach to Determine the Weights of Decision Makers for Each Criterion with Crisp and Interval Data in Group Decision Making Under Multiple Attribute. International Journal of Service Science, Management, Engineering, and Technology (IJSSMET). IGI Global. DOI: 10.4018/IJSSMET.2018100103.

Bizzdesign (2022). Digital Transformation. Bizzdesign. https://bizzdesign.com/blog-category/digital-transformation/

Chaione (2022). Digital Transformation-The 4 Types of Digital Transformation. Chaione.com.

Clancy, L. (2019). Functional programming reaches for stardom in finance. CME Group. https://www.risk.net/risk-management/6395366/functional-programming-reaches-for-stardom-in-finance

Clark, M., Fletcher, P., Hanson, J., Irani, R., Waterhouse, M., Thelin, J. (2013) Web Services Business Strategies and Architectures. Apress. USA.

Codd E.F., Codd S.B., and Salley C.T. (1993). "Providing OLAP (On-line Analytical Processing) to User-Analysts: An IT Mandate". Codd &Date,.

Crittenden, V. (2005). Cross-functional education: The need for case development. February 2005. Journal of Business Research. 58(7):955-959. DOI: 10.1016/j.jbusres.2003.12.004. https://www.researchgate.net/publication/4967219_Cross-functional_education_The_need_for_case

_development
Daellenbach, H., McNickle, D., & Dye, Sh, (2012). Management Science - Decision-making through systems thinking. 2nd edition. Palgrave Macmillian. USA.
Della Croce, F., &T'kindt, V. (2002). A Recovering Beam Search algorithm for the one-machine dynamic total completion time scheduling problem, Journal of the Operational Research Society, 53:11, 1275-1280. Taylor & Francis.
Dogan, S., Çalgici, P., Arditi, D., & Gunaydin, H. (2015). Critical success factors of partnering in the building design process. METU JFA 2015/2. Department of Architecture, İzmir Institute of Technology, İzmir, Turkey.
Easterbrook, S., Singer, J., Storey, M., & Damian, D. (2008). Guide to Advanced Empirical Software Engineering-Selecting Empirical Methods for Software Engineering Research. F. Shull et al. (eds.). Springer.
Eira, A. (2022). 72 Vital Digital Transformation Statistics: 2023 Spending, Adoption, Analysis & Data. FinancesOnline. https://financesonline.com/digital-transformation-statistics/
Farhoomand, A., Lynne, M., Markus, M., Gable, G., & Khan, H. (2004). Managing (e)Business Transformation: A global Perspective. UK: Palgrave Macmillan.
Gartner (2005). External Service Providers' Service Oriented Architecture Frameworks and Offerings: Capgemini. Gartner. USA.
Giachetti, R (2012). A Flexible Approach to Realize an Enterprise Architecture. Department of Systems Engineering, Naval Postgraduate School, Monterey, CA USA. Presented: New Challenges in Systems Engineering and Architecting. Conference on Systems Engineering Research (CSER). St. Louis, MO. Elservier.
Google. (2022a). Google Cloud Platform. Google Inc. USA.
Hine, G. S. C. (2013). The importance of action research in teacher education programs. In Design, develop, evaluate: The core of the learning. environment. Proceedings of the 22nd Annual Teaching Learning Forum, 7-8 February 2013. Perth: Murdoch University. http://ctl.curtin.edu.au/professional_development/conferences/tlf/tlf2013/refereed/hine.html
Hinkelmann, K. (2016). Modelling in Enterprise Architecture. University of applied sciences northwest Switzerland. Business School. Switzerland.
Holilah, H., Girsang, A., &Saragih, M. (2019). Designing IT Blue Print Academic System on Higher Education with Togaf. Journal: Advances in Science, Technology and Engineering Systems Journal.
Hosiaisluoma (2022). Holistic Enterprise Development. https://www.hosiaisluoma.fi/blog/archimate-examples
Hussain, O., Dillon, Th., Chang, E., & Hussain, F. (2010). Transactional risk-based decision making system in e-business interactions.. International Journal of ComputSystSci& Eng (2010) 1: 15-28. CRl Publishing ltd Computer Systems. Science & Engineering.
Järvinen, P. (2007). Action Research is Similar to Design Science. Quality & Quantity. February 2007, Volume 41, Issue 1, pp 37–54. Springer Verlag. Germany. Retrieved August 10, 2018, from https://link.springer.com/article/10.1007/s11135-005-5427-1

Jonkers, H., Band, I., &Quartel, D. (2012a). ArchiSurance Case Study. The Open Group.
Kim, J., & Lennon, Sh. (2017). Descriptive Content Analysis on E-Service Research. International Journal of Service Science, Management, Engineering, and Technology (IJSSMET). IGI Global. DOI: 10.4018/IJSSMET.2017010102.
Krigsman, M. (2008). Business change failures: 9 success tips. Reviewed from http://www.zdnet.com/blog/transformationfailures/business-change-failures-9-success-tips/1080. USA.
Lankhorst, M. (2009). Enterprise Architecture at Work Modelling, Communication and Analysis. Springer, Berlin, Heidelberg. Germany.
Lebreton, P. (1957). The Case Study Method and the Establishment of Standards of efficiency. Academy of Management Proceedings, 1957, p103-103, 1p
Leitch, R. & Day, Ch. (2000). Action research and reflective practice: towards a holistic view. Taylor & Francis. Queen's University of Belfast, United Kingdom. Retrieved February 10, 2018, from https://www.tandfonline.com/doi/ref/10.1080/09650790000200108?scroll=top
Liu, A. (2022). Rumbaugh, Booch and Jacobson Methodologies. Opengenus. https://iq.opengenus.org/rumbaugh-booch-and-jacobson-methodologies/
Lockwood, R. (2018). Introduction The Relational Data Model. Retrieved January 29, 2019, from http://www.jakobsens.dk/Nekrologer.htm
Markides, C. (2011). Crossing the Chasm: How to Convert Relevant Research Into Managerially Useful Research. Journal of Applied Behavioral Science, March 2011 vol. 47 no. 1 121-134. London, UK.
Moore, J. (2014). Java programming with lambda expressions-A mathematical example demonstrates the power of lambdas in Java 8. Retrieved March 10, 2018, from, http://www.javaworld.com/article/2092260/java-se/java-programming-with-lambda-expressions.html. Accessed on 13 April 2018. Javaworld.
Morawski, R. (2013). An application-oriented mathematical meta-model of measurement. Elsevier. Journal Measurement: Volume 46, Issue 9, November 2013, Pages 3753-3765. https://doi.org/10.1016/j.measurement.2013.04.004
Morrison, M. (2016). Critical Success Factors – Analysis made easy, a step by step guide. rapidBI. Accessed and reviewed in April 2019, https://rapidbi.com/criticalsuccessfactors/
Myers, B., Pane, J., & Ko, A. (2004). Natural programming languages and environments. ACM New York, NY, USA. Accessed and reviewed in April 2019, https://dl.acm.org/citation.cfm?id=1015888 .
Neumann, G. (2002). Programming Languages in Artificial Intelligence. Bidgoli (ed) Encyclopaedia of
OMG (2022). DECISION MODEL AND NOTATION (DMN). OMG. https://www.omg.org/dmn/
Ouye, J. Facility Technics Facility Management Consulting, 505 17th Street, Suite 300, Oakland, CA 94612. USA.
Nijboer, F., Morin, F., Carmien, S., Koene, R., Leon, E., & Hoffman, U. (2009). Affective brain-computer interfaces: Psychophysiological markers of emotion in healthy persons and in

persons with amyotrophic lateral sclerosis. 3rd International Conference on Affective Computing and Intelligent Interaction and Workshops. IEEE.
Peterson, S. (2011). Why it Worked: Critical Success Factors of a Financial Reform Project in Africa. Faculty Research Working Paper Series. Harvard Kennedy School.
Polderman, J., & Willems, J. (1998). Introduction to Mathematical Systems Theory: A Behavioral Approach. (Texts in Applied Mathematics) 2nd Edition. Springer Verlag. Germany.
Pushpakumara, H., Jayaweera, P., &Manjulan W. (2021). Using the Open Group Architecture Framework (TOGAF) for Quality Assurance in Higher Education Teaching and Learning. January 2021 SSRN Electronic Journal. DOI: 10.2139/ssrn.3808691.
Putri, N., & Yusof, SM (2009). Critical success factors for implementing quality engineering tools and techniques in malaysian's and indonesian's automotive industries: An Exploratory Study. Journal Proceedings of the International MultiConference of Engineers and Computer Scientists. Volume 2. Pages 18-20.
RedHat (2022). Decision Model and Notation (DMN). RedHat. https://access.redhat.com/documentation/en-us/red_hat_process_automation_manager/7.1/html/designing_a_decision_service_using_dmn_models/dmn-elements-example-con
Rockart, J. (1979). Chief Executives Define Their Own Data Needs. Harvard Business Review, Mar/Apr79, Vol. 57 Issue 2, p81-93, 13p. Accessed and reviewed in April 2019, https://hbr.org/1979/03/chief-executives-define-their-own-data-needs
Ronald, D. (1961). Management Information Crisis. Harvard Business Review, Sep/Oct61, Vol. 39 Issue 5, p111-121, 11p.
Sankaralingam, K., Ferris, M., Nowatzki, T., Estan, C., Wood, D., & Vaish, N. (2013). Optimization and Mathematical Modeling in Computer Architecture. Morgan & Claypool Publishers.
Satterlee, B. (1996). Continuous Improvement and Quality: Implications for Higher Education. Warner Southern College (FL). USA.
Schmelzer, R. (2021). Data science vs. machine learning vs. AI: How they work together. TechTarget.
https://searchbusinessanalytics.techtarget.com/feature/Data-science-vs-machine-learning-vs-AI-How-they-work-together?track=NL-1816&ad=937375&asrc=EM_NLN_144787081&utm_medium=EM&utm_source=NLN&utm_campaign=20210114_An%20open%20source%20database%20comparison
Shrivastava, R. (2023). BUILDING AN ENTERPRISE BUSINESS GLOSSARY. HITACHI VANTARA.
https://community.hitachivantara.com/blogs/rishu-shrivastava/2023/03/23/building-an-enterprise-business-glossary
Simonin, J., Bertin, E., Traon, Y., Jezequel, J-M., & Crespi, N. (2010). Business and Information System Alignment: A Formal Solution for Telecom Services. 2010 Fifth International Conference on Software Engineering Advances. IEEE. Nice. France.
Spencer, L. (1955). 10 problems that worry presidents. Harvard Business Review, Nov/Dec55, Vol. 33 Issue 6, p75-83, 9p.

Syynimaa, N. (2015). Enterprise Architecture Adoption Method for Higher Education Institutions. Doctoral Thesis. Informatics Research Centre Henley Business School University of Reading. UK.
The Open Group (1999). Building Blocks. Introduction to Building Blocks. The Open Group. USA.
The Open Group (2011a). Architecture Development Method. The Open Group. USA. The link was reviewed and extracted in February 2018, http://pubs.opengroup.org/architecture/togaf9-doc/arch/chap05.html.
The Open Group (2011b). TOGAF 9.1. The Open Group. The Open Group. USA.
The Open Group (2021). TOGAF Model Patterns. The Open Group. https://sparxsystems.com/enterprise_architect_user_guide/15.2/model_domains/togaf_model_patterns.html
The Open Group (2011c). Foundation Architecture: Technical Reference Model. The Open Group. USA. http://www.opengroup.org/public/arch/p3/trm/trm_dtail.htm
The Open Group (2011d). Architecture Skills Framework. https://pubs.opengroup.org/architecture/togaf8-doc/arch/chap30.html . The Open Group. USA.
Trad, A. & Kalpić, D. (2014a). The Selection and Training Framework for Managers in Business Innovation and Transformation Projects-An applied mathematics hyper-heuristics model. Proceedings of the 2014 International Conference on Mathematical Methods, Mathematical Models and Simulation in Science and Engineering (MMSSE 2014). ISBN: 978-1-61804-219-4. Switzerland.
Trad, A. & Kalpić, D. (2014b). The Selection, and Training Framework selection and training framework (STF) for Manager's in Business Innovation Transformation Projects–Educational Recommendations. Journal EDEN. Zagreb. Croatia.
Trad, A. & Kalpić, D. (2014c). The selection and training framework for managers in business innovation and transformation projects: The Profile and Education of a Business Transformation Manager - An enterprise architecture approach. The Business & Management Review; London Vol. 5, Iss. 1, London: Centre for Business & Economic Research. (Jun 2014): 424-433.
Trad, A. (2015a). A Transformation Framework Proposal for Managers in Business Innovation and Business Transformation Projects-Intelligent aBB architecture. Centeris. Portugal.
Trad, A. (2015b). A Transformation Framework Proposal for Managers in Business Innovation and Business Transformation Projects-An ICS's atomic architecture vision. Centeris. Portugal.
Trad, A., & Kalpić, D. (2017a). An Intelligent Neural Networks Micro Artefact Patterns' Based Enterprise Architecture Model. IGI-Global. USA. 2017.
Trad, A., & Kalpić, D. (2017b). A Neural Networks Portable and Agnostic Implementation Environment for Business Transformation Projects. The Basic Structure. IEEE. Annecy, France. 2017.
Trad, A., & Kalpić, D. (2018a). An applied mathematical model for business transformation-The Holistic Critical Success Factors Management System (HCSFMS). Journal: Encyclopaedia of E-Commerce Development, Implementation, and Management. Hershey, PA: IGI-Global. Source Title: Using Applied Mathematical Models for Business Transformation. Pages: 36. DOI: 10.4018/978-1-7998-1009-4.ch003

Trad, A., & Kalpić, D. (2020a). Using Applied Mathematical Models for Business Transformation. IGI Complete Author Book. IGI Global. USA.

Trad, A., & Kalpić, D. (2020b). Business Transformation and Enterprise Architecture: The Holistic Project Asset Management Concept (HPAMC). Book: Handbook of Research on Strategic Fit and Design in Business. IGI.

Trad, A. (2021a). The transformation framework-The role security in the global education system. Journal: International Journal of Higher Education Management. Volume: 8, Issue 1. Centre for Business & Economic Research. UK. ijhem.com

Trad, A. & Kalpić, D. (2021a). Business transformation project's architect's profile (BTPAP). The Business & Management Review. Volume 12, Issue 2, Pages 137-153. Centre for Business & Economic Research. cberuk.com

Trad, A. (2021b). The business transformation enterprise architecture framework for innovation: The role of artificial intelligence in the global business education (RAIGBE). Journal: The Business & Management Review. Volume: 12, Issue 1, Pages: 82-97. Centre for Business & Economic Research. UK. cberuk.com

Trad, A. & Kalpić, D. (2022a). Business Transformation Project's Holistic Agile Management (BTPHAM) CBER 2022.

Trad, A., & Kalpić, D. (2023a). Educational Transformation Project's Remote Group Work (ETPRGW). Book: Shaping Online Spaces Through Online Humanities Curricula. Pages: 175-207. IGI Global. USA.

Trad, A. (2023a). Academic and Educational Transformation Projects-The Role Team-Based Learning in Polymathics (RTBLP). IGI-Global. USA.

Trad, A. (2023b). Business Transformation Projects: The Role of Psychology-Based Resistance (RPbR). Book: Considerations on Education for Economic, Social, and Environmental Sustainability. Pages: 423-457. IGI Global. USA.

Trad, A. (2023c). The Societal and Educational Transformation Projects: The Evolution of the Lebanese Diverse Education (ELDES). Book: Global Perspectives on the Internationalization of Higher Education. Pages: 233-260. IGI Global. USA.

Trad, A. (2023d). Organizational and Digital Transformation Projects-A Mathematical Model for Building Blocks based Organizational Unbundling Process. IGI Global. USA.

Trad, A. (2023e). A Relational DataBase based Enterprise Transformation Projects. Journal: International Journal of Mathematics and Computers in Simulation. Volume 17, Pages 1-11. Publisher: NAUN.

Trad, A. (2024c). Enterprise Transformation Projects- The use of the Polymathic Rating and Weighting Concept (PRWC). IGI-Global. USA.

Visual Paradigm (2019). TOGAF ADM Tutorial. Visual Paradigm. Reviewed from https://cdn.visual-paradigm.com/guide/togaf/togaf-adm-tutorial/02-togaf-adm.png

Zandia, F. & Tavana, M. (2011). A fuzzy group multi-criteria enterprise architecture framework selection model. Management Information Systems, Lindback Distinguished Chair of Information Systems, La Salle University, Philadelphia, PA 19141, USA. Elsevier.