Business, Economic, and Common Transformation Projects-The Polymathic Ratings and Weightings Concept (PRWC)

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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 approaches privilege interdisciplinary concepts for the implementations of various BTP's phases, sub-domains, and components. This chapter uses the author's Applied Holistic and Poly-Mathematical Model (AHMM) for PRWC (AHMM4PRWC), which is a variant of the author's generic and Polymathic AHMM which also includes enhancements and findings from his previous research articles and works; which are added to the PWRC. TheAHMM4PRWC supports the Polymathic Enterprise MetaModel (PEMM), where the PEMM needs the PRWC to tune and support various BTP's elements in-order to evaluate its status(es) and to check its integrity. The PEMM and PRWC combine various fields that can include 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 author's Research and Development Project (RDP), and this RDP is the continuation of his previous works and findings that are used to prove PRWC's feasibility and integration in BTPs.
Keywords: Business Transformation Projects, 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 multi-dimensional approach to RDPs and BTPs (simply Project) that contains: 1) An innovative and adapted research approach; 2) Presents how to create an In-House Implemented (IHI)

Transformation Framework (IHITF); 3) Uses IHI Methodology, Domain, and Technology Common Artefacts Standard (MDTCAS) that is based Enterprise Architecture (EA) and other existing methodologies; and 4) The Factor' Management System (FMS). The PRWC uses 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-Making System (DMS). The PRWC is based on linking and evaluating of sets of CSAs, CSFs, KPIs, and VARs (simply Factors). The vast majority of Projects have an eXtremly High Failure Rates (XHFR) that is mainly due the lack of a Holistic or Polymathic concepts that are suited for the PWRC. This chapter is intended for Project managers and engineers to present how to implement an PRWC for Projects and that be used for DMS and Knowledge Management System (KMS) (simply Intelligence) activities. The PRWC for enterprises or organizations (simply Entity), needs an agile and collaborative IHITF that offers an Action Research (AR) based Learning Process (ARbLP) that can learn and persist experiences from any type of encountered Projects' problems. The PRWC interfaces 1) An common and limited version of EA that has the form of the MDTCAS (Pushpakumara, Jayaweera, & Manjulan, 2021); 2) DMS, Heuristics Decision Tree (HDT), and KMS (simply Intelligence); 3) The AHMM4PRWC or any other Mathematical Model (MM) (Trad, & Kalpić, 2020a); 4) A pool of ICS services (Trad, 2015a, 2015b); and other IHITF modules and phases, as shown in Figure 1.

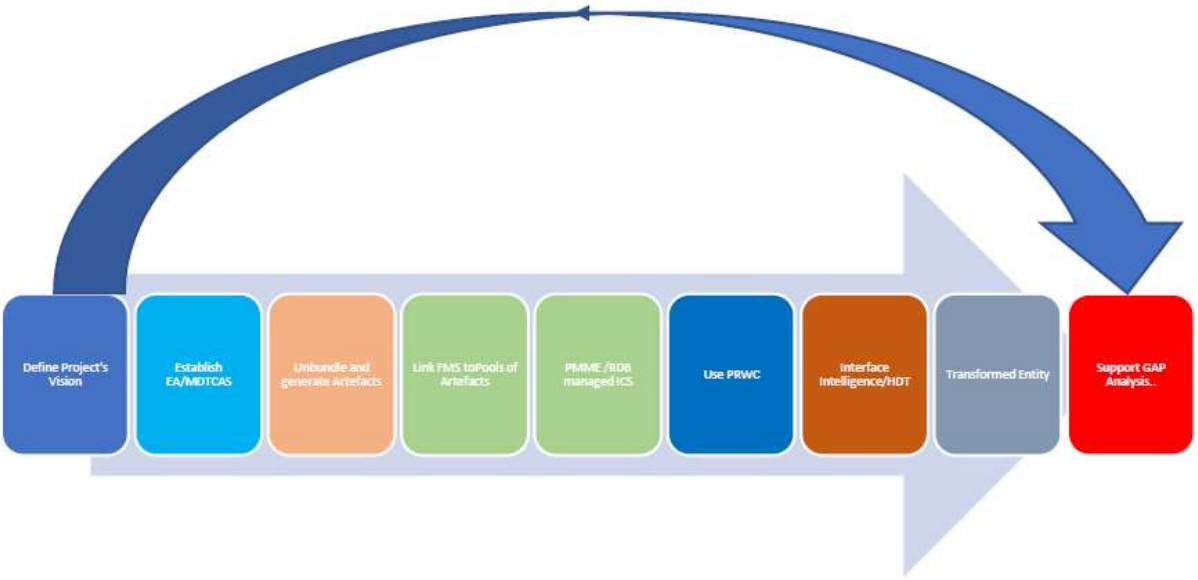

Figure 1. PRWC's sequence of phases.

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 Project can 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.
- "M" a Meta or Meta-Meta Model / Mathematical; which is this article's focus.
- "F" for Asset, and financial transformations.
- "I" for Infrastructural transformations.
- "O" for Organizational, Enterprise and Business transformations.
- "S" for Security based transformations.

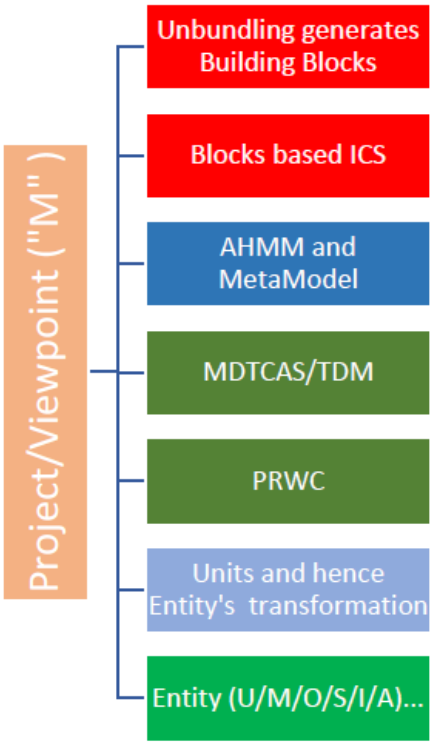

Figure 2. Viewpoint's "M" evolution roadmap.

Viewpoint's "M" combines various Viewpoints and has a structured evolution's roadmap for the PRWC, as shown in Figure 3. The presented IHITF (or Transformation Research Architecture Development framework (TRADf)) and RDP follow an iterative and recurrent concept, in which each research work (like this chapter), is just a brick in its wall. The author's main concern is that an important subjects like 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… Well, seeing the rate of 95% of Projects' XHFRs we can assume that such conventional standards

are a not adapted for Projects (Krigsman, 2008)… Therefore, this chapter reuses TRADf, RDP, and other author's research concepts and modules. This reuse concept of approaches, resources, and keywords, can be considered by some simplistic automated/robotized tools as some kind of duplication or cases of similarities… Which is definitely not because such an approach privileges XHFRs; and the author's approach justifies the search for some other complex methods and approaches… Why shouldn't researchers build their own research innovation, vision, research/methods, transformation IHITF, and reuse some parts to deliver a coherent overall PRWC concept… By just using directed standards, there isn't any 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 Polymathic Researched Literature Review (RLR) and Gap Analysis (GAPA).

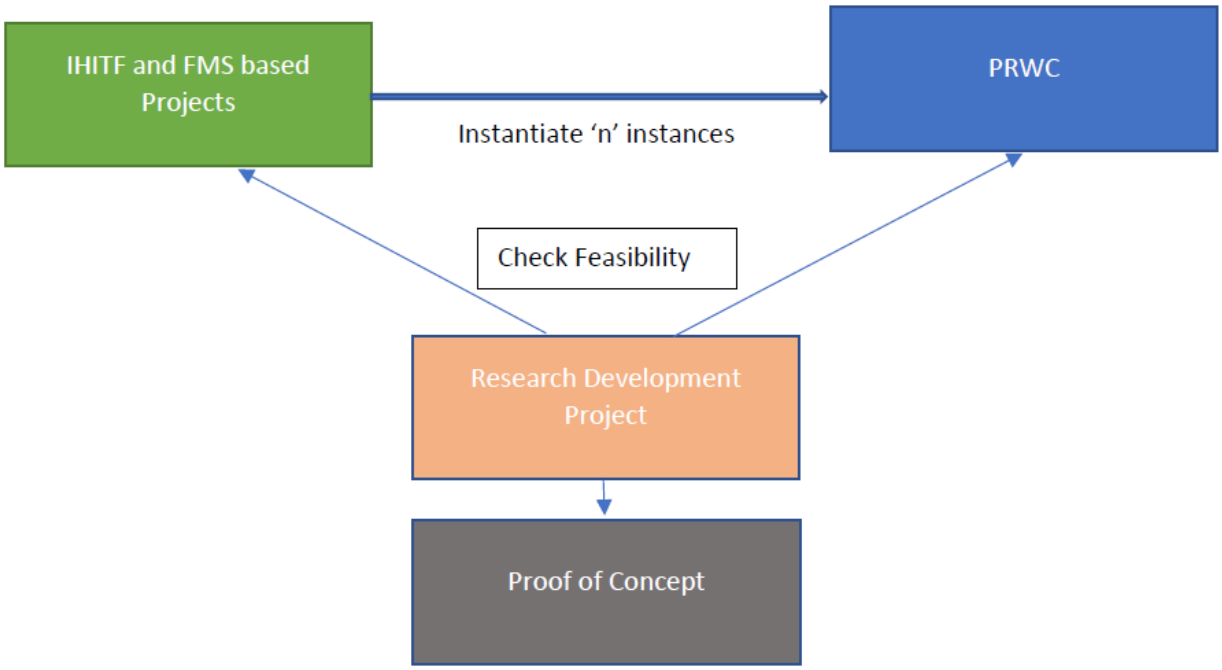

Figure 3. The interaction between the Project (hence STP4SC) and the RDP.

The PRLR and the Research/Project GAPA

Project's complexities and their XHFRs s are mainly due to the incapacities in the integration of Polymathic/cross-functional domains and GAFAM's monopolistic attitudes. The PRWC needs the AHMM4PRWC and ARbLP based HDT, to support Intelligence's operations (Trad, & Kalpić, 2014a). This chapter's Research Question (RQ) is: "Which PRWC characteristics are needed to support Projects?" The PRLR is mainly based on TRADf's and author's 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).

- Educational Transformation Project's Remote Group Work (ETPRGW) (Trad, & Kalpić, 2023a).
- The transformation framework-The role security in the global education system (Trad, 2021a).
- 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).
- The Societal and Educational Transformation Projects: The Evolution of the Lebanese Diverse Education (ELDES) (Trad, 2023c).
- 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 (Trad, & Kalpić, 2014c).
- 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 localized an important research gap that is mainly due to the fact that there isn't: 1) Any identical Polymathic approach to a Project and PRWC; 2) Projects' XHFRs; 2) No existing mixed-method; 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 6) CSA-DTs processing capabilities, as shown in Figure 4.

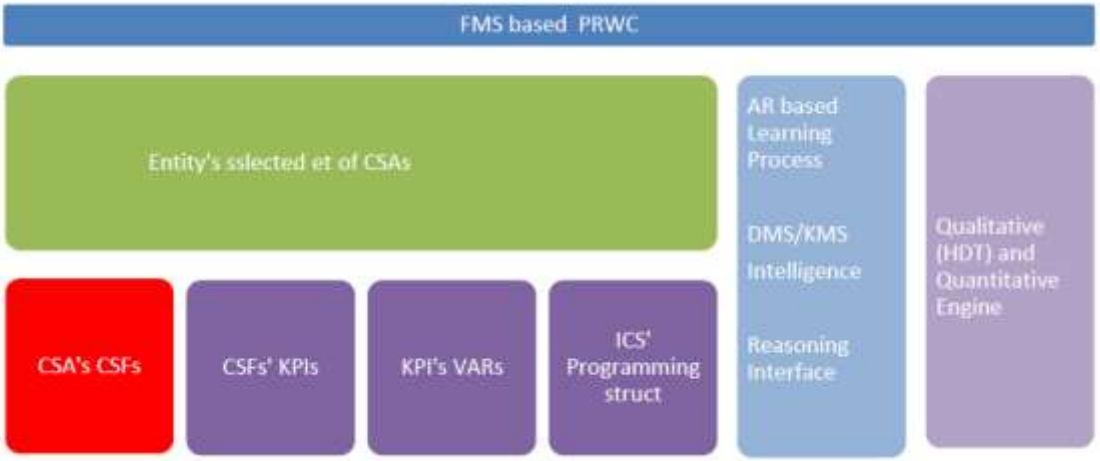

Figure 4. The FMS based PRWC that processes CSA_DTs.

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 author's 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 this case is the PRWC.
- 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_DT Processing and Resulting Findings

For this CSA's resultant 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) IHITF's integration.
- The resultant set of CSF's related 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) IHITF_Integration_VAR. All these VARs are concrete ICS application variables, like for example Mixed_Methodology_Basics_VAR Microsoft's C# language structure as shown in Figure 5 which is a concrete programming structure:

```
public struct Mixed_Methodology_Basics_VAR
{
        public Mixed_Methodology_Basics_VAR(
                                                int MethodologyType,
                                                int MethodologyStat
                                              )
        {
            ….
        }
        public int cMethodologyType { get; }
        public int cMethodologyStat { get; }
        public string ToString() => $"({cMethodologyType},{cMethodologyStat})";
    }
```

Figure 5. The Mixed_Methodology_Basics_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_Mixed_Methodology_Basics_EERM	Feasible	From 1 to 10. **09 Selected**
CSF_RDP_ Mixed_Methodology_Basics_HDT	Feasible	From 1 to 10. **09 Selected**
CSF_RDP_IHITF_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, as shown in Table 1 that is 9.20 that corresponds to "Mature". The details on how the CSA_DT was processed in the AHMM and PRWC CSAs/sections. A Project is made of many Phases and CSAs, and the first CSA is to establish the Project's BTPAPs (simply Team, that includes other types of specialists).

THE TEAM

Managing Complexities

Project's complexities lie in the transformation of the Legacy ICS heterogenous components to offer an agile, secured, and unbundled ICS. The PRWC is used by the Team to evaluate Project's GAPA (or statuses) and the usage of EA methodologies, and Team's capacities and skills. The author's previous RDP related articles and works, have localized an important research gap related to Projects; that is mainly due to XHFR. And the main reason for such XHFRs is the Polymathic capabilities in management and coordination of Projects, that needs the role and profile of the Architect of Adaptive Business Information System (AofABIS). These crucial Project profiles are today represented 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 structure, design, develop and implement effective solutions and to enhance ARbLP based ELPs (Crittenden, 2005). Complex Projects' managers need to coordinate Polymathic Teams who are capable of developing and integration of needed modules (Satterlee, 1996). The Project Team needs cross-functional/Polymathic skills that is based on common (or generic skills) and the capability to quickly getting specialized in needed domains. This characteristic can be found in limited number of Team members and people in general. Polymathic skills can be built on a variant of *Technocrat's* profile; that includes: 1) Lean business architectures; 2) Integrated development environments; 3) Business peoples' integration, 4) Agile Project Management (APM), and 5) Coordination of ICS engineers. Projects influence the way Business Processes (BP) are integrated and how they influence the PRWC. The use of BPs will enhance the management of Intelligence and help in the selection of the Team and its APM application.

APM's Application and a Polymathic Team Profiles

The BTPAP's specific skills (and characteristics) contains also how to integrate the APM in EA's roadmap and Transformation Development Methodology's (TDM) paradigm, and to and Gartner claims that, "the ability to

apply versatile and extensive methodological skills in managing business processes is the number one business priority for successful entrepreneurial activities". Project's main difficulties lie in its duration that can be many years… One of the main complexities is how synchronize the APM 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 includes: 1) Business architectures and BP and their Models (BPM) implementation; 2) Automated Project's processes (Krigsman, 2008); 3) APM's interfaces to TDM and other; 4) Unification of integration processes; 5) Organizational (re)engineering; 6) Intelligence's implementation; 7) TDM's phases synchronization; 8) Separating EA and APM tasks and responsibilities; and 9) Other. Therefore, the Project Team needs Polymathic skills and agile affinities, who can transform the Entity and this is a generic profile as shown in Figure (The Open Group, 2011d; Trad, & Kalpić, 2021a).

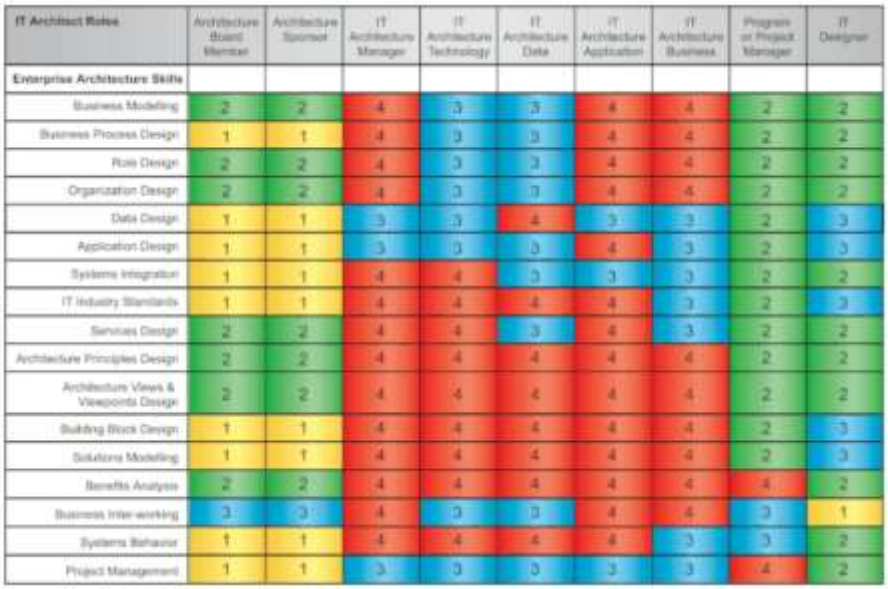

Figure 5. BTPAP's specific skills (The Open Group, 2011d).

Managing the Continuum, Repository, and Reference Models

The Team has the responsibility that includes architectural design and documentation at a technical reference model level; and the main types of architects are (The Open Group, 2011d): 1) Leading a Industry Architects groups; 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

```
        public struct Using_TDM_VAR
        {
            public Using_TDM_VAR(
                                        int TDMype,
                                        int TDMStat
                                    )
            {
```

```
            ….
        }
        public int cTDMType { get; }
        public int cTDMStat { get; }
        public string ToString() => $"({cTDMType},{cTDMStat})";
    }
```

Figure 6. The Using_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; and 5) HumanFactor_Resistance_VAR. All these VARs are concrete ICS application variables, like for example Using_TDM_VAR Microsoft's C# language 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_IHITF_TDM	Feasible	From 1 to 10. **09 Selected**

valuation

Table 2. The CSA_DT outcome is 8.5.

The Project starts with UP and RP (simply Disassembling).

DISASSEMBLING PHASE

Disassembling Entity's Legacy

Projects are complex and have XFHRs because they depend on Composite BBs (CBB). CBBs are created by Disassembling process. Where Organizational UP (OUP) is a sequential set of Disassembling processes that transform 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 the main reason for XHFRs; and 3) Difficulties in interfacing the PRWC. The Disassembling Strategy is the Project's first and major step and if it faces the XHFR then the Disassembling should restart, until it delivers the Entity's pool of refined BBs and a central Entity's Polymathic Dictionary and Glossary (EPDG) (Trad, 2023d).

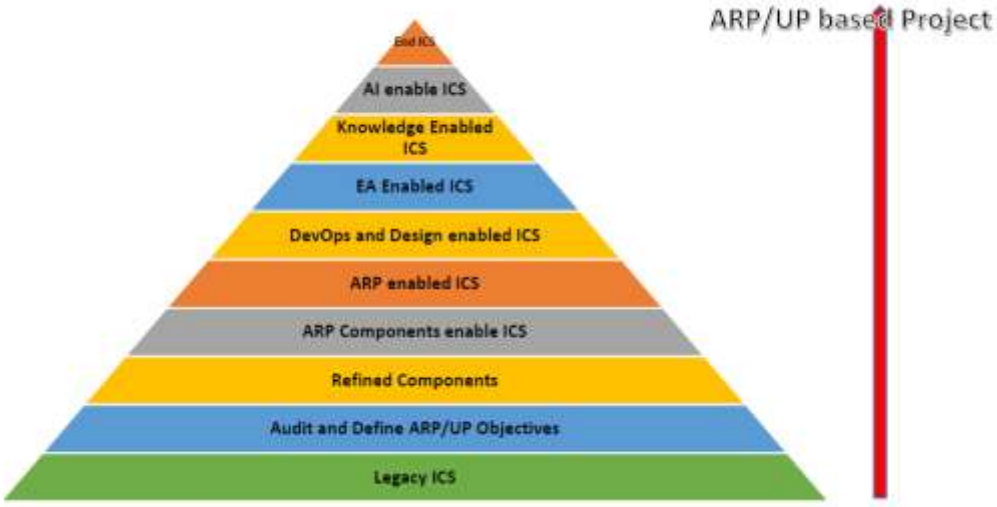

Figure 6. Disassembling based Project's Approach (Trad, 2023d).

The EPDG

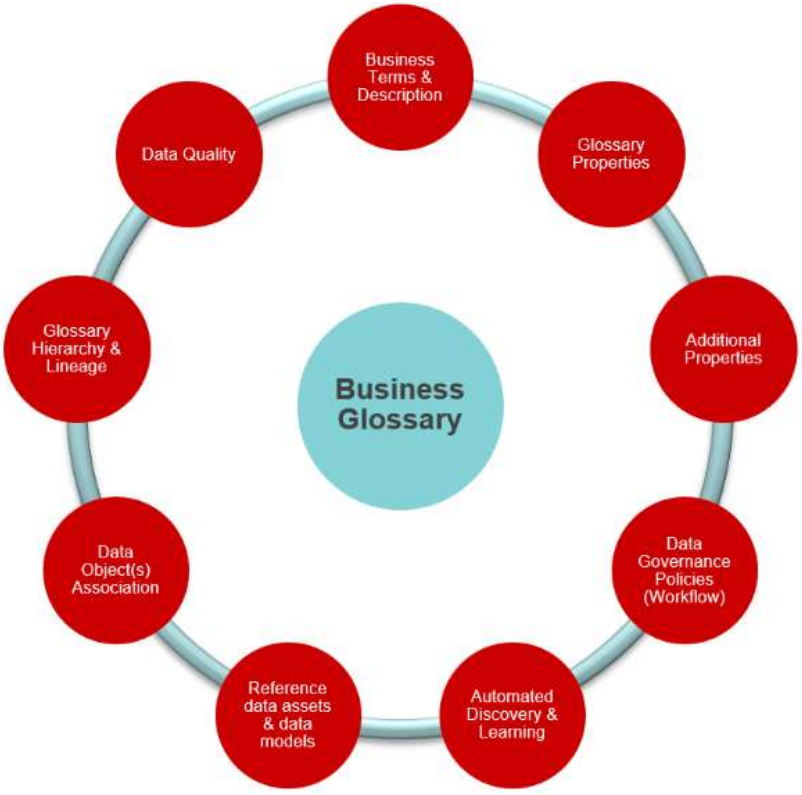

Figure 7. EPDG's components (Shrivastava, 2023).

Implementing the EPDG in an IHITF 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 catalog that enables common vocabulary for development processes.
- Collections of related terms, definitions, and other properties; defined with an IHITF and PRWC conventions.

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

The Pool of Refined CBBs

Projects refined CBBs and ABBs, use existing services' architecture frameworks and standards; and they are managed by the TDM which synchronizes Disassembling 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 used for the PRWC; 3) Offers interoperability; 4) ICS awareness; 5) Uses the ADM based TDM to manage CBBs and BBs as shown in Figure 8.

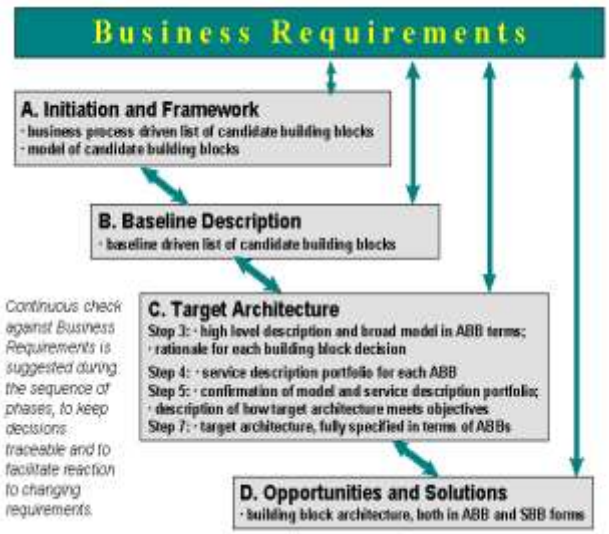

Figure 8. TOGAF's BBs are managed (The Open Group, 1999).

Entity's Reference Models

The TDM uses the Technical Reference Model (TRM) that offers a generic concept for CBBs and its services, which makes them interoperable, as shown in Figure 9. CBBs and services' interoperability are ensured by the communications Infrastructure and is leveraged by the transformed ICS. The The MDTCAS offers 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). Where Disassembling activities for (Trad, 2023d): 1) Breaking-down legacy components into a set of classified CBBs/BBs; 2) Simplifies the implementation phase and PRWC's interfacing; 3) Aligns CBBs/BBs by using the "1:1" mapping concept; and 4) Enables the development of IHITF patterns, templates, and models.

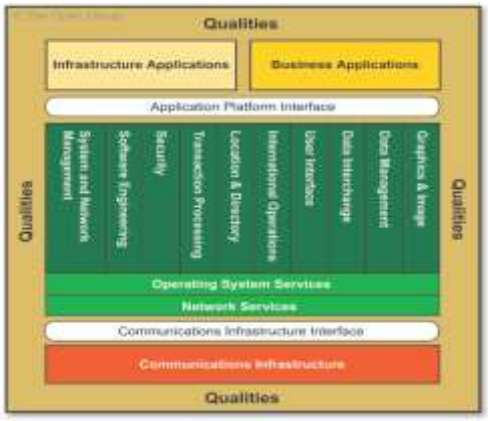

Figure 9. The TRM's services' categories (The Open Group, 2011c).

Disassembling Models and Procedures

Disassembling extracts APD 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 used for modeling 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) IHITF's integration.
- The VARs: 1) Legacy_Transformation_VAR; 2) EPDG_Implementation_VAR; 3) ARP_Capacities_VAR; 5) Reference_Models_VAR; and 6) IHITF_Integration_VAR. And a related structure as shown in Figure 10:

```
public struct EPDG_Implementation_VAR
{
        public EPDG_Implementation_VAR(
                                        string key,
                                        string value
                                    )
        {
            ….
        }
        public int cKey { get; }
        public int cValue { get; }

        public string ToString() => $"({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 on how the CSA_DT was processed in the PRWC section. The Disassembling processes 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 how to build a PEMM and that depends on the Entity's ICS structure. A PEMM is the an Entity (and Projects') point of reference and that establishes a method on how to avoid commercial-only ICS/AI products, promotes XHFRs detection, and the synchronization of activities. To build a PEMM there is the need to (Trad, & Kalpić, 2020a, 2020b; Trad, 2023e): 1) Implement an EPDG, IHITF, TDM, and MDTCAS; 2) Implementing 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) An Asset Management System (AMS); and other.

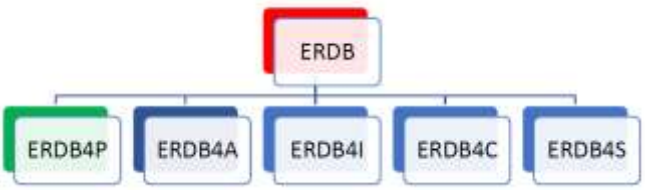

Figure 11. The ERDB based PEMM (Trad, 2023e).

Where the ERDB is the basis of Intelligence that needs Entity Meta-Base (EMB) for storage purposes.

The EMB

Figure 12. The EDM (Google 2022a).

The IHITF (like TRADf) and uses an EMB that can use the ERDB or any other support to support persistence and cross-Entity checking activities (Codd, Codd, and Salley 1993; IBM, 2022), 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 which is the Entity's and Projects' ultimate reference model, supports all IHITF modules and its development follows the Dissembling phase; but this is a circular process where the CBBs, AHMM, and PEMM evolve together. Complex models like HDAT related modules use the PEMM to link the PRWC (Schmelzer, 2021; Della Croce, T'kindt 2002).

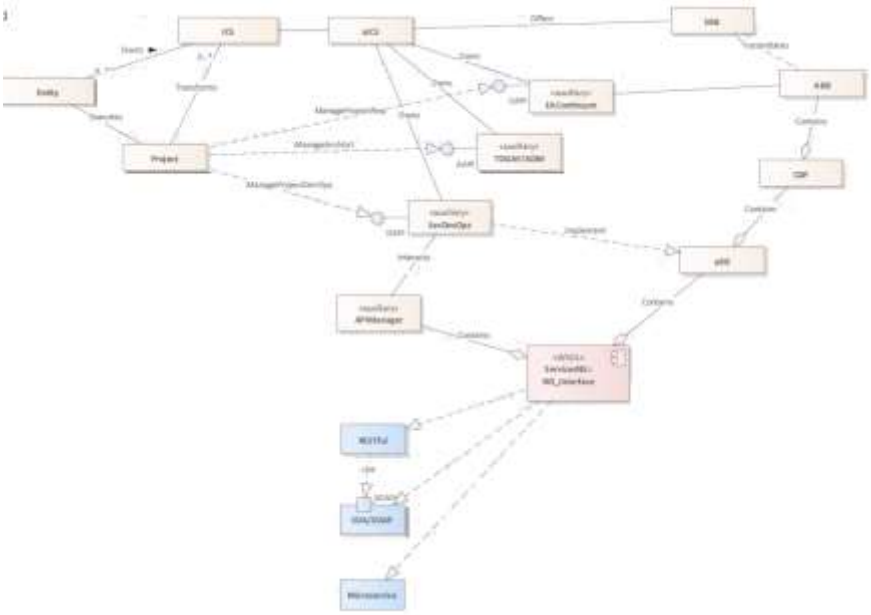

Figure 13. The PEMM.

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) IHITF_Integration.
- The VARs: 1) PEMM_Feasibility_VAR; 2) Fundements_Conept_VAR; 3) Disassembling_Sync_VAR; 4) Global_Construct_VAR; and 5) IHITF_Integration_VAR, like the Disassembling_Sync_VAR example shown in Figure 14.

```
public struct Disassembling_Sync_VAR
{
        public Disassembling_Sync_VAR(
                                        int BBType,
                                        int BBAdr
                                    )
```

```
            {
                ….
            }

            public int BBType { get; }
            public int BBAdr { get; }

            public string ToString() => $"({BBType},{BBAdr})";
        }
```

Figure 14. The Disassembling_Sync_VAR structure.

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

Critical Success Factors	KPIs	Weightings
CSF_PEMM_Basics	Complex	From 1 to 10. **08 Selected**
CSF_PEMM_EMB	Possible	From 1 to 10. **09 Selected**
CSF_PEMM_Relate_Disassembling	VeryComplex	From 1 to 10. **07 Selected**
CSF_PEMM_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 FMS can integrate various levels of Projects' risks and the FMS is based on CSAs, where (Myers, Pane, & Ko, 2004; Neumann, 2002; Trad, & Kalpić, 2018a): 1) Each CSA corresponds to an Entity APD or common domain, like for example, logistics; 2) Each CSF maps to a set of requirements and problems, like for example, accounting activities; and 3) Each KPI corresponds to a unique Entity's ICS item that is linked 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 (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 CBBs (Syynimaa, 2015). This work is based on empirical engineering models. The proposed FMS delivers a set of Factors that are aligned with IHITF's objectives and main constructs like the CSA (Trad & Kalpić, 2018a).

The CSAs

IHITF's repository contains and maps to Project's selected CSAs (which in turn map to CSFs, and other types of Project's Intelligence resources, like services, architecture models, requirements) as shown in Figure 15. 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 applied on them (Lockwood, 1999).

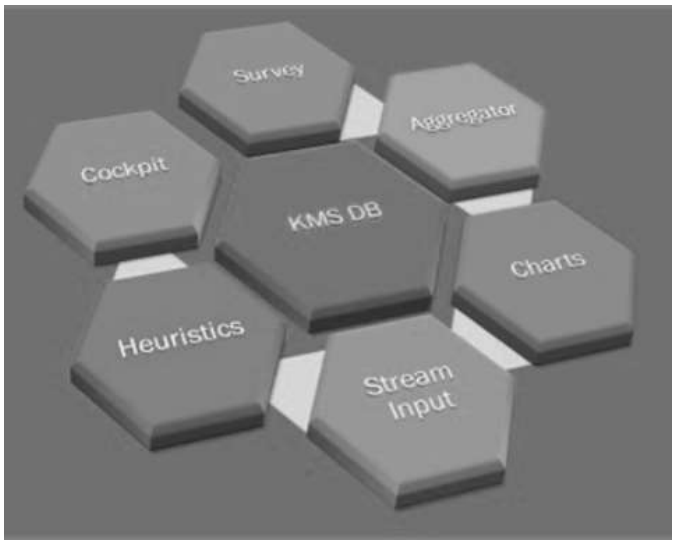

Figure 15. Intelligence subsystem that contains CSAs' information.

The CSFs

A CSF is a set of integrated KPIs, and a KPI related/maps to a unique Project 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).

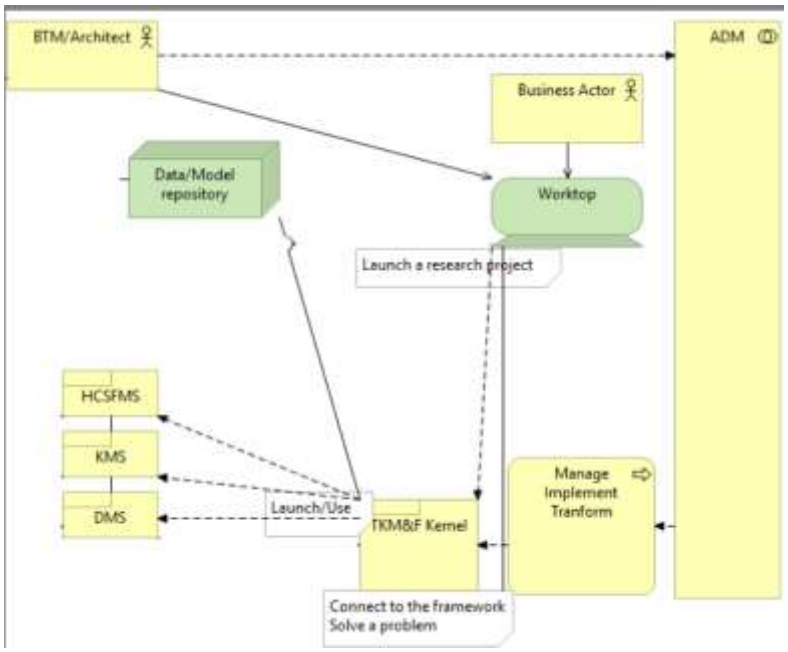

Figure 16. The architecture method's interaction.

Therefore, CSFs are important for the mapping between the problem types, Intelligence constructs, and other Entity's items and resources. A CSFs reflects a Project problem types 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 Factors that correspond to problem type solution(s). The TDM manages the Project's iterations and 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/KPIs need a detailed PRWC interaction, where a KPI is used for the mapping between Project's objectives, business requirements, VARs, organisational structure (Putri & Yusof, 2009).

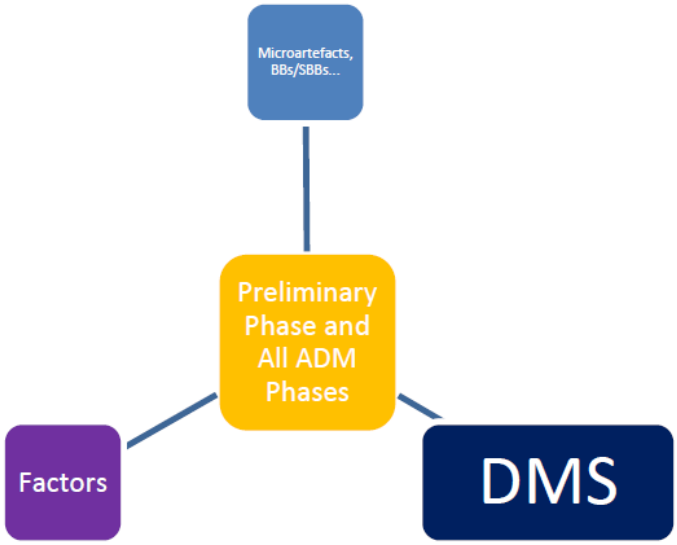

Figure 17. The relations between ADM's phases and FMS/Factors.

A Project establishes and links initial sets of Factors that 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 an CBBs/BBs based SBB or a bundle of services.

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

The symbol ∑ relates to processing of a series of Project of 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 IHITF's repository and are used by the PRWC because they offer: 1) Predefined Factors to be used by Intelligence; 2) Defined responsibilities, relationships, and content; 3) Relationships between CBBs; 4) Default Factors' values; and 5) Interfaces to PRWC and FMS' rules. A Project starts with TDM's initial phase which is also the feasibility's checking phase. This phase checks if the Project is feasible and the possibilities of XHDRs. The FMS offers the following rules to check Factors (Trad, & Kalpić, 2018a):

- R1: References' checking which evaluates their credibility and that can be done by the Team. That should into account that existing rankings are less important. References refer to various types of literature and other resources which are linked to CSFs. The credibility of these references is estimated by KPI 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's value; 2) Existing statistical checkers like Gartner, Forester and others make 20% of the estimation's value; 3) Various company's and specialists surveying that is 20% of the estimation's value; 4) Factors resultant from application-sources' prototyping that is 20% of the estimation's value; and 5) Using a PoC and Project's statuses build the final 20% of the estimation's value.
- R2: Projects result in organisational changes and these changes' success is measured by Factors by using GAPA or similar concepts.
- R3: Applied modelling language which change in the diagrams and artefacts can help the estimation.
- R4: The Meta-Model which change in the diagrams and artefacts can help the estimation.
- R5: The TDM which is mature and the diffs between phases can help the estimation.
- R6: If the aggregations of all Project's CSA_DTs are positive and exceed the defined minimum, the Project continues to its PoC (or phase 2) where can try to solve 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) Rules_Sets; 5) FMS_HDT_Processing; and 6) IHITF'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) IHITF's integration_VAR; and the related example is FMS_HDT_Processing_VAR structure as shown in Figure 18:

```
public struct FMS_HDT_Processing_VAR
{
        public FMS_HDT_Processing_VAR (
                                        int cInterfaceType,
                                        int cReturnStat
                                      )
        {
            ….
        }

        public int cInterfaceType { get; }
        public int cReturnStat { get; }

        public string ToString() => $"({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 that corresponds to "Risky".

Critical Success Factors	KPIs	Weightings
CSF_FMS_Integration	Mature	From 1 to 10. **10 Selected**
CSF_FMS_Factors	Possible	From 1 to 10. **09 Selected**
CSF_FMS_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 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 behavioral view, which is an instance of the statical view.
- Is the skeleton of the IHITF and its modules like the PRWC.
- Defines the interface to external frameworks.

- Defines a Quantitative-Qualitative Research Mixed Model (QQRMM).

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, TRADf's HDT inputs various sets like: Constraints, Rules, Data-sets, Configurations, and other, which are stored in TRADf's repository. 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 evaluates Projects' problem types and to proactively detects violations to 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 improve the ELP and supports the resolving Project problems and PRWC tuning processes. AR uses a systematic process and offers solutions for the problems types, where solutions 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 AHMM4PRWC variant, which uses a multi-level Disassembling process. The PRWC identifies and assesses strategic and critical Factors and hence risks in order to support and guaranty Entity's operations' and business coherencies, by using the AHMM4PRWC, which constitutes its structure. For a given Project and PRWC requirement (or problem type), the AHMM4PRWC 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 the PRLR used the following resources: 1) Articles and resources related to Projects, FMS, Factors' evaluations, ICS (re)engineering, AI/HDT, …; 2) The author's RDP/PRLR works, and TRADf; 3) Project's and PRWC'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 a 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 an PMM.
- The gap between the PMM based Project's adoption and its usage is still very important today (Syynimaa, 2015).
- An PMM that optimizes Projects by using FMS, Factors, and PRWC (Dogan, Çalgici, Arditi, & Gunaydin, 2015).
- A generic variant of the PMM, is the proposed AHMM4PRWC (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":

mcREQ	= m KPI	(R1)
mcMapping mcArtefact/mcREQ	= mcArtefact + m mcREQ	(R2)
FTR	= mcREQ	(R3)
PRB	= m PRB	(R4)
REQ	= m CSF = $\bigcup$ mcREQ	(R5)
REQ	= $\bigcup$ FTR + $\bigcup$ RUL + $\bigcup$ CNT + $\bigcup$ DIA + $\bigcup$ REL	(R6)

The Viewpoint "M"':

sMA	= $\sum$ aBB + $\sum$ sBB + $\sum$ aMVC	(C1)
sBB	= $\sum$ UP+ $\sum$ sMA + $\sum$ sOPM	(C2)
sCBB	= $\sum$ sBB + $\sum$ sABB + $\sum$ SBB	(C3)
sIBB	= $\sum$ sCBB	(C4)
Unit	= $\sum$ sIBB	(C5)
…		
sUnit	= $\sum$ sSUPL	(C10)
……		

WGT	€ {1 … 10}	(B1)
mcENT	= $\underline{\bigcup}$ mcArtefact	(B2)
OU or Sector	= APD[n]	(B3)
ENT	= $\underline{\bigcup}$ OUs (or Sectors	(B4)
CSA(OU or APD)	= Σ CSF	(B5)
OU_Element	= OU[n or element], € {1 … k}	(B6)
CSF(OU_Element)	= ΣKPI	(B7)
KPI	= ΣVAR	(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)
Σ WGT	= 1 (or 100 % max)	(B15)

Σ CSF	= 1 (or 100 % max)	(B16)
Σ KPI	= 1 (or 100 % max)	(B17)
Σ VAR	= 1 (or 100 % max)	(B18)

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 PRWC

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

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

Factors define Project's initial nodes that are defined as vital for its success and targets to be reached.

AHMM4PRWC's basic element are used in PRWC and is TRADf's specific model. The AHMM4PRWC nomenclature is presented in Figure 19:

- The symbol ∑ indicates summation of PRWC's actions, denoting the relative importance of the set members selected as relevant. Ratings and weightings as integers ranging in ascending importance from 1 to 10.
- The symbol ⋃ indicates sets union.
- The AHMM4PRWC defines the Project and PRWC as models.

The Applied Transformation Mathematical Model

The AHMM4PRWC is composed of: 1) A static view; 2) A dynamic (or behavioural) view; and 3) A pool of reusable ARbLP based scenarios. The AHMM4PRWC can be modelled using following formula for Entity Transformation Mathematical Model (ETMM) that abstracts the Project:

$AHMM4PRWC=Weigthing_1*AHMM4PRWC\_Qualitative+Weigthing_2*AHMM4PRWC\_Quantitative$ (N18).

$AHMM4PRWC = \sum AHMM4PRWC \text{ for an Project iteration}$ (N19).

$ETMM = \sum AHMM4PRWC \text{ instances}$ (N20).

$Weigthing_1$ and $Weigthing_2$ are delivered by the PRWC. ETMM's OF optimization is done by using constraints and extra variables that need to be tuned. These variable (for maximization or minimization) can be, for example: Team's Polymathic capacities, costs, or another Factor. For PRWC'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 PRWC's efficiency. The ETMM is a combination of used methodologies and AHMM4PRWC. The AHMM4PRWC is a part and the skeleton of TRADf that used scenarios to support PRWC requests (Kim, & Lennon, 2017). The initialization phase generates PRWC problem types and cross-functional aspects to be analysed by using the PRWC (Agievich, 2014).

The AHMM CSA Processing and Findings

```
public struct QQRMM_Feasibility_VAR
{
        public QQRMM_Feasibility_VAR(
                                                Array  QQRMM_List,
                                        )
        {
            ….
        }
        public int QQRMM_List { get; }
        public string ToString() => $"({ 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) IHITF_Integration.

- The VARs: 1) QQRMM_Feasibility_VAR; 2) Elements_Sets_VAR; 3) Transformational_Model_VAR; 4) Viewpoints_VAR; 5) ETMM_VAR; and 6) IHITF_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_AHMM4PRWC_Basics_QQRMM	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4PRWC_Transformational_Model	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4PRWC_Elements_Artefacts	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4PRWC_Viewpoints	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4PRWC_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, AHMM4PRWC, and PRWC

Figure 21. The IHITF layers of models.

The MetaModel has the following characteristics:

- Has a static and dynamic form.
- Is AHMM's (and hence AHMM4PRWC) 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.

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

TDM's Role

The TDM manages the Project's implementation phases and PRWC's integration by (Visual Paradigm, 2019):

- The preliminary phase defines the relevant Factors and their weightings.
- 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 Project's first phase (or the feasibility phase) uses the PRWC to check the selected Factors (that are stored in CSA_DTs). 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 IHITF 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/commercial PRWC(s) or like in TRADf, 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 values, 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 IHITF or a domain specialist; or 3) An external concept.
- CSA_WGT = $\sum$CSF*CSF_WGT.
- CSF_WGT = $\sum$KPI*KPI_RAT.
- KPI_RAT = $\sum$VAR*VAR_RAT.

Interfacing the System

It interfaces the system by:

- The AHMM4PRWC applies the HDT, which uses the PRWC.
- PRWC (Project-iteration i) = $\sum$CSA*CSA_WGT.
- The AHMM4PRWC 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 PRWC use 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 in order to solve various problem. The PRWC has an objective, to use critical-thinking based concept that combines: 1) ELP; 2) AHMM4PRWC, and HDT based decision making; 3) FMS; 4) Provides a Polymathic approach; 4) Uses the TDM; and 5) Uses success metrics and rules. The Project's evaluation starts with phase 1 (PHASE_1) called the feasibility phase, which checks if the whole Project is feasible. Then 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, should be credible and are estimated by the author; the notions of official ranking is less important and are ignored.
- PRWC-related references have to be credible and are estimated by the author, Intelligence and have to be conform to TRADf's classification concept.
- Rule 2: labelled the change launcher, Projects like 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, in order to make the Project's GA 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 TRADf's iterations.
- Rule 6: labelled the aggregation phase, if the aggregations of all the Project GA's CSA/CSF tables are positive and exceeds the defined minimum the Project's GA continues to execute the PoC and can be used for a problem solving.
- Project's iterations are 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, by the use of KPIs.
- The TDM manages TRADf'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 Project's and its modules performances. 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 UP's BBs and PRWC outcomes; 3) GAPAs storage and comparison; 4) TDM phases' synchronization; and 5) HDT based Intelligence requests calls. KPIs relate to VARs from BBs, so HDT's based evaluation processes can automatically estimate the values of CSAs, and CSFs. Therefor, 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:

```
public struct GAPA_Exec_VAR
{
        public GAPA_Exec_VAR(int GAPAValue)
        {
            ….
        }
        public int GAPAValue { get; }
        public string ToString() => $"({ 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_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

Projects depend on Entity's structure which needs the application of selected Viewpoint(s) which for this RDP is Viewpoint "M" and "O" is the second one. The TDM synchronizes Project's phases and manages RDP, IHITF, PRWC, and the HDT to solve problem types as shown in Figure 23 (Markides, 2011).

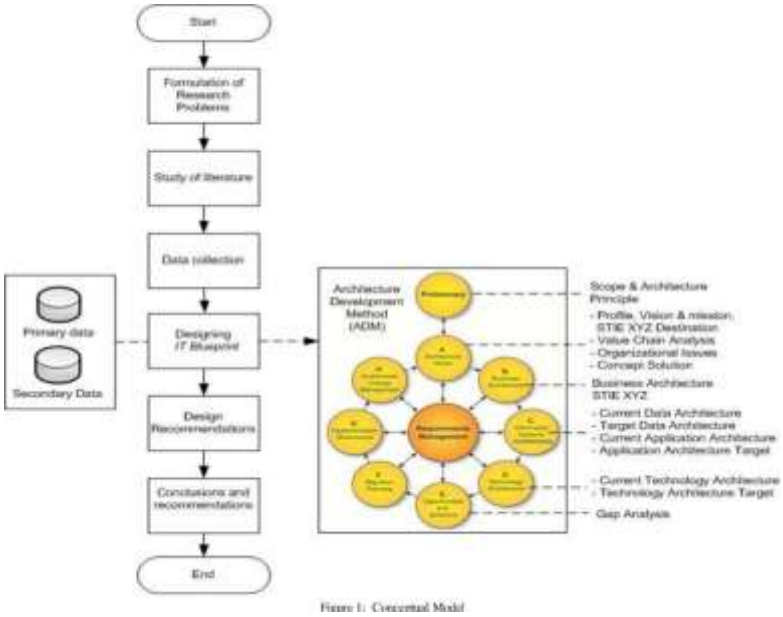

Figure 23. ADM's phases (The Open Group, 2011a, 2011b; Holilah, Girsang, & Saragih, 2019).

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 the PRWC and the TDM manages Project's implementation, and maintenance processes. The TDM supports the PRWC in pointing to the: 1) Right vision(s)/Viewpoint(s); 2) Principles; 3) FMS/Factors; 4) Standards/Frameworks; 5) PEMM and AHMM4PRWC; 6) Team's skills; 7) GAPA/Intelligence; and 8) MDTCAS and CBBs.

The MDTCAS

The IHITF integrates the MDTCAS and TDM to manage CBBs which 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).
- …

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 behavior (the functionalities) (Hosiaisluoma, 2022); and 7) Use the PEMM as a reference (Trad, 2023d).

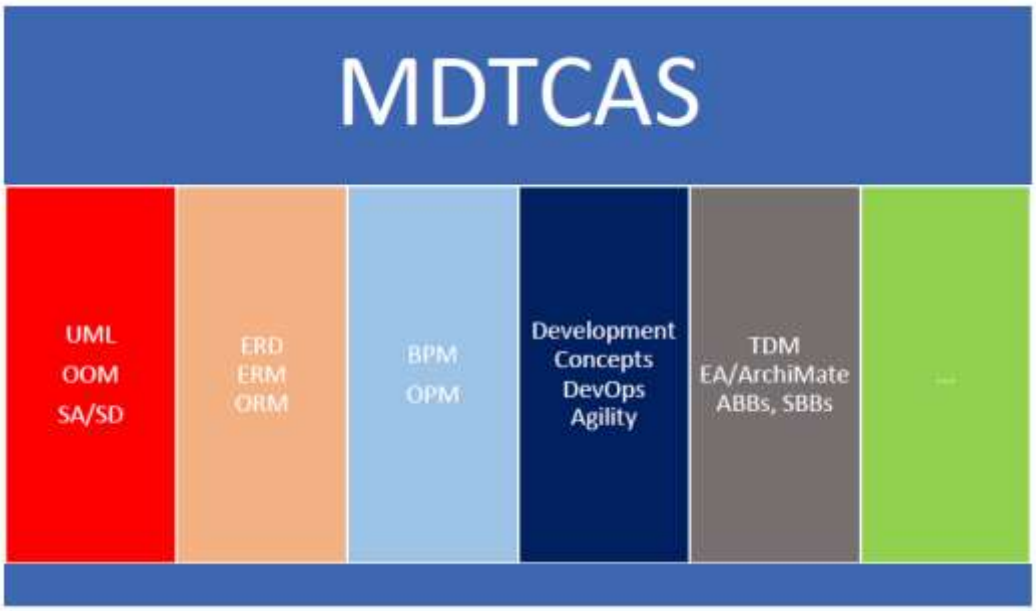

Figure 23. MDTCAS' Layers (Trad, 2023d).

Entity's Cartography and Reference Models

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 a central pool of CBBs.
- Factors to be selected and tuned.
- That 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 usage.
- 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 4) Technology Architecture (Bizzdesign 2022).

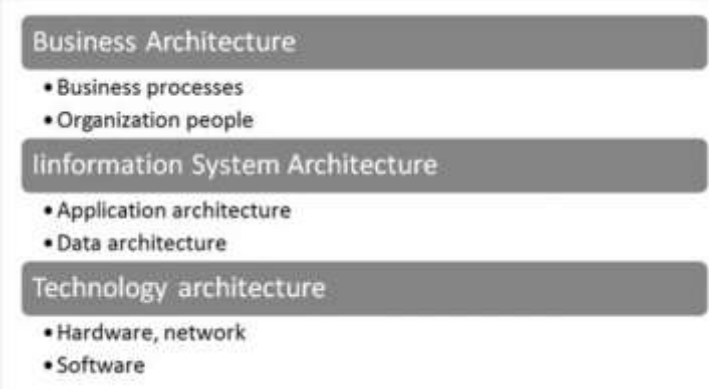

Figure 24; EA layered concept.

PRWC based Continuous Improvements

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, Governance and renewal, Transformation technics, Linking PRWC to Project'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) PEMM_Integrity; and 5) IHITF's integration.
- The VARs are: 1) Viewpoints_Establishement_VAR; 2) MDTCAS_Usage_VAR; 3) Cartography_Generation_VAR; 4) PEMM_Integrity_VAR; and 5) IHITF's integration_VAR. An example is PEMM_Integrity_VAR shown in Figure 25:

```
public struct PEMM_Integrity_VAR
{
        public PEMM_Integrity_VAR(
                                        int IntegrityValue,
                                )
        {
            ….
        }
```

```
        public int IntegrityValue { get; }
        public string ToString() => $"({ 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

The FMS and PRWC interface Intelligence which supports complex problem-solving activities. Project's and Intelligence's Polymathic/holistic concepts that is based on the building of complex systems needs a systemic approach (Daellenbach, & McNickle, 2005). The Project and PRWC is supported by Intelligence that is based on various components like the HDT, ELP and other. Intelligence just-in-time solution(s) for pre-defined problem types. Possible solution(s) propose sets of actions, recommendations on changes and their implications. Intelligence integrates 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 AHM4PRWC 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 the IHITF 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 BBs (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 PRWC is based on the PEMM and AHMM4PRWC and used FMS to interface the ARbLP/ELP based HDT. The proposed RDP uses the that is indented and is optimal for cautious and evolutive Projects, where AR can be used to improve ELPs (Trad & Kalpić, 2017a; 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 AHMM4PRWC is responsible for the QQRMM for problem solving and synchronizes a set of AHMM4PRWC instances that support dynamic tree algorithm, as shown in Figure 26 (Nijboer, Morin, Carmien, Koene, Leon, & Hoffman, 2009) that manages HDT's nodes.

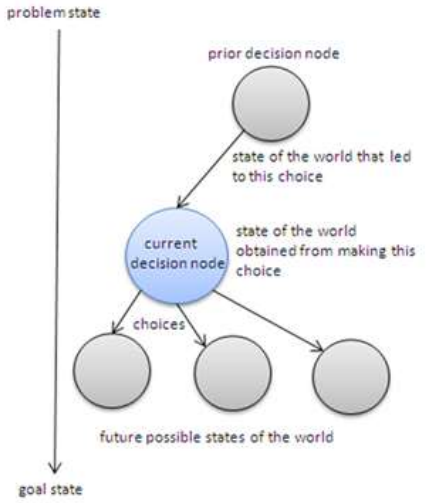

Figure 26. The applied heuristics tree algorithm (Nijboer, Morin, Carmien, Koene, Leon, & Hoffman, 2009).

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

Implementing the IHI KMS and DMS

The ELP manage Entity and Project's Knowledge Items (EPKI) that are related-linked to Entity's/Project's resources and modules like Intelligence. Intelligence supports Entity's KMS which manages EPKIs that are in turn linked to Factors. Intelligence supports Project's enhancements and interfaces the PRWC to evaluate Factors. The KMS identifies the concerned Factors their PRWC evaluation processes. Which also 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. NLP scenarios manage Intelligence's requests and control various IHITF 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's change request can generate a large set of actions and solutions, which's 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. The FMS-PRWC based DMS, the Team selects and tunes Factors, which are then orchestrated by the NLP scripts. The DMS is used in all Project's processes which contains sets of Factors that are mapped to CBBs (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 CBBs, BPMs and other artefacts which

improve Entity's Time-to-Market (TtM). DTs are strategic objectives but Projects' digitization are complex and have XHFRs (Eira, 2022). The DT uses the PRWC to Disassemble legacy systems and enables 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 an 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.

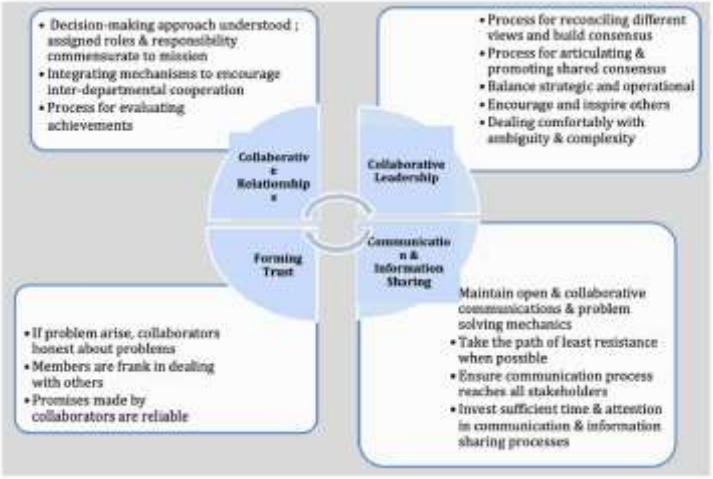

Figure 28. Four dimensions of cross-functional/Polymathic collaboration (Morse, 2020).

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 CBBs, 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 or regressions.

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) IHITF's integration.
- The VARs are: 1) QQRMM_Application_VAR; 2) HDT_Access_VAR; 3) KMS_DMS_Integration_VAR; 3) GAPA_Processing_VAR; and 4) IHITF's integration_VAR, like the HDT_Access_VAR structure example as shown in Figure 3:

```
public struct HDT_Access_VAR
{
        public HDT_Access_VAR(
                                        int HDT_Access_Args
                                    )
        {
            ….
        }
        public int HDT_Access_Args { get; }
        public string ToString() => $"({ 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_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, are 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 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 guaranty 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.

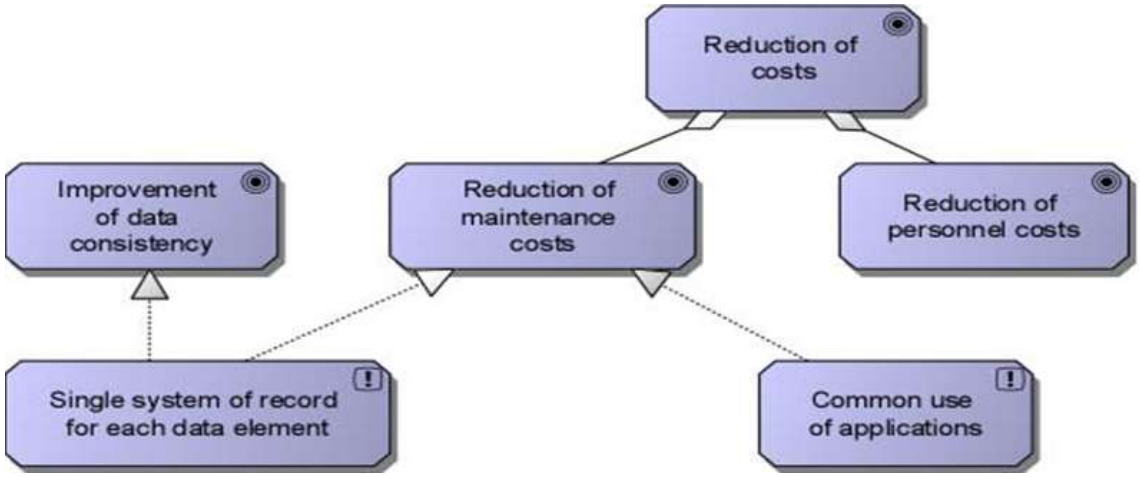

Figure 30. Project's transformation goals (Jonkers, Band, & Quartel, 2012).

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 PoC.
- Phase B or the Business Architecture phase shows how the Project's target architecture implements key requirements and related them to the 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 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. The PoC was implemented using *TRADf* 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 *TRADf's* client, Factors/CSFs were linked to a specific node of the ARbLP/HDT.

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
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 programs linked the AHMM4PRWC 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 IHITF's modules. The AHMM4PRWC'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 IHITF's setup.

IHITF's Setup and Configuration

The PoC configures the FMS and Factors then these Factors are mapped to Projects resources and artefacts. The FMS contains the relationships that link Project's requirements, CBBs, NLP scripts, Factors, and Global Unique IDentifiers (GUID). IHITF's client'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.

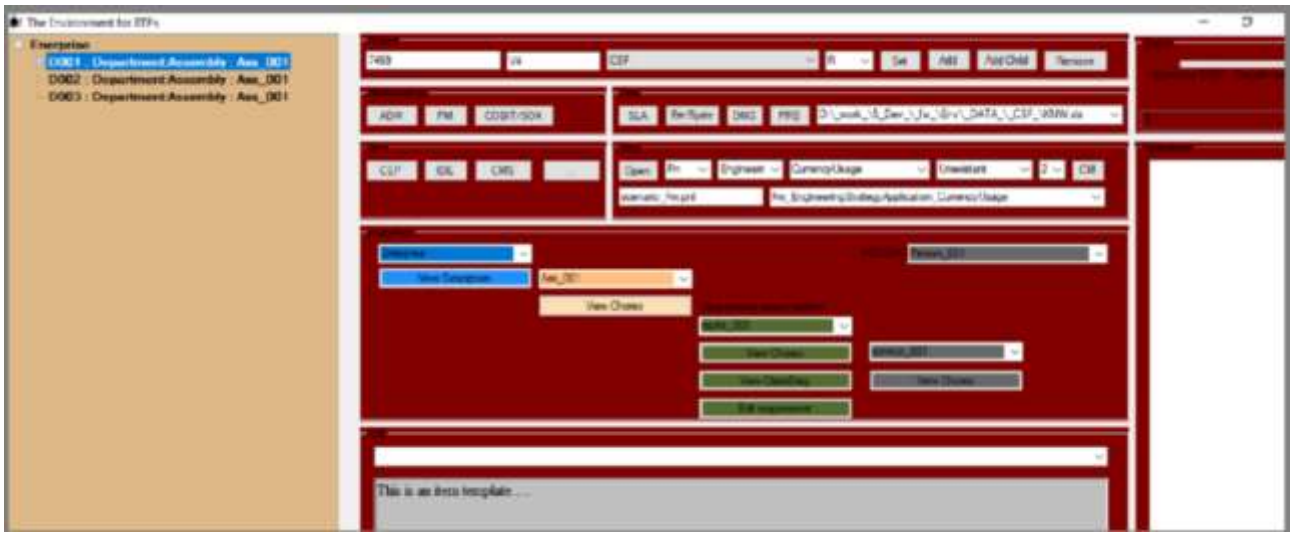

Figure 32. The IHITF's graphical interface.

NLP scripts are the backbone of Intelligence and contain the define sets of actions to be processed. The AHMM4PRWC ensures PRWC's integrity and HDT's tree configuration as shown in Figure 33.

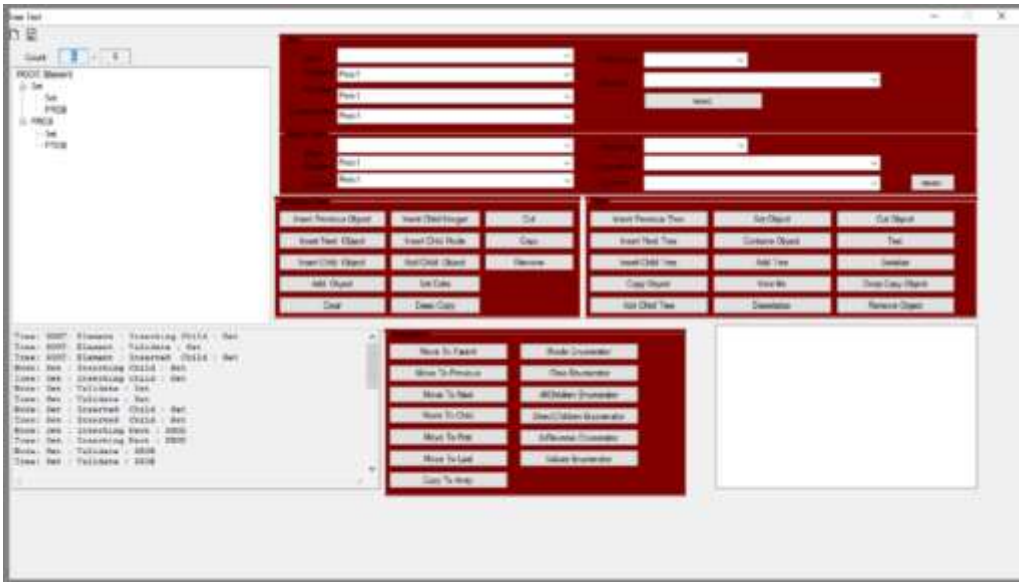

Figure 33. The heuristics tree configuration.

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 and PRWC.
- Sub-phase A establishes the Disassembling approach and its goal.

- Sub-phase B establishes PRWC's target models.
- Sub-phase C shows and uses the ACD and describes PRWC's activities.
- Sub-phase D shows the needed PRWC's infrastructural landscape.
- Sub-phases E and F presents intermediate Project's situation(s) and evaluates PRWC; and updates the list of Problem types (PRB) to be solved.

PRBs Solving for a Concrete 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_KMS_DMS_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 IHITF has implemented NLP scripts to process CSA_DTs, and related PoC's resources to the CSF_KMS_DMS_Integration_Procedure; 2) Intelligence is configured and uses the PRWC support the HDT; 3) Linking HDT's node to data-contents; and 4) The HDT executes the CSF_KMS_DMS_Integration_Procedure and delivers SOL(s).

SOL Nodes activities:

- NLP scripts are called by the PRWC.
- These scripts are processed in the background to deliver PRWC 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 PRWC for Projects. The PRWC uses Factors to iteratively assert Project's feasibility and because of the low score of 8.80 (Table 10) implies that it is "Risky", and the resultant recommendations are:

- TRADf shows how to implement an IHITF.
- This RDP uses a QQRM concept.
- The PRLR proved the existence of an important knowledge gap.
- The AHMM4PRWC and ELP based HDT support Intelligence.
- The HDT supports the PRWC.
- Cross-functional/Polymathic skills are needed.
- PRWC, uses existing frameworks.
- The PRWC evaluates Projects' progress.
- The PoC checked PRWC's feasibility.
- The PRWC integration is complex and "Risky".

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