Business, Economic, and Common Transformation Projects-The Integration of Six-Sigma (ISS)

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Abstract

Evolutive Industrial (business, economic, financial, or common) Transformation Projects (ITP) are fundamental for the enhancements of enterprises' performances and in insuring their sustainability. But ITPs are complex, because of the heterogeneous environment, reality in inter-linking various domains, and lack of adoption of a realistic Polymathic concept. Such a concept is needed to finalize ITPs and to offer the executive management an operational decision-making environment. Polymathic or holistic concepts privilege interdisciplinary approaches for ITPs' decision-making implementations. This article uses the Applied Holistic and Poly-Mathematical Model (AHMM) for ISS (AHMM4ISS), which is another variant of the Polymathic AHMM. TheAHMM4ISS supports the Polymathic Enterprise MetaModel (PEMM), where the PEMM needs the ISS to improve implementations' feasibility management and over-all business services' quality. The ISS interfaces Six-Sigma's set of methodologies'components and existing tools, to transform organizational processes by improving robustness, effectiveness, and quality. Quality improvements include reducing defects and errors, minimizing variation, and increasing controls and efficiency. Six-Sigma's main objective is to improve the organization's capabilities and quality levels. The PEMM and ISS combine different fields like: Quality management, Organizational engineering, Transformation processes, Enterprise architecture and methodologies, Artificial intelligence (AI), Mathematical models, and other. This article is a new brick in the authors' Research and Development Project (RDP), and transformations orientedframework.

Keywords: Six-Sigma, Quality management, 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

The authors use an In-House Implemented (IHI) Polymathic Transformation Framework (IHIPTF) based RDP,which in-turn is based on a semi-automated concept. The concept uses a template artefact-document which contains the basics of the IHIPTF and all its modules;that have a generic approach and are adapted to RDP's focus.In this article the focus is on the ISS andit is strongly recommended to consult the article:"Business, Economic, and Common Transformation Projects-IHIPTF" (Trad, & Kalpić, 2024a);before analysing-reading this article. For each new RDPwork (article, experiment, book article, or other…), the artefact-document is adapted, complemented, and modified to include new research sub-domain topic, which in this case is the ISS.It can be considered that the complemented/modifiedpart, contains more than 60% (to 75%)of the new topic(s)- The authors' main aim is not just to publish, but to offer the IHIPTF that is capable of confronting ITPs complexities, Polymathy, and to avoid eXtremly High Failure Rates (XHFR). This article has aspecific-proprietarymulti-dimensional approach to the IHIPTF, RDPs and ITPs(simply Project). The IHIPTF supports: 1) The IHI Methodology, Domain, and Technology Common Artefacts Standard (MDTCAS) as a transcendent model; 2)Enterprise Architecture (EA)and Six-Sigma methodologies; 3)The Factors' Management System (FMS); 4) The Polymathic Rating-Weighting Concept (PRWC)that usesCritical Success Areas (CSA), Critical Success Factors (CSF), Key Performance Indicators (KPI), VARiables (VAR) which areused to interface the Information and Communication Systems (ICS) and Decision-MakingSystem (DMS)/Knowledge Management System (KMS)/Groupware (simply Intelligence). The FMS and PRWCuse sets of CSAs, CSFs, KPIs, and VARs (simply Factors), for Project's evaluation purposes.TheIHIPTFfororganizations (simply Entity*)*needsIntelligence that usesAction Research (AR) based Learning Processes (ARbLP).

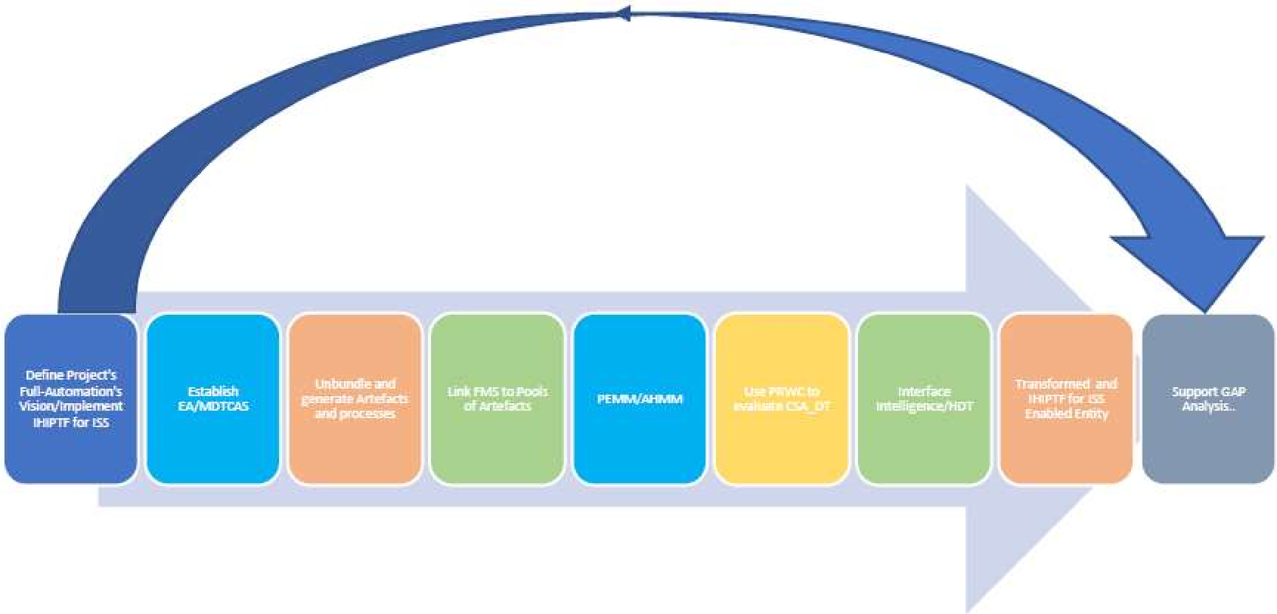

Figure 1. IHIPTF's sequence of phases for the ISS

Figure 1 shows IHIPTF's phases for the ISS module and the Project is a set of CSAs to be analysed and this article 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 and the ISS, which is this article's focus.
- …

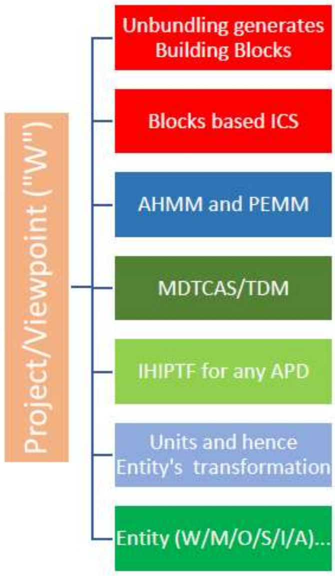

Figure 2. Viewpoint's "W" evolution roadmap

As shown in Figure 2, the focus is on Viewpoint "W" (because ISS is a methodology and therefore is a part of IHIPTF),having in view also the rate of 95% of Projects' XHFRs; which forcesthe RDP to be unconventional (Krigsman, 2008), as shown in Figure 3.

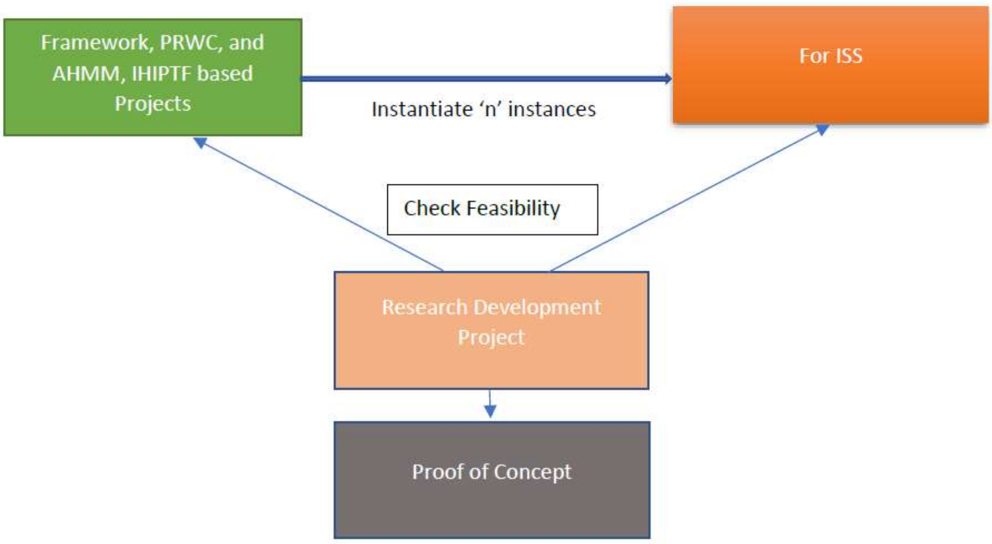

Figure 3. The interaction between the Project (hence IHIPTF for ISS) and the RDP

Therefore, this article reuses IHIPTF, RDP, and other authors' research resources. 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. 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 (or Anti-Locked-In/ALI) Polymathic Researched Literature Review (RLR) and Gap Analysis (GAPA).

The PRLR and the Research/ProjectGAPA

Project's complexities and their XHFRss are mainly due totheincapacities in the integration of Polymathic/cross-functional domains and GAFAM's monopolistic attitudes.The IHIPTF for ISS(IHIPTF4ISS) needsthe AHMM4ISSand HDT, to supportIntelligence's operationsto offer solutions. This article's Research Question (RQ) is: "Which IHIPTF for ISScharacteristics and capability are needed to support Projects?"The PRLR is mainly based on IHIPTF'sknowledge repository and authors'related works, like:

- 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 phases.
- The Business Transformation Project's Holistic Agile Management (Trad, & Kalpić, 2022a).
- The Selection, and Training Framework selection and training framework (STF) for Managers in Business Innovation Transformation Projects–Educational Recommendations (Trad, & Kalpić, 2014a, 2014b, 2014c).
- Enterprise Transformation Projects- The use of the Polymathic Rating and Weighting Concept (Trad, 2024a).
- The Project and the IHIPTF (Trad, & Kalpić, 2024a).
- … and many others.

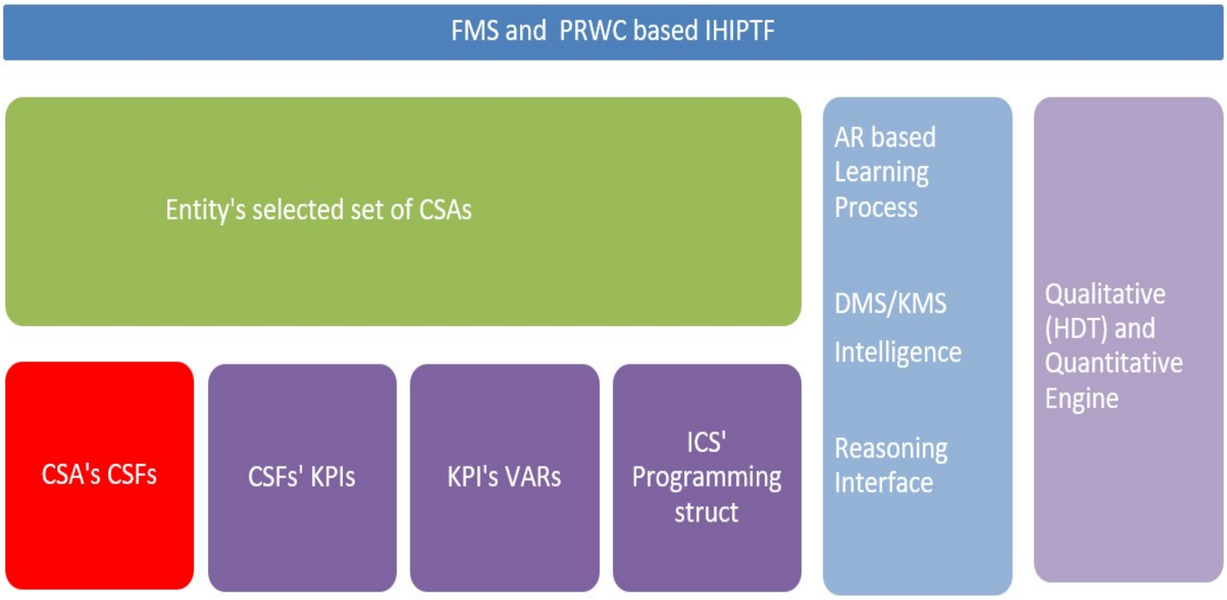

Figure 4. The FMS and PRWC IHIPTF (for ISS)that processes CSA_DTs

This RDP has identified an important RDP gap that is due to the fact that there is: 1) No identical

Polymathic approach to a Project and IHIPTF for ISS; 2) Projects' XHFRs; 2) No 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 for ISS; and 6) CSA-DTs processing capabilities, as shown in Figure 4. 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; 2) Presents a Six-Sigma paradigm-shift and a translation into a Pool of services (Bernal, García, & Zenón, 2021); and 3) PoCs from previous works. An RDP has to setup the PRWC a set(s) of Enumerators (PRWCE), which for this article 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 6 or 7); 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 article's CSA/CSA_DT processing and resulting findings.

RDP's Pattern

This article, 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(s) 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 for ISS.
- Each part (or CSA) contains a table of selected and weighted Factors.
- An APplication Domain (APD) section.
- The conclusion and recommendations that summarizes and concludes the research work.

The RDP CSA/CSA_DTProcessing and Resulting Findings

For this CSAsresultant Factors and processing procedure that are 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) IHIPTF4ISS' integration.
- The resultant set of CSFs 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) IHIPTF4ISS_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 and APD'smodules):

```
publicstructIHIPTF4ISS_Integration_VAR
{
    publicIHIPTF4ISS_Integration_VAR(
                                        int  APDType,
                                        int  APDStat
                                    )
    {
        ….
    }
    publicintcAPDType{ get; }
    publicintcAPDStat{ get; }
    publicstringToString() =>$"({cAPDType},{cAPDStat})";
}
```

Figure 5. The IHIPTF4ISS_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_Intelligence/HDT	Feasible	From 1 to 10. **09 Selected**
CSF_RDP_IHIPTF4ISS	Feasible	From 1 to 10. **09 Selected**

valuation

Table 1. The CSA_DT outcome is 9.20

This CSA's Decision Table (CSA_DT) uses the defined CSFs and KPIs (and related 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 can be found in AHMM, FMS, 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 Team members (simply Team, that includes also other types of specialists).

THEPROJECT'S TEAM AND MANAGER PROFILES

Managing Complexities, and Polymathics

Projects are very challenging and have many types of complexities; andthe most important ones lie in the conversion and transformation of the Legacy ICS'and APD's heterogenous components to offeran agile, secured, and unbundled ICS services, APD resources, and Business Processes Models (BPM). The IHIPTF4ISS 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. XHFRs are mainly due tothe lack of Polymathic capabilities and skills, especially for the ISS as the management methodology parts. Managers (and methodology specialists) need to have theArchitect of Adaptive Business Information System (AofABIS)or Business Transformation Project's Architect's Profile (BTPAP) (Trad, & Kalpić, 2021a).The BTPAP that super-classes of the AofABIS profile, who should have adequate set of skills related to the integrationofIHIPTF4ISS with Agile Project Management (APM), EAmodels, methodologies like Six-Sigma. (Trad, & Kalpić, 2021a). The IHIPTFoffers the Architecture Development Method (ADM) based Transformation Development Methodology's (TDM) approach.

Managing the Continuum, Repository, and Reference Models

The Team has the responsibility that includes the integration of the IHIPTF4ISS, Six-Sigma's artefacts, architectural design, and documentation at a technical reference model level. The IHIPTF4ISS includes various types of architects' profilelike (The Open Group, 2011d): 1) Leading an Industry Architects groups; 2) System Architect has the responsibility for architectural design and documentation; 3) Industry Architect has the responsibility for EA/TDMbased ISS design; and 4) Organization Architect and Team have the responsibility for architectural design of a specific Entity, and interfacing other methodologies like Six-Sigma's integration, that is the APD.

The APD

ISS tries to integrateProject's improvement processes, which is a continuous cycle, with the main goal,to improveeffectiveness and efficiency. The ISS is a disciplined transformation that delivers near-perfect services,

eliminates waste, increases actors' satisfaction, by offering (Tutorialpoint, 2024):

- A structured methodology and has defined roles for actors.
- A data-driven methodology and requires accurate data-collection.
- A gatewayfor results' integrationin Financial Statements.
- A business-driven, multi-dimensional structured approach for:Improving Processes, Lowering Defects, Reducing process variability, Reducing costs, Increasing customer satisfaction, Increased profits
- Concepts that are related to: Critical to Quality; Defect detection; Process Capability; Stable Operations;and Design for Six-Sigma.

The ISS tries to integrate Six-Sigma, the Team, with the APM.

The APM

The ISS and APM's collaboration can be based on the following facts (Agile Alliance, 2014):

- Software development processes include innovation, creativity and depend on Team's skills and APM based intensive communication. The ISS supports software products and related processes and takes into account the *Agile Manifesto*(Individuals and Interactions Over Processes and Tools). It also reduces variations and defects/bugs.
- On Problem-solving activities are a structured methodology that provides tools,roadmaps, and techniques, where the focus is on business sustainability and costs.
- On finding an agility level by adapting the cycles through frequent collaboration and defining the right iterations' rhythm to integrate Lean Six-Sigma(LSS).

- On use of the Define, Measure, Analyse, Improve, and Control (DMAIC) as shown in Figure 6, which is a data--driven concept and roadmap, for improving legacy processes by removing waste,defects, and for improving performance(s).

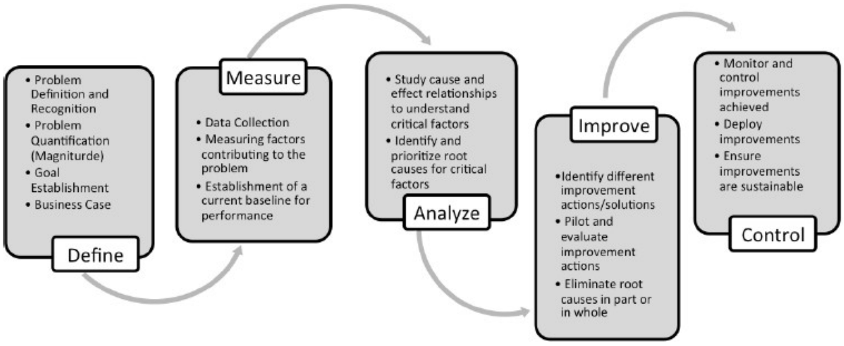

Figure 6. The DMAIC

The TEAM CSA Processing and Findings

The resultant Factors are:

- The structure publicstructUsing_TDM_VAR{ …}
- 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#.

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.

THE DISASSEMBLING PHASE AND BUSINESS PROCESSES

Disassembling Entity's Legacy

Projects and ISS are complex and have XFHRs because they depend on Composite BBs

(CBB)based creation processes. CBBs are created by the Disassembling process and serve for Six-Sigma's diagrams artefacts and environments. 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 7, deliver a Pool of heterogenous CBBs that are (re)used to build Architectural BBs (ABB). Disassembling (that is Automated RPs-ARP) can face difficulties in interfacing the various transformation modules like ISS, GAPA, FMS, PRWC. Disassemblingprocess should deliver afeasible Entity's Pool of refined CBBs and a central Entity's Polymathic Dictionary and Glossary (EPDG) (Trad, 2023d). The EPFG offers: 1) Common data and terms vocabulary for IHIPTF and Six-Sigma; 2) A data catalog; and 3) Collections of related terms, definitions, and other properties.

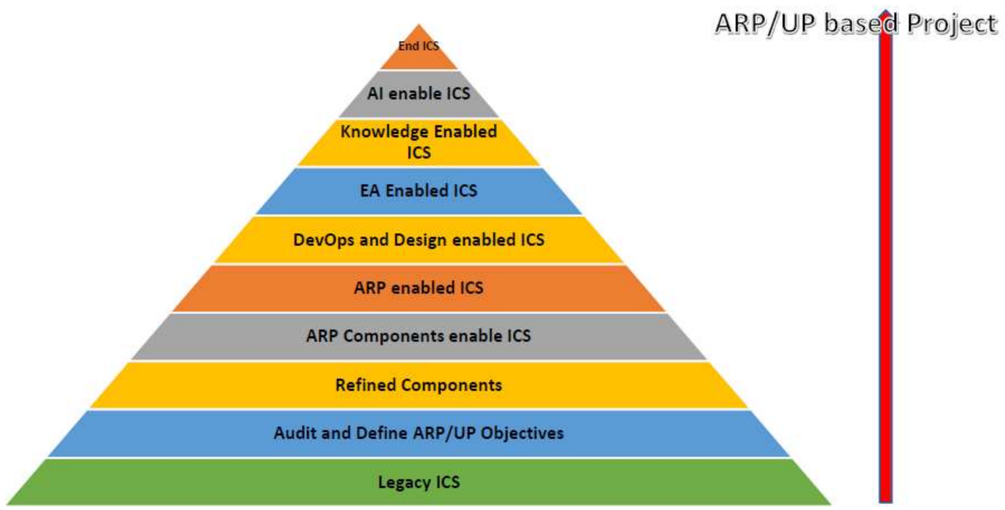

Figure 7. Disassembling based Project's Approach(Trad, 2023d)

The Pool of Refined CBBs, BP(M)s, and Reference Models

Projectsand hence ISS refined CBBs and ABBs,use existing services' architecture frameworks and standards; and they are managed by the TDM which synchronizesProject's Disassembling processes. ABBs are existing templates that are used for instantiating Solution BBs(SBB) that is APD'sagnostic. The TDM uses The Open Group's (TOG) Architecture Framework (like TOGAF that includes a generic BBs, CBBs, ABBs, and SBBs guidelines (The Open Group, 1999). The IHIPTF4ISSand TDM use the Technical Reference Model (TRM) that offers a generic concept for CBBs, ABBs, BBs. (simply Block) and its services, which makes Blocks interoperable. The MDTCAS offers the common methodological language "1:1" mapping concept (The Open Group, 2011c). 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; 3) Supporting

Disassembling to deliver needed artefactsfor Six-Sigma's environments; and 4) ISS specific Blocks concept.

The ISS Specific Blocks Concept

LSS/ISS are used as a set of tools to optimize Project's processes which use Blocks (that include BPMs) to (Skalle, & Hahn, 2013):

- Accelerate improvements by increasing organizational agility and technology skills.
- Improve responsiveness to challenges, opportunities, and changes in regulatory requirements.
- Improve the capacity to innovate and achieve strategic differentiations.
- Reduce process costs through automation and monitoring.
- Lower technical implementation costs through shared services.
- Lower analysis costs through collaborative online BPMs.
- Use standard services architectures like Service Oriented Architecture (SOA).

Integrating Services Architecture and Related Design Methodology

ISS uses Blocks that in turn can be based onSOA, but SOA alone is not sufficient for performing quality checks. So, SOA needs to becombined with quality mechanisms, by using Design for Six-Sigma (DFSS) (or toolDesignForSix-Sigma). DesignForSixSigma defines the objectives of a SOA implementation and avoids Pool's Blocks redundancies (Amile Institute, 2018). DFSS describes the application of Six-Sigma tools/environments for the development and BPMs' implementation. DFSS is a systematic methodology that can have the following five steps: Define, Identify, Design, Optimize, and Verify.

The Disassembling CSA Processing and Findings

This CSA's resultant Factors and artefacts are:

- The structure: public struct IHIPTF4ISS_Capability_DFSS_VAR
- The CSFs: 1) Legacy_Transformation; 2) EPDG_Implementation; 3) ARP_Capacities; 5) Reference_Models; and 6) IHIPTF4ISS_DFSS integration.
- The VARs: 1) Legacy_Transformation_VAR; 2) EPDG_Implementation_VAR; 3) ARP_Capacities_VAR; 5) Reference_Models_VAR; and 6) IHIPTF4ISS_Capability_DFSS_VAR. and a related structure.

This CSA_DT uses the defined Factors, as shown in Table 3 that is 8.50 that corresponds to "Risky". The details on how the CSA_DT was processed are 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_Blocks_Services_DFSS	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 8.50

THE PEMM

Basics and Construct

There are many ways how to builda PEMMfor the IHIPTF4ISS and its adapted modules. PEMM depends on Sig-Sigma's heterogenous environment, the Entity's ICS components and structure, as well as on its organizational transformational capacities. APEMMshould be theEntity's, IHIPTF4ISS', 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.The PEMM as shown in Figure 8, is the Entity's, IHIPTF4ISS', and Projects' ultimate reference model, and supports all IHIPTF4ISS' modules and Six-Sigma's Meta-Model (SSMM).

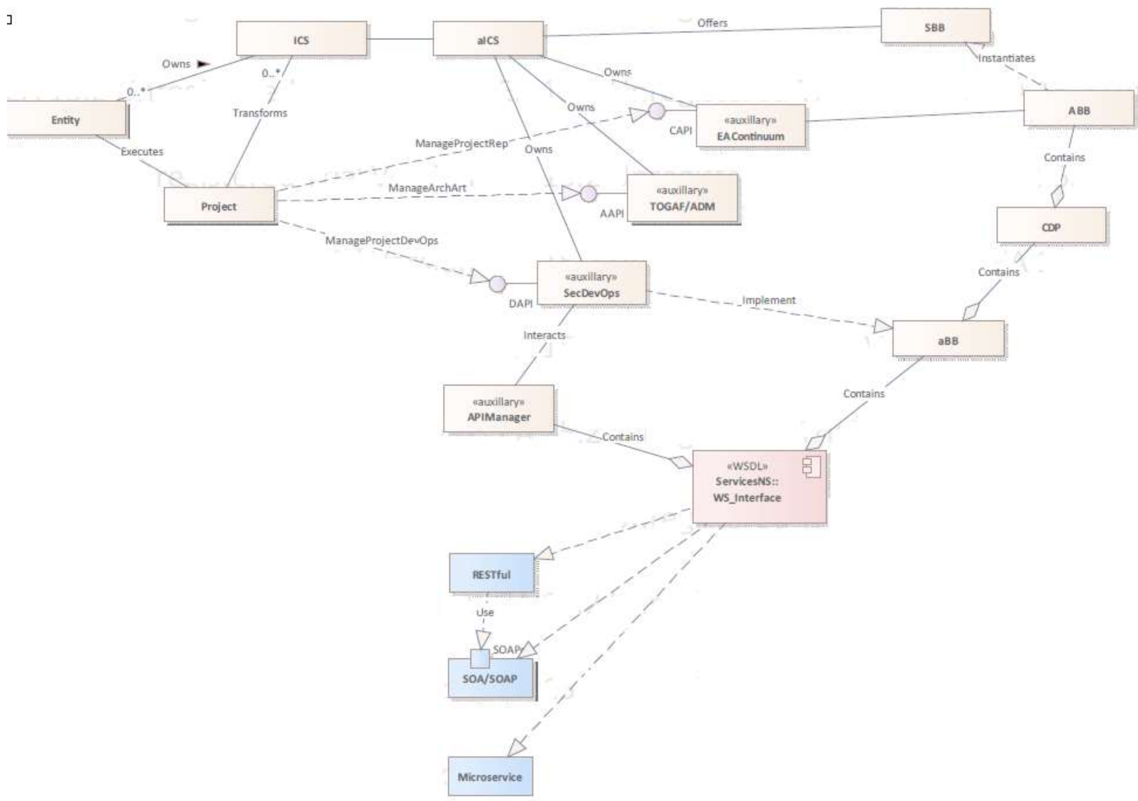

Figure8. A version of aPEMM

Interfacing PEMM with SSMM

The interface between PEMM and SSMM (PEMM&SSMM), can be built on the following facts (Deeb, Bril-El Haouzi, Aubry, &Dassisti, 2018; Herreraa, &Hillegersbergb, 2018):

- The IHIPTF has to integrate the PEMM&SSMM's related phases and tools.
- It needs to formalize Six-Sigma's concepts (using classes and associations) as shown in Figure 9, and to define the conditions for moving from one phase to another.
- The Project is designed to achieve objectives measured and quantified by Factors.
- To achieve the defined objectives of each phase, there is a need to define processes for the needed tools, application, and data-collections.
- The defined processeshave to be linked to tools used for each phase.
- To define the class "knowledge" that is owned by the belt-level.
- Deliverables are documents, information produced that should satisfy one or several requirements.
- When requirements are achieved, thenit is considered that the actual phase has terminated.
- Enables LSS' integration for continuous improvement of ICS services.
- Enables the interface to ITIL and COBIT.

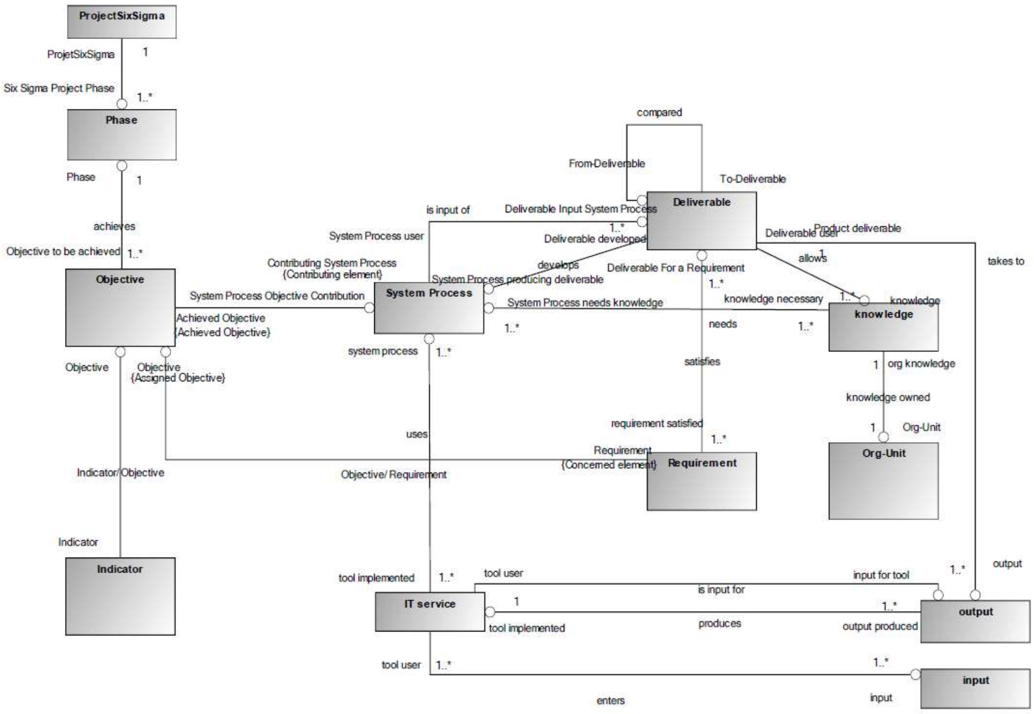

Figure 9. Six-Sigma's meta-model

The PEMM CSA Processing and Findings

The resultant Factors are:

- The structure: public struct IHIPTF4ISS_PEMM&SSMM_VAR…

- The CSFs: 1) PEMM_Feasibility; 2) Fundements_Conept; 3) Disassembling_Sync; 4) Global_Construct; and 5) IHIPTF4ISS_PEMM&SSMM_Integration.
- The VARs: 1) PEMM_Feasibility_VAR; 2) Fundements_Conept_VAR; 3) Disassembling_Sync_VAR; 4) Global_Construct_VAR; and 5) IHIPTF4ISS_PEMM&SSMM_VAR.

This CSA_DT uses the defined Factors, as shown in Table 4 that is 8.25 what 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_Meta_Modelling	Possible	From 1 to 10. **09 Selected**
CSF_PEMM_Relate_Disassembling	VeryComplex	From 1 to 10. **07 Selected**
CSF_PEMM_IHIPTF_PEMM&SSMM	Possible	From 1 to 10. **09 Selected**

valuation

Table 4. The CSA_DT outcome is 8.25

THE SET OF FACTORS AND THE INTEGRATION BY FMS

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).

The CSAs and CSFs

IHIPTF4ISS'repository contains and maps to Project's selected CSAs (which in turn map to CSFs, and other types of Project'sIntelligence resources, like LSS services, architecture models, requirements) as shown in Figure 10. A CSA maps to CSFs and other Project's resources, supported by the TDM (The Open Group, 2011a; Trad, & Kalpić, 2018a). CSF is a set of integrated KPIs, and a KPI is related/maps to a uniqueProject requirement and/or problem type as shown in Figure 10. The Project Team identifies the initial set of Factors to be managed by the FMS (Peterson, 2011).

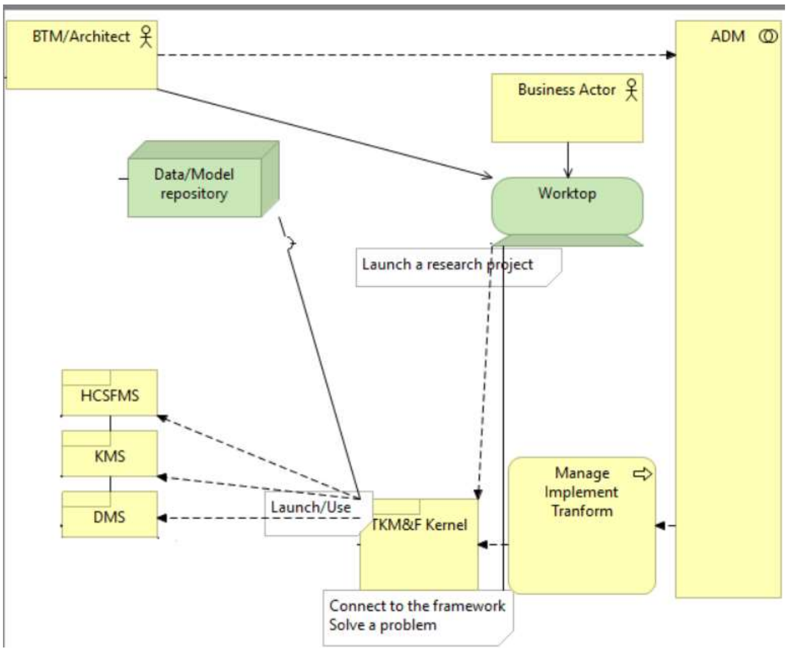

Figure 10. The TDM's architecture method's interaction

Therefore, CSFs are important for the mapping between Project's and/or IHIPTF4ISS' problem types (simply Problem), Intelligence constructs, and other Entity's items and resources. A set of CSFs reflects a Problem with its predefined constraints.

The KPIs and VARs

A CSF is a set of KPIs, and a KPI is related/maps to a unique Project requirement and/or problem type(s). FMS' 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).A Project establishes and links initial sets of Factorswhat is a complex process 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 an 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 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.

Factors Patterns and Rules

Factors pattern(s)are persisted in IHIPTF4ISS' repositoryin the form of Blocks, and are (re)used by the FMS and PRWC because they offer: 1) Predefined set(s) ofFactorsto be usedby Intelligence and GAPA; 2) Defined responsibilities, relationships,best practices, and content; 3) Relationships betweenBlocks and other Six-Sigma's artefacts; 4) Default Factors' values; and 5) Interfaces to evaluation rules.A Projectstarts with TDM's initial phase which is also the feasibility's checking phase. This phase checksifthe Project is feasible and the possibilities of XHDRs; andFMS offers the following set of rulesto check Factors (Trad, & Kalpić, 2018a):

- R1: References' checking which evaluates their credibility and that can be done by the Team.
- 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's in the diagrams and artefacts can help 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 can try to solve problems, and adapt Factors to APD's environment, like the LSS oranother sub-methodology.

Factors and Six-Sigma

The integration of Factors with Six-Sigma is based on (and supports) (Al-Jazzazen, &Schmuk, 2022; Odysseas, & Vasileios, 2012), as shown in Figure 11:

- Operational efficience,and continuous improvements but there are many challenges and XHFRs.
- Executive managements' commitment and involvement.
- Factorsare responsible for determining the success of LSS' implementation.
- Uses a Top-down top management approach.
- The Project to restructure and achieve cultural changes towards quality.
- Improves agility and related training.
- Changes in channels and communications plans and motivates employees to overcome resistance.
- Offers appropriate training and education.
- Success relatedto financial benefits.
- Utilization of quality-statistical tools and data analysis.
- Linking Six-Sigma to Entity's and Project'sstrategy.

critical Success Factor		Literature support
1-	Top management commitment and involvement	(Brun, 2011)
		(Jeyaraman & Teo, 2010)
		(Kwak & Anbari, 2006)
		(Laureani & Antony, 2012)
		(Näslund, 2008)
		(Raval et al., 2018)
		(Snee, 2010)
2-	Adequate Lean/ Six Sigma training.	(Antony et al., 2012)
		(Bhasin, 2012)
		(Brun, 2011)
		(Kumar et al., 2015)
3-	Linking Lean/Six Sigma to HR reward system	(Albliwi et al., 2014)
		(Jeyaraman & Teo, 2010)
		(Kumar et al., 2015)
		(Laureani & Antony, 2012)
4-	Choosing the most talented people	(Antony et al., 2017)
		(J. Douglas et al., 2015)
		(Snee, 2010)
5-	Informal communication and open discussion	(Brun, 2011
		(Albliwi et al., 2014)
		(Antony et al., 2017)
		(Raval et al., 2018)
6-	Linking Lean/Six Sigma to business strategy	(Brun, 2011)
		(Näslund, 2008)
		(Snee, 2010)
7-	Adequate of Lean/Six Sigma tools-knowledge	(Albliwi et al., 2015)
		(Brun, 2011)
		(Chakravorty & Shah, 2012)
		(Thomas et al., 2008)
8-	High employee retention	(Laureani & Antony, 2010)
		(Raval et al., 2018)
		(R. D. Snee, 2010)
9-	Sufficient organisational infrastructure	(Aboelmaged, 2011)
		(Brun, 2011)
		(Laureani & Antony, 2012)
		(Snee, 2010
10-	Understanding and awareness about Lean/Six Sigma benefits to the business	(Gurumurthy & Kodali, 2011)
		(Psychogios et al., 2012)
		(Raval et al., 2018

Figure 11. Selected Six-Sigma Factors (Al-Jazzazen, &Schmuk, 2022)The Factors and FMS CSA Processing and Findings

The resultant Factors and artefacts are:

- The structure public struct FMS_HDT_Processing_VAR.

- The CSFs: 1) FMS_Feasibility; 2) Factors_Defaults; 3) KPI_VAR_Interface; 4) Patterns_Collection; 6) Rules_Sets; 5) FMS_HDT_Processing; and 6) IHIPTF4ISS' 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) IHIPTF4ISS'integration_VAR; and the related example is 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_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 QQRMM

The initial set of Project problem types and their selected/related Factors are initialized in TDM's preliminary (and corresponding Six-Sigma's) phase (or initial iteration). Then, IHIPTF4ISS' HDT inputs various sets like: Constraints, Factors, Rules, Datasets, Configurations, and other, which are stored in IHIPTF4ISS'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 evaluatesProjects' problem types and proactively detects violations of the defined constraints and applied rules.

The Transformational Model and Structure

The adoption of a holistic, cross-functional and Polymathic modelling approach, is supported by the AHMM and its AHMM4ISS variant, which uses a multi-level Disassembling process. The RDP uses the Empirical Engineering Research Model (EERM) (Easterbrook, Singer, Storey, & Damian, 2008) andaPolymathic-Mathematical Model (PMM) that can describe a real-world system's behaviours, capabilities, and possibilities.

AHMM4ISS's basic element are used in IHIPTF4ISS, which is a specific model. The AHMM4ISS nomenclature is presented in Figure 12:

- The symbol ∑ indicates summation of IHIPTF4ISS' 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 symbolU̲ indicates sets union.
- The AHMM4ISS defines the Project and IHIPTF4ISS 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 = $\bigcup$ microRequirement	(N3)
CSA	= Σ CSF	(N4)
microMapping microArtefact/Req	= microArtefact + (maps to) microRequirement	(N5)
microKnowledgeArtefact	= $\bigcup$ knowledgeItem(s)	(N6)
neuron	= action->data + microKnowledgeArtefact	(N7)
microArtefact / neural network	= $\bigcup$ neurons	(N8)
microArtefactScenario	= $\bigcup$ microartefact	(N9)
AI/Decision Making	= $\bigcup$ microArtefactScenario	(N10)
microEntity	= $\bigcup$ microArtefact	(N11)
Entity or Enterprise	= $\bigcup$ microEntity	(N12)
EnityIntelligence	= $\bigcup$ AI/Decision Making	(N13)
BMM(*Iteration*) as an instance	= EnityIntelligence(*Iteration*)	(N14)

The Generic AHMM's Formulation

AHMM	= $\bigcup$ ADMs + BMMs	(N15)

AHMM's Application and Instantiation for ISS

Domain	= PRWC	(N16)
AHMM4(*Domain*)	= $\bigcup$ ADMs + BMMs(*Domain*)	(N17)

Figure 12. AHMM's nomenclature (Trad, & Kalpić, 2020a).

The Applied Transformation Mathematical Model

The AHMM4ISS is composed of: 1) A static view; 2) A dynamic (or behavioural) view; and 3) A pool of reusable ARbLP based scenarios. The AHMM4ISS can be modelled using following formula for Entity Transformation Mathematical Model (ETMM) that abstracts the Project:

$AHMM4ISS = Weigthing_1 * AHMM4ISS\_Qualitative + Weigthing_2 * AHMM4ISS\_Quantitative$ (N18)

AHMM4ISS = $\sum$ AHMM4ISS for a Project iteration (N19)

ETMM = ∑ AHMM4ISS instances
(N20)

The ETMM and Six-Sigma

Six-Sigma can be linked to the ETMM by (Tekriwal, 2023; Bernal, García, & Zenón, 2021; Orbak, Küçük, Akansel, Sharma, Li, Kumar, Singh, & Di Bona, 2022):

- Design of a Range using the concept of Transfer Function development.
- Offeringtechniques for Problem-Solving at the different decision-making levels.
- A solution process, where an AHMM offers resolutions. Defines problem-types, locates real problems in each of the strategic decision levels, and shows the different tools useful for solving these problems.
- To translate methods into a Pool of services.
- A well-defined system can be modelled by a mathematical model to identify the underlying problem.
- For optimization and problem-solving purposes like in logistics by using DMAIC.

The AHMM CSA Processing and Findings

The resultant Factors and artefacts are:

- public struct QQRMM_Feasibility_VAR.
- The CSFs: 1) QQRMM_Feasibility; 2) Elements_Sets; 3) Transformational_Model; 4) Viewpoints; 5) ETMM; and 6) IHIPTF4ISS_Integration.
- The VARs: 1) QQRMM_Feasibility_VAR; 2) Elements_Sets_VAR; 3) Transformational_Model_VAR; 4) Viewpoints_VAR; 5) ETMM_VAR; and 6) IHIPTF4ISS_Capability_VAR, like for example QQRMM_Feasibility_VAR structure.

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

Critical Success Factors	KPIs	Weightings
CSF_AHMM4ISS_Basics_QQRMM	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4ISS_Transformational_Model	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4ISS_Elements_Blocks_Artefacts	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4ISS_Viewpoints	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4ISS_ETMM_Six_Sigma	Possible	From 1 to 10. **08 Selected**

valuation

Table 6. The CSA_DT outcome is 9.40

THE PRWC

The Role of the PEMM,AHMM4ISS, IHIPTF4ISS, and PRWC

The PEMM based PRWC as shown in Figure 13, has the following characteristics:

- Has a static and dynamic form.

- Is AHMM's (and hence AHMM4ISS) 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 ensures 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 is also the need to implement the "1:1" mapping, implementation and classification concept.
- Is IHIPTF4ISS' structure.
- Is the Project's GAPA enabler.

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

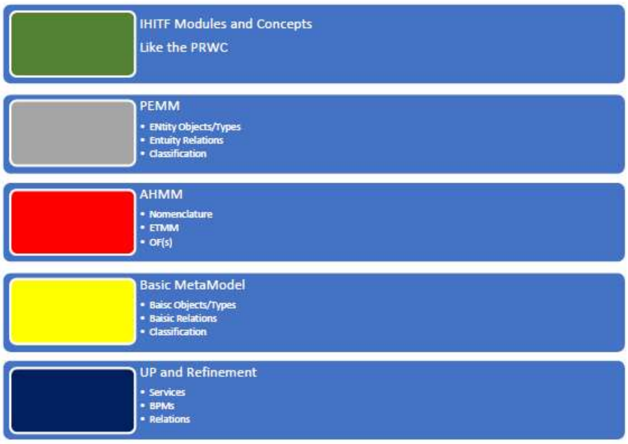

Figure 13. The IHIPTF4ISS layers of models

HDT's Actions

For a Project requirement (or problem type), the IHIPTF4ISS 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 IHIPTF4ISS, it builds its own one, which functions as follows:

- The weightings for each CSA, CSA_WGT ϵ { 0.00% … 100.00% } are floating-point /percentage values, 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 IHIPTF4ISS or a domain specialist; or 3) An external concept.
- CSA_WGT = ∑CSF*CSF_WGT.

- CSF_WGT = ∑KPI*KPI_RAT.
- KPI_RAT = ∑VAR*VAR_RAT.

Evaluating GAPA

GAPA is used to evaluate performances of the Project and its modules. There it can be also used for each Entity's CSA, where CSFs can be: 1) A status for a Six-Sigma resource like a requirement; 2) Mapping levels of UP's BBsand 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. 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 and artefacts are:

- The structure: public struct GAPA_Exec_VAR…
- 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.

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

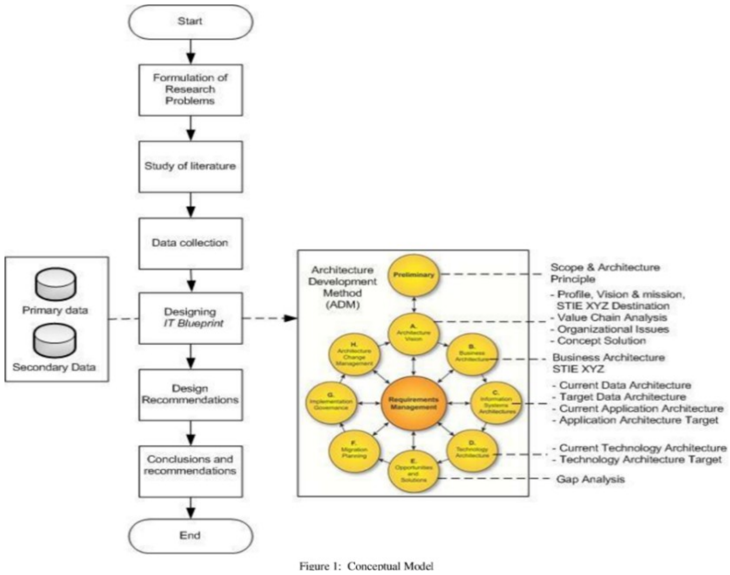

Figure 14. ADM's (TDM) phases (The Open Group, 2011a, 2011b; Holilah, Girsang, &Saragih, 2019)

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, IHIPTF4ISS, PRWC, and the HDT to solve Problems as shown in Figure 14 (Markides, 2011).

The MDTCAS

TheIHIPTF4ISSintegrates 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. TheMDTCAS, as shown in Figure 15,is a mixture ofexisting methodologies like(Trad, 2023d):Structure Analysis and Structured Design (SA/SD), Object Oriented (OO) Methodology (OOM),UML/ArchiMate, The Entity Relationship Diagrams (ERM), DMN, BPM Notation (BPMN), Six-Sigma…etc.

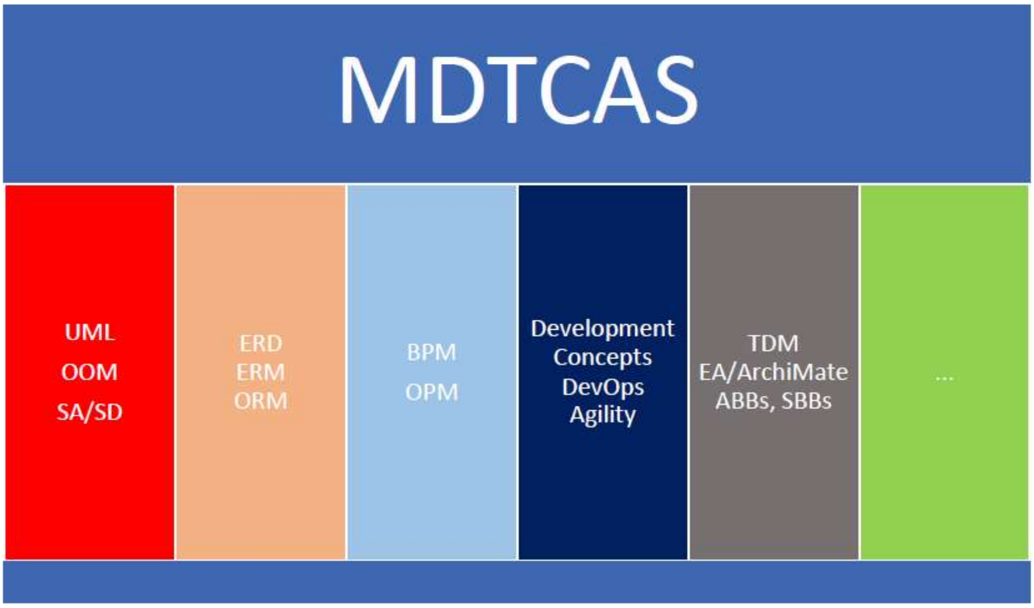

Figure 15. MDTCAS'Layers (Trad, 2023d)

PRWC based Continuous Improvements and GAPA

The Project can use the PRWC for continuous improvements and where ELP based enhancements 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….Six-Sigma is a measurement-based strategy for improving/transforming Entity's processes, by using DMAIC and associated diagrams: Cause and effect diagram or Ishikawa diagram; Flow Chart; Pareto Chart; Histogram; Check Sheet; Scatter Plot; and Control Chart (Greycampus, 2024).

Integrating the DMAIC

The DMAIC can interface the TDM by mapping its main cycles (Greycampus, 2024):

1) Definethatincludes:
    - The Project plan, charter and sets of problems are summarized.
    - The business case to understand how the Project and its objectives.
    - A problem statement that describes the Project.
    - The goal statement, by considering all elements.
    - Project's scope and boundary.
    - Team's responsibilities:
    - Time plan or milestones.
    - Project'sbenefits.
2) And measuring, by collecting the data that is relevant to the Project's scope. This phase focuses on identifying the parameters that need to be measured/quantified. The analysis

phase's main objective is to find the root cause of business inefficiency and to identify the gaps between actual and goal performance.

3) The improve phase improves the process by determining solutions, and action plans are presented.
4) The control phase main objective is to generate a detailed solution monitoring plan that ensures required performances.

Figure 16. DMAIC as a continuous improvement cycle

Integrating the DFSS Methodology

DFSS is a separate and emerging discipline related to Six-Sigma and is a systematic methodology utilizing tools, training, and measurements toenable the design of products and processes. It can have the following five steps to:

- Define the customers'requirements.
- Identify customers' roles in a Project.
- Design the processesto support the requirements.
- Optimize the processes.
- Verify by using tests and validation.

Integrating Other Frameworks

To align various types of frameworks, there is the need to (The Open Group, 2022):

- Create a catalogue of needed frameworks and their area of focus.
- Include planning andexecution (Project Management Institute (PMI), PRINCE2, Six-Sigma).
- Include ICS governance and operation (Lean,COBIT, ITIL).

- Include management and measurement frameworks (Balanced Scorecard and SABSA Enterprise Risk).
- Include industry specific**WHAT?**(SCOR and eTOM).
- Group the frameworks by type like risk, accounting, and planning as shown in Figure 17.
- Define the intersection with EA/TDM capability because EA provides value in planning, change governance, and realization.
- Adjust the Project's roadmap to either fit the EA Capability or to extend the EA Capability to fill the gap.

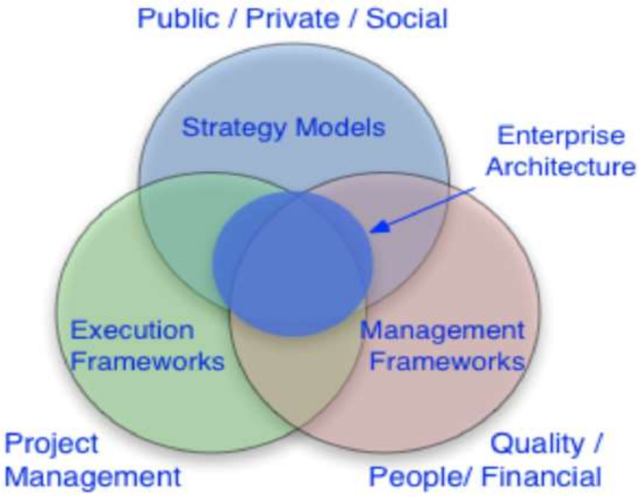

Figure 17. Grouping frameworks

Convergence of TOGAF-ADM and LSS

The convergence Perspective of TOGAF-ADM/TDM and LSS can be based on Business-ICS alignment and Pool of Blocks. A possible convergence model of TDM and LSS, that can support performance and tasks improvement, is based on ADM phases, iterations, features, and information architecture. The ADMmaps to LSS' DMAIC stages for a systematic process wastes removal, knowledge creation and data mining to develop a unified model. Such a model supports efficiency and performance. The IHIPTF and PRWC measures possible activities, that can be based on accumulated knowledge (Mohamed, Elmusrati, Gaafer, Zakariya, &Elawady, 2023).

Figure 18. Interfacing the ADM with the LSS

The TDM CSA Processing and Findings

The resultant Factors and artefacts are:

- The public struct PEMM_Integrity_VAR.
- The CSFs are: 1) Viewpoints_Establishement; 2) MDTCAS_Usage; 3) Cartography_Generation; 4) PEMM_Integrity; and 5) IHIPTF4ISS' integration.
- The VARs are: 1) Viewpoints_Establishement_VAR; 2) MDTCAS_Usage_VAR; 3) Cartography_Generation_VAR; 4) PEMM_Integrity_VAR; and 5) IHIPTF4ISS'integration_VAR.

This CSA_DT uses the defined Factors as shown in Table 8 that is 8.60what 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_Blocks	Possible	From 1 to 10. **09 Selected**
CSF_TDM_PEMM	Possible	From 1 to 10. **09 Selected**
CSF_TDM_Interfacing_Frameworks	Complex	From 1 to 10. **08 Selected**
CSF_TDM_LSS_DMAIC_DFSS	Complex	From 1 to 10. **08 Selected**

valuation

Table 8. The CSA_DT outcome is 8.60

INTELLIGNCE

Basics

The HDT based problem-solving process is supported mainly by the ELP based Intelligence module; andit uses the: 1) AHMM's instances based on beam-search that is mainly a qualitative-heuristic processing (Della Croce, &T'kindt, 2002); 2) The twins PRWC/FMS; 3) QQRMM (Nijboer, Morin, Carmien, Koene, Leon, & Hoffman, 2009). The ELP managesEntity and Project's Knowledge Items (EPKI) that are related-linked to Entity's/Project's resources and modules like PRWC, Intelligence...The IHIPTFsupports the Entity's Legay KMSwhich can be transformed to manageEPKIs. The KMSpart of Intelligence, identifies theconcerned Factors their PRWC/FMSevaluation processes(Rockart, 1979).

Problem Solving Capacities

In Six-Sigma's case HDT's problem solving module can interface the DMAIC, especially its Measure, Analyse, and Improve phases, but only for quantitative/data-driven requests, because Six-Sigma has basically a quantitative approach. DMAIC's phases for problem solving support look as follows (Agile Alliance, 2014):

- Define the Project'sproblemset, where the goal is to describe and formulate a business case for the ongoingProject.
- Measure the Entity's processes form key units/parts viewpoint???, and collect data about Factorsthat can be related to the problem set;establish an actual baseline for performance-metrics from a mixed (quantitative andqualitative) perspective.
- Analyse the Factors related to the problem in order to identify the origin of causes.
- Improve by identifying, implementing, and evaluatingpossible improvement(s) solutions.

The GAPA

GAPA is done by the DMS which uses the HDT to narrow the Project's gap by using localized 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 GAPA in Six-Sigma's context has the following characteristics and steps (Hessing, 2022; Kinney, 2023):

- GAPA is a well-established business improvement methodology that is designed to manage steps and actions to improve BPs, business efficiency, product quality…
- Analyzes the existing context and situation; and plan the next steps and context's changes.
- Defines what should be the gap; and find the reason and origin of the gap between these two Project's phases.
- Consuders which metrics' logic/algorithmcan be used for GAPA.
- Finds transformation steps to cover the gap.
- Plans the needed resources and the manner to intervene.
- There are many GAPA metrics, and finding/tuning of the right metrics logic is of crucial importance for the Project, where the IHITPF uses the PRWC.
- It uses metrics' logic that include: 1) Measurable Factors like costs or public opinion…; 2) Adopting a meaningful and instrumental bridging in Project's gaps like Cloud implicationscanbe meaningful; 3) Improvability can be verified by using Factors; and 4) Complementary using sets of Factors,rather than a single one, because using a single Factor/metric would deliver a limited GAPA.
- GAPA can use five key process steps and has a number of parallels to DMAIC's approach, like in: 1) Defining the scope of the analysis; 2) Defining the current state or performance; 3) Defining the required future state or potential; and 4) Analyzing the gap between current and future state; and 5) Implementing and controlling actions that bridge the gap.
- It needs to prioritize actions to bridge the gap.
- Localizes the current stateby identifying and exploring existing business metrics, processes and quality data; where Key Process Input Variables (KPIV) can be of support.
- Defines the future state and the expected outcomes to be supported bythe Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis.
- Bridges the gap by exploringpossible routes and methods available to us to move from the Project's current state to the future state; which can be supported by the Failure Mode & Effects Analysis (FMEA) documents that can ensure the future state to be sustainable.
- GAPA depends on decision-making.

Decision-Making

Six-Sigma decision-making capabilities is built on (Freeman,2023; Hess, 2023):

- Business success depends on the speed and quality of decision-making which leads to major performance improvements by reducing work, and hence committing of errors.
- Six-Sigma matrices and charts like the prioritization matrix, involvement matrix, and feature comparisonchart.Dodati glagol!
- Matrices can be used to compare two or more groups of features/requirements, determine their relationships, and make decisions.
- It also helps prioritize tasks or problemsin order to support decision-making.

- It supports narrowing down the Project's tasks by identifying the optimal order.
- The DFSS can improve the speed and quality of decision-making.
- The morphologicalmatrix supports Team'scapacities in finding solution(s) and producing documentation.
- The documentation is made available for Project audits and the KMS.
- Decision speed and quality are important,butbad decisionscan result in problems or even XHFRs.
- The four steps to the *Best Solution,* by overcoming this impasse and to make optimal decisions quickly and:1) Gather the Voice Of the Customer (VOC); 2) Translate Factors (CTX) from VOC; and 3) Use morphological matrix to determine possible solutions and functionalrequirements; and 4) Use Pugh matrix.

The Pugh Matrix

Figure 3: Pugh Matrix

Critical-to-Success Factors	**Importance**	**File System**	**Website**	**Doc.Mgt.Sys.**
Store All Project Evidence	111	D	S	S
Reliable Availability	51	A	S	S
Secure Data	48	T	–	S
Implementation in One Week	40	U	–	–
O Cost	31	M	–	–
Minus (-)			3	2
Plus (+)			0	0
Same (S)			2	3
Analysis			**-3**	**-2**

Figure 19. The Pugh matrix

Entity's hierarchy, and Teams need to deliver decisions thatsuit Project's requirements.

Decision-making requires a process in which they can track usingof statistics, reasoning, and feedback.The mentioned process can be implemented by Pugh's Matrix developed by Stuart Pugh that is a qualitative technique used to rank the multi-dimensional options of option-set, which is a roughly a similar approach to the authors' PRWC based CSA_DT.It is used in engineering-based research processes for multi-dimensional or Polymathic Entities' change management.It is optimal for iterative transformation processes.As shown in Figure 19, the major advantageof Pugh's matrix is making the optimal decisionsthat are based on data-sets. Then to rankeach solution against the timestamp/datum for each Factor. In this type of matrix, 3 symbols areused for comparison: 1) S,for the same as datum; 2)The minus sign (-) for the worse than datum; and 3) The plus sign (+) for the better than datum. As shown in Figure 19, 3 solutions are similar. The final decision-making process' deliverable from it is to make an educated decision and store it in the ELP. From the presented Pughmatrix, it is obvious that the file-system solution is the best one. In addition, there are positive side effects. The morphological matrix determines the functional requirements.When the team is ready to implement, the functional requirements have been defined. To improve the quality of decision-making, the Project team performs a risk-assessment (orfailure mode and effects analysis (FMEA)on the selectedsolution(s) (6sigma, 2021).

The Intelligence CSA Processing and Findings

The resultant Factors and artefacts are:

- The structure: public struct HDT_Access_VAR…
- The CSFs are: 1) QQRMM_Application; 2) HDT_Access; 3) KMS_DMS_Integration; 3) GAPA_Processing; and 4) IHIPTF4ISS' integration.
- TheVARs are: 1) QQRMM_Application_VAR; 2) HDT_Access_VAR; 3) KMS_DMS_Integration_VAR; 3) GAPA_Processing_VAR; and 4) IHIPTF4ISS'integration_VAR, like theHDT_Access_VAR structure example as shown in Figure 29:

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_CSA_DT_GAPA	Complex	From 1 to 10. **08 Selected**

valuation

Table 9. The CSA_DT outcome is 9.25THE APD-ISS

DT's Implementation Impact

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' digitization is complex and has XHFRs (Eira, 2022). The DT uses the IHITF to Disassemble legacy systems and it enables the use of TDM, MDTCAS, Six-Sigma, and EA digitized models and defines DT's scope (Bizzdesign, 2022). A successful DT is the base of a successful Project that needs Polymathic skills which are needed like in the case of Six-Sigma where aProjectcharter has the following elements/components: Name, Business case (or ACS),Scope, Goals, Milestones, and (specific) Requirements. Such environments face XHFRs and need adapted environments.

Adapted Environments

Many surveys show XHFRs for Six-Sigma based Projects that is due to many Factors, like:

- Lack of top management skills-level, commitment, and support.
- The implementation needs strong leadership and support.
- Inadequate training and resources needed for effective application of Six-Sigma's methodologies.
- Resistance to change, because Teams face significant changes to their working processes and the Entity's organizational culture. Resistance.
- Poor project selection where Six-Sigma must be adapted by using the TDM and IHIPTD; and selecting Projects with unclear goals will probably face XHFRs.
- Lack of highly coordinated environments.

Coordinated Environments

Six-Sigma based coordinatedenvironments need to use/implement the following tools and artefacts:

- The Critical to Quality (CTQ) tree is used during DMAIC's design phase, for brainstorming and to validate Project's requirements. CTQ tree'ssteps are to identify:Customer(s); Their requirements; First level of requirements; How they can be satisfied…; and then to describe detailed requirements.
- The Process Maps are created during the definition phase, where the process map is a diagram of the process' activities.
- The Histogram is used during the analysis of collected (continuous) data during the stage of DMAIC.
- The Pareto chart is used for discrete datasets.
- The Process Summary Worksheet to support effectiveness and efficiency.Efficiency is weighting with the Factors:Cost, Time, labor, or value.
- The Cause-Effect Diagram is the most important environment that assists the Team in determining root causes. It captures all the Project's requirements and relates them to possible problems, or root causes.
- The Scatter Diagram is useful when requirements (ideas) have been prioritized after use of the cause-effect diagram, and then the Team validatesthe ideas with facts anddata.
- The Affinity Diagram can be used to sort and categorize a large number of ideas into CSAs; and is also useful for Team's brainstorming activities.
- The Run Chart, where the Histogram and Pareto charts are similar to a camera where a snapshot was taken. But the Runchart is similar to a camcorder, recording processes' element over-time.

- The Control Chart is similar totheRun chart, but where theControl chart uses the data from a run chart to determinethe upper and lower control limits. Control limits are the expected limits of variationabove and below the average of the datasets.

The presented environments theTeam can use to estimate XHFRs.

Resulting XHFRs

Various sources show the limitations and emerging trends of Six-Sigma methodologies' weakness and the failure of continuous improvement initiatives or XHFRs, which are related to (Antony, Sony, 2020; Albliwi, Antony, Abdul Halim Lim, & van der Wiele, 2014; Chakravorty, 2009):

- Six-Sigma's initiatives have XHFRs which is similar toany other organizational transformation initiative.
- The first limitation of Six-Sigma is viewed as a gap in the sense that it addresses XHFRs in many Entitiesthat make more than 60%.
- Many Entitieswhich implemented Six-Sigma left good impressions in the Project's initial phases,but then they were disproved by the final outcomes.
- Because of various types of complexities,these XHFRs that happen to Entities across different APDs,Six-Sigma initiatives are stopped, mainly due to massive costs.
- The main reasons for XHFRs are:Individualism, Team's resistances, Project's complexities, Organisational complexities...When the reasons for XHFRs are understood, frameworks (like the IHIPTF) for mitigating XHFRs can be implemented.
- Another viewpoint on success or failure of Six-Sigma's based Projects, report that they face even higher XHFRs, i.e. more than 70% of business transformation projects fail.
- Process Maps can enhance success rates.

Process Maps

Implementing a Six-Sigma Process Map (SSPM) and its related Flow Chart (SSPM-FC) it is a practicalmanner to:

- Transformbusinesses and to improve inefficiencies.To create a SSPM-FC starts by determining the context and scope of transformed BP(M)s.
- Identify and sequence of BPs' activities/steps before reviewing and analysing the map for accuracy.
- Create a new map for the optimal state to improve the current BP(M).
- SSPM acts as the roadmap for any business endeavour, by providing a comprehensive view of how BPMs are implemented and improved, and how they contribute to organizational goals.
- Offer a visual representation of every BP step,what allows stakeholders to pinpoint areas of inefficiency, redundancy, or waste.
- Identifybottlenecks and flaws in BPMs' flow. Entities can strategically allocate resources to make targeted improvements, resulting in enhanced efficiency.
- A Well-designedSSPMsupports standardization across different Entity's departments.
- Team members can understand their roles and their impact on organizational objectives and changes.

- Offer a navigational aid for businesses and in supporting improvement, operational excellence, and sustained success.
- Support various types of SSPM-FCs.

Types of SSPMs

Six-Sigma's SSPM-FC types are:

- Process Flowchart is a simple step by step process of activities carried out in the process.The Process Flowchart is a fundamental component of the Six-Sigma methodology, specifically within the Define-Measure-Analyse-Improve-Control (DMAIC) framework.
- Deployment Flowchartis referred to, as a Swimlane flow chart or cross-functional flowchart describing the roles of different Teams/departments/stakeholders involved in the process.This flow chart type illustrates the sequential steps involved in deploying a process improvement initiative.
- Alternate Path Flowchart is a step-by-step flowchart that provides alternate paths for most of its steps. This is unlike the swimlane (deployment) or regular flow-charts.The Alternate Path Flowchart is a valuable component within the Six-Sigma methodology, designed to enhance process mapping by accounting for variations and deviations in workflows.

The ADP CSA Processing and Findings

The resultant Factors and artefacts are:

- The structure: public struct Process_Maps_VAR.
- The CSFs are: 1) DT_Implementation_Impact; 2) Adapted_Environments ; 3) Coordinated_Environments ; 4) Resulting_XHFRs ; 5) Process_Maps ; and 6) Types_of_SSPMs.
- The VARs are: 1) DT_Implementation_Impact_VAR; 2) Adapted_Environments_VAR; 3) Coordinated_Environments_VAR; 4) Resulting_XHFRs_VAR; 5) Process_Maps_VAR; and 6) Types_of_SSPMs_VAR.

This CSA_DT uses the defined Factors as shown in Table 10 that is rounded 8.20 that corresponds to "Risky".

Critical Success Factors	KPIs	Weightings
CSF_APD_DT_Implementation_Impact	Complex	From 1 to 10. **08 Selected**
CSF_APD_Adapted_Environments	Possible	From 1 to 10. **09 Selected**
CSF_APD_Coordinated_Environments	Possible	From 1 to 10. **09 Selected**
CSF_APD_Resulting_XHFRs	VeryComplex	From 1 to 10. **07 Selected**
CSF_APD_Process_Maps	Complex	From 1 to 10. **08 Selected**
CSF_APD_Types_of_SSPMs	Complex	From 1 to 10. **08 Selected**

valuation

Table 10. The CSA_DT outcome is 8.20

THE PROOF OF CONCEPT

Introduction and the used ACSs

Factors are deduced from the selected ACSs, used in Projects to evaluate success rates and they are managed by the FMS/PRWC that are used in this PoC, which tries to show how the IHIPTF's modules are used for ISS.The PRWC, GAPA, HDT, and other are used to estimate Project's success or XHFRs(Lebreton, 1957; Ronald, 1961). The ACSs/PoC select and tune the related Factors with this question in mind: "What are the essential Factors that guarantee ISS' success?" The first ACS is an insurance management system (ArchiSurance),used to present basic Project's transformational capacities to convertthe legacy system and then use a specific Six-Sigma CSA. The mentioned ACS explains how to manage, register, accept, valuate, and invoice claims-related activities (Jonkers, Band, &Quartel, 2012). The transformed ICS has to improve Blocks' usage, data-quality, and Factors evaluations, as shown in Figure 20.

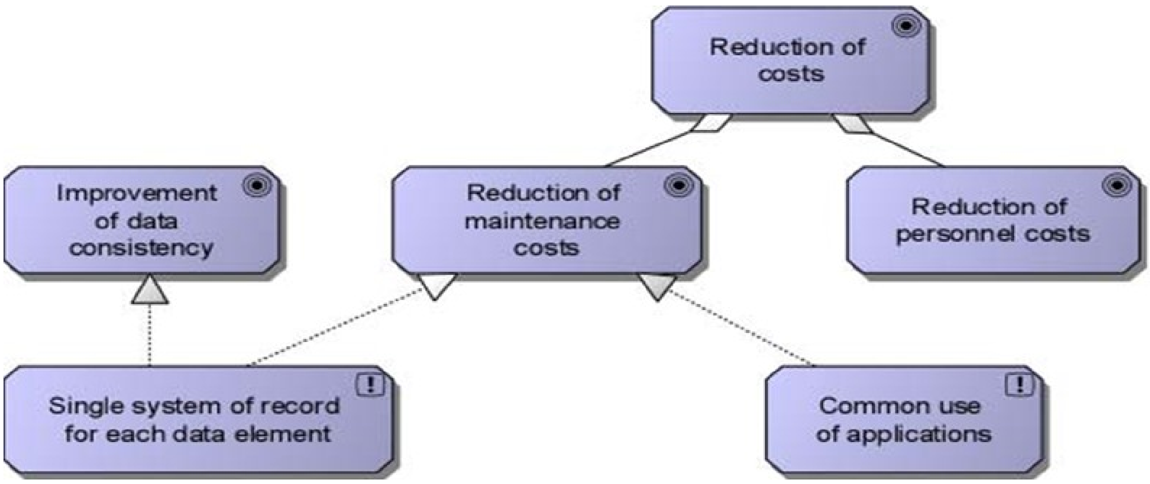

Figure 20. Project's transformation goals (Jonkers, Band, &Quartel, 2012)

ISS' and TDM's Interactions

The setup of ISSand interactions with TDM's 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 ISS and hence the PoC.
- Phase B or the Business Architecture phase shows how the Project's target architecture implements key requirements and relates them to the IHIPTF4ISS, ISS, FMS and PRWC.
- Phase C or the GAPA phase shows and uses the cartography generation, 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 are Implementation and Migration Planning.tThe transition architecture proposes possible intermediate situation and evaluates (with the IHIPTF4ISS and PRWC) the Project's status using defined Factors.

Evaluating RDP's CSA_DTs

The ISS interfaces Intelligence and PRWC/Factors which are presented and evaluated in Table 11, and using the CSA_DT's Tables Weighting and Rating Enumerator (CTWRE) that is shown in Figure 21.

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 21. The CTWRE's values.

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

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. 8.50	3
PEMM's Implementation	Risky	From 1 to 10. 8.25	4
FMS' Integration	Risky	From 1 to 10. 8.50	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. 8.60	8
Intelligence's Integration	Mature	From 1 to 10. 9.25	9
APD's Integration	Risky	From 1 to 10. 8.20	10
IHIPTF4ISS/Phase's 1 Outcome	Risky	From 1 to 10. 8.74	11
Evaluate First Phase			

Table 11. The RDP's outcome is (rounded) 8.70

After initializing IHIPTF4ISS' client, Factors/CSFs were linked to a specific node of the ARbLP/HDT. The programs linked the AHMM4ISS instance to the set of HDT/Intelligence actions which uses Intelligence actions. Table 11 presents Phase's 1 results that the PRWC and Projects are "Risky". ISS is not an independent task or component; and is linked to all IHIPTF4ISS' modules. TheAHMM4ISS'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 8.70 implies that ISS' integration is "Risky" and due to various types of complexities. As Phase 1 is not a "Failure" the PoC continues to IHIPTF4ISS' setup.

IHIPTF4ISS' Setup and Configuration

Figure 22. The IHIPTF'sgraphical interface

The PoC configures the FMS and Factors, then these Factors are mapped to Project's resources and artefacts. The FMS/PRWC contains the relationships that link Project's (and ISS) requirements, Blocks, NLP scripts, Factors, and Global Unique IDentifiers (GUID). IHIPTF4ISS'client's interface that is shown in Figure 22 sets up all the Project's operations like NLP scenarios development and linking scripts to Factors and Blocks. NLP scripts are the backbone of Intelligence and contain the defined sets of actions to be processed. The AHMM4ISSensures ISS' integrity and HDT's tree configuration.

Phase 2-Solving a Concrete Problem

Phase 2 relates to concrete ACS.The Unleashing Synergies are The Intersection of Digital Transformation and Lean Six-Sigma in the Modern Business Landscape (Lean Manufacturing &Six-Sigma Worldwide, 2023). This ACS is about manufacturing improvements, where a leading manufacturing enterprise implemented a DT to automate production BPs and collect real-time datasets from integrated sensors. LSS was applied to analyze collected datasets, resulting in reduced defects, shorter lead-times, and improved overall equipment effectiveness. 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 IHIPTF4ISS' target models to support ISS.
- Sub-phase C shows and uses the cartographyand describesIHIPTF4ISS' activities.
- Sub-phase D shows the needed IHIPTF4ISS'and Project's infrastructural landscape.
- Sub-phases E and Fpresent intermediate Project's situation(s) and evaluates ISS; and updates the list of Problems (or PRB) to be solved.

PRBs Solving for aconcrete HDT Node:

- Intelligence solves PRBs, where Factors to the defined set of actions which are processed in a selected/concrete HDT node. For this aim the action

CSF_IHIPTF4ISS_Capability_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 IHIPTF4ISShas implemented NLP scripts to process CSA_DTs, and related PoC's resources to theCSF_IHIPTF4ISS_Capability_Procedure; 2) Intelligenceis configured and uses the PRWC support to the HDT; 3) LinkingHDT's node to data-contents; and 4) The HDT executes the CSF_IHIPTF4ISS_Capability_Procedure and delivers SOL(s).

SOL Nodes activities:

- NLP scripts are called by the IHIPTF4ISS' modules like the PRWC.
- These scripts are processed in the background to deliver IHIPTF4ISS' modules value(s).
- These values are translated into actions, conclusions, and recommendations.

CONCLUSION AND RECOMMENDATIONS

This RDP proposes a set of recommendations and techniques on how to implement a IHIPTF4ISSfor Projects in any APD. The IHIPTF4ISSuses FMS/PRWC, GAPA, HDT, and Factors to iteratively assert Project's feasibility and because of the low score of8.70 (Table 11)implies that it is "Risky" Project, and the resultant recommendations are:

- ISS is a Six-Sigma methodologies' integration concept.
- The IHIPTF4ISS shows how to implement an IHI and Anti-Locked-In (ALI) transformation framework.
- The GAPA and PRWC evaluate Projects' progress.
- This RDP uses a specific QQRMMconcept and ignores statistical/quantitative approach.
- The PRLR proved the existence of an important knowledge gap and XHFRs.
- The AHMM4ISS and ELP based HDT support Intelligence.
- The HDT supports IHIPTF4ISS' modules reasoning, like in the case of the PRWC.
- Cross-functional/Polymathic skills are needed.
- The IHIPTF4ISSuses and interfaces existing frameworks, standards, and methodologies, like TOGAF, SWOT, Six-Sigma's environments...
- The PoC checkedIHIPTF4ISS' feasibility.
- The IHIPTF4ISSintegration is complex and "Risky".
- Six-Sigma is not a transformational methodology but can be a complement to a transformation's initiative and framework like the IHIPTF.

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