Advanced Research on Information Systems Security

ARIS[2]
an
international journal

ISSN: 2795-4609 | ISSN: 2795-4560
Print & Online

Enterprise Transformation Projects-The Role of Enterprise Architecture in Implementing a Holistic Security Concept (ETP-HSC)

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Abstract

This article presents the ETP-HSC and a corresponding enterprise transformation framework, where the focus is on the application of Enterprise Architecture (EA) to support Security (EA4S) and it is the central topic. The EA4S is a Polymathic-holistic approach, which adopts a clear EA as the main ETP constraint for the implementation of a secured Information and Communications System's (ICS). EA and all other ICS related architecture disciplines, are inspired from the term *Architecture* that comes from civil engineering, and in this domain, secured building objects are achieved by implementing robust building and urbanistic architectures, like the famous case of Hausmann's Architecture and Urbanistic plan for the (re)Architecture of Paris in France, in which its primary objective was to assert Paris' security. Therefore, the author considers that EAS' first step is to build an enterprise security concept. But enterprises that have been archaically built and do not have the needed resources to implement a Haussmannian security concept, therefore an iterative ETP-HSC implementation process can transform the enterprise's security. ETP-HSC's feasibility and integrity can be supported by an integrated Applied Holistic Mathematical Model (AHMM) for EAS (AHMM4EAS), and author's various research works on the applications of holistic security concepts, ETPs, Artificial Intelligence (AI), Cloud Services (CS), and AHMM. The ETP-SRC is based on multi-disciplinary proprietary-mixed research method.

Keywords: Enterprise Security; Enterprise architecture; Enterprise Transformation Projects; Artificial Intelligence; Mathematical Models; Requirements; Strategic and Critical Business Systems; Performance Indicators; and Strategic Visions.

1. Introduction

This article analyzes the possibility to implement ETP-HSC, by using the Security Refinement Concept (SRC), and the Automated Refine Processes (ARP) based Unbundling Process (UP) [4]. The ETP-HSC that starts with an SRC based Digital Transformation (DT) process, which is a critical process and it decides if the ETP will be successful. ETP-HSCs are of strategic importance for the enterprise or organization (simply an *ENT*), but they are complex and they have high failure-rates. Failure-rates can be estimated by using risk mitigation approach, that uses the AHMM4EAS to evaluate progress or regression. The basic SRC is a set of UP operations like extraction, conversion, and refinement; these operations are executed on various *ENT's* ICS components and resources. An *ENT* can be consisted of the following elements: 1) Stakeholders; 2) Executive managers and directors; and 3) A set of *ENT* units (simply a Unit), where each Unit can have its own (1 or more) Unit's ICS shares or PLatform(s) (UPL). The application of the SRC based ETP-HSC on *ENT's* ICS, refines and transforms all its Units and its underlying UPL(s); to deliver reusable and secured Building Blocks (sBB). SRC based ETP-HSC generated sBBs can be combined in secured Composite sBBs (sCBB) to securely reorganize *ENT's* APplication Domain's (APD) business and common functions, Units, UPLs, and all their dependencies. The AHMM4EAS verifies *ENT's* generated sBBs, Units, and UPLs integrities; and they can be used in the ETP. ETP's implementation phase relies on generated sBBs and sCBBs, where an sBB is a set or library of secured Micro-Artifacts (sMA) which can be any ICS resource, component or resource like: 1) Code archives, modules, or libraries; 2) Data-sources objects, like a set of data-sets, tables or files; 3) Business resources like Business Processes (BP); 3) Network component; 4) External ICS components; or other. Various types of sBBs are combined to create an sCBB, and in turn sCBBs are combined to deliver secured organizational or ICS BBs (sIBB). Then sIBBs can be used to implement or (re)build *ENT's* Units and its UPL(s). In this article, the ETP-HSC takes into account intangible and non-financial transformation objectives, because it is not business oriented one.

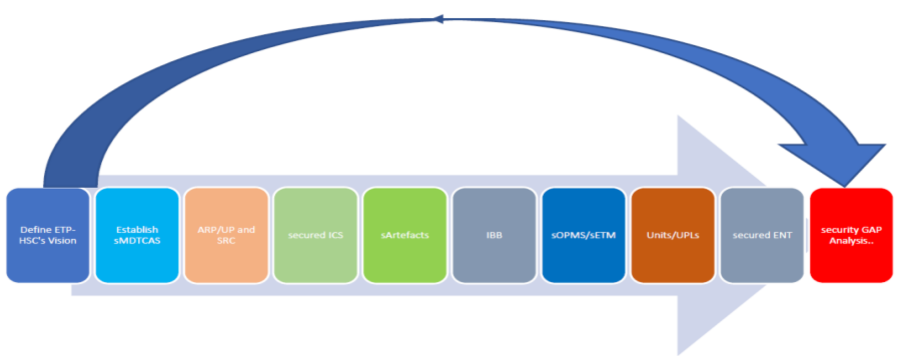

Figure 1: ETP's and HSC's phases

The ETP-HSC is a sequence of secured SRCs executed on the UPL (sSUPL), which goal is to disassemble and (re)secure *ENT's*: Legacy Units' archaic structure(s), Organizational processes, ICS' management, Resources/objects, Applications/Modules, BPs, and Components. reusable sCBBs which can be (re)used in standardized or In-House-Implemented (IHI) sIBBs; where a Unit is a set of sIBBs and different Units can share sIBBs, and hence sCBBs. The ETP-HSC promotes an IHI secured Methodology, Domain, and Technology Common sArtefacts Standard (sMDTCAS) that maps to existing sBBs, sCBBs and sIBBs. The ETP-HSC can face difficulties because of *ENT's* heterogenous human profiles/cultures, ICS parts, ETP's Resistances (ETPR), managers/stakeholders exaggerated financial ambitions, and ETP's limited time/budgets. In this article author uses an adapted version of the AHMM4EAS [1], to support ETP-HSC s feasibility, where a secured Unit (sUnit) is a set of refined sIBBs and a secured *ENT* Transformable Model (sETM) that is a set of refined Units; and finally, an *ENT* is a set of sETMS. ETP-HSC's success depends on the initial SRC based implementation phase which can face difficulties because of the *ENT's* heterogenous environments and the AHMM4EAS can support the abstraction of such an issue and to check its feasibility and integrity; knowing that ETPs fail at the rate of more than seventy percent. The ETP-HSC tries to avoid financial-only locked-in strategies and ensures success and previews ETPRs. The complexity lies in the definitions of the levels of granularity and mapping concepts for the sMDTCAS, which enables the reuse of existing or newly refined sMAs, sBBs, sCBBs and hence sIfBBs (simply secured Artefact, sArtefact). As shown in Figure 1, the ETP-HSC follows the SRC phase and if that step fails because of various types of resistances (like the ETPR) and other types of difficulties, then a new ETP-HSC iteration is to be implemented. Otherwise, the ETP-HSC can move to the next step and can consider another major achievement was done. The ETP-HSC can choose an initial Unit's module to be converted by using the SRC, to prove that the ETP-HSC is feasible and try to convince the *ENT's* managers to continue/proceed to the sETM, which is this article's scope; and the secured Organizational Process/collaboration Models (sOPM) System (sOPMS) based Units. In turn an *ENT* is a set of sETMs. Various *ENTs* and their APDs have critical ETP and ETP-HSC requests and the very quick evolution of business requirements/technics, concepts/methodologies, and ICS/technologies, can create major problems, because of the encountered gaps between security concepts, ICS/technologies' evolution and ETP's progress is are wide ones.

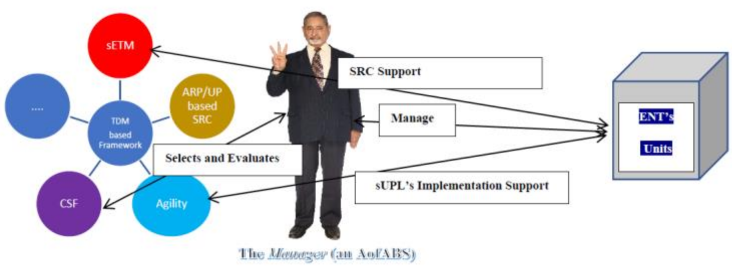

Figure 2: ETP's and HSC's phases

Knowing that ETP-HSCs take long time to terminate, on the other hand, security products, business and ICS/technology fields have a hyper-evolution. That implies that there is a need to implement a holistic sMDTCAS to support ETP-HSC's evolution and independent of all security products/services, business and technological evolutions. The sMDTCAS based ETP-HSC is an important factor for the success of an ETP, because SRCs unify sArtefacts' implementations needed to support the reorganization and securing Units. In this article, the author proposes that the ETP-HSC supports ETP Managers (or simply *Managers*) and his security team(s), in managing sArtefacts. SRC is not only disassembling (and reassembling) of sArtefacts, but it is a structural and coherent securing of Units. sArtefacts are reused in diagrams/documents to create secured Architectural BBs (sABB). The ETP-HSC is a *reengineering process*, which delivers sArtefacts, which are used in all ETP*'s* phases, as shown in Figures 1 and 2. In many ETPs, related SRCs operations are underestimated and marginalized, and that causes ETPs to fail. Therefore, SRC based ETP-HSC success is crucial for next ETP's phases and operations. ETP-HSC's activities and its generated sArtefacts, are independent of a specific editor brand, methodology, tool, or other locked-in strategy or gadget. The EAS and AHMM4EAS [1] support ETP-HSC's extraction and (re)design of sArtefacts. The ETP-HSC that can be used in any APD and its objective is to (re)engineer common sArtefacts can be done in consequent SRC steps; which depends on the complexities that are related to the secured ICS (sICS) and sUPL's heterogenous transformation statuses and that ensures APD's sustainability [5,6,7]. The AHMM4EAS supports iterative ETP's activities like the sSUPL of legacy systems. The sSUPL uses the Transformation Development Methodology (TDM) based sMDTCAS to implement and integrate existing internal and standard concepts and methodologies, like The Open Group's (TOG) Architecture Framework's (TOGAF) Architecture Development Method (ADM) [31] and Sherwood Applied Business Security Architecture (SABSA) [8]. The ICS' related SRCs and hence ETP use agile cyclic/iterative TDM's implementation phases, which include UPs. SRCs are performed mainly for creating and managing sIBBs that include: 1) Organizational refinement technics; 2) Development and Operations for SRC (DevOps4SRC); 3) Automated tests, qualifications, and deployment procedures; 4) Extracting sBBs/sCBBs based sIBBs; and 5) sCBBs/sIBBs design and modelling activities. The ETP-HSC proposes the efficient use SRC, which faces complexities that are mainly due to the following facts: 1) The implementation of complex, and heterogenous sArtefacts based Units; 2) Technologies' and methodologies hyper-evolution, mainly is due to financial objectives; 3) The incapacity to establish an adaptable sMDTCAS; 4) Resistance for Change (R4C) that is the ETPR's central types of critical problems, which should be checked with the an optimal Readiness to Transform (R2C); and 5) Maintenance difficulties [8]. In this article the ETP-HSC uses a Proof of Concept (PoC) and a related Applied Case Study (ACS). The ACS descries a leading *European Bank's* (simply EUBank) UP based SRC. The mentioned ETP was mainly used to support an SRC for EUBank's legacy framework and Units structure, which was based on Unified Modelling Language (UML), EA, TDM (that abstracts ADM), ArchiMate, Mainframe and Integrated Development Environments (IDE) environments. The ADM based TDM, managed underlying design modelling, refinement, DevOps4SRC, and governance procedures. As shown in Figure 2, such a ETP needs a qualified and experience *Manager* (or Architect of Adaptive Business Information System-AofABIS), SRC specialists, and a capable team. And in this ETP, the team was the main weakness and generated R4C and ETPR, which proves that SRC is a critical phase mainly because of the human incapacity factor. The TDM managed the implementation of the *ENT* refactored sCBBs/sIBBs/sIBBs and storing them in *ENT's Enterprise Continuum* [4,5]. There were three types of sCBBs: 1) Common sCBBs/sIBBs; 2) Mixed sCBBs which include sABBs and Solution sBBs (SBB), and create sIBBs' libraries [31]; and 3) Imported sCBBs/sIBBs. As shown in Figure 2, ETP-HSC' interaction includes: 1) Decision Making System (DMS) for SRC (DMS4SRC); 2) Knowledge Management System (KMS) for SRC (KMS4SRC); 3) Critical Success Factors (CSF) (and areas Critical Success Areas-CSA) Management System (CSFMS); and 4) An IHI

ETP-HSC. To prove ETP-HSC' feasibility, the author uses his PoC and Research and Development Process (RDP) for SRC (RDP4SRC) concepts.

2. The RDP for SRC

2.1. AHMM's Generic Basic Elements

The ETP-HSC identifies and assesses strategic and critical ETP*'s* risks to guaranty SRC operations' coherency, by using the AHMM4EAS and its basic elements:

- ***a*** for atomic
- ***m*** mapping operator
- ***i*** instance of
- ***R*** $\bigcup$ of Requirements
- ***C*** $\bigcup$ of Constraints
- ***V*** Valuate function, $\bigcup$ of ***H***
- ***St*** $\bigcup$ of States
- ***T*** $\bigcup$ of Sts
- ***S*** $\bigcup$ of Solutions
- ***F*** Function
- ***A*** $\bigcup$ of Actions/***Fs***
- ***P*** $\bigcup$ of Problem
- *GID or GUID* *is a* ***unique identifier*** *for all AHMM4EAS's objects.*
- *FTR* *is a* ***feature,*** *of an ENT.*
- *ART* *is an* ***artefact****, …,*
- *CNT or* ***C's element*** *is a* ***constraint,*** *of an ENT, Enterprise,* ETP*, ICS…*
- *RUL* *is a* ***rule,*** *of an ENT, Enterprise,* ETP*, ICS…*
- *REL* *is a* ***relationship or association, …*** *Which has three dimensions*
- *PRB* *is an ETP or SRC* ***problem***
- *REQ* *is an ETP* ***requirement***
- *CLS* *is a* ***structure****, class, method-part,…*
- *OBJ* *is a* ***CLS instance****.*
- *SRV* *is a* ***service***
- *DIA* *is a* ***Diagram****, UML, TOGAF,…*
- *APP* *is an* ***application.***
- *WGT* *is a* ***Weighting.***
- *SOL* *is a* ***solution.***
- *GAP* *is a* ETP ***gap*** that results from SRC.

- *TSK* *is an* ETP or SRC ***task.***

2.2. AHMM4EAS' Nomenclature

The ETP-HSC uses AHMM4EAS' basic elements to construct its nomenclature that has two major parts: 1) ICS basics; and 2) The applied requirements, as shown in Figure 3:

ICS basics:

ART	= ***m*** SRV	(I1)
ART	= ***m*** DTB	(I2)
ART	= mcArtefact	(I3)
SRV	= $\underline{\cup}$ mcArtefact	(I4)
CLS	= $\underline{\cup}$ FUN ***or*** SRV + $\underline{\cup}$ VAR + $\underline{\cup}$ REL	(I5)
OBJ	= ***i*** CLS	(I6)
DIA	= $\underline{\cup}$ CLS + $\underline{\cup}$ REL	(I7)
DIA	= $\underline{\cup}$ OBJ + $\underline{\cup}$ REL	(I8)
SCR	= ***i*** DIA	(I9)
BB	= $\underline{\cup}$ DIA	(I9)
ABB	= $\underline{\cup}$ DIA	(I9)
SBB	= ***i*** SCR	(I9)
APP	= $\underline{\cup}$ SCR	(I10)
CMP	= $\underline{\cup}$ APP ***or*** IEL ***or*** DST	(I11)
ICS	= $\underline{\cup}$ CMP	(I12)
CLD	= $\underline{\cup}$ ICS	(I13)
EST	= $\underline{\cup}$ CLD	(I14)

Requirements:

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

Figure 3: AHMM4EAS' nomenclature.

2.3. AHMM4EAS' SRC Artefacts

AHMM4EAS's basic elements are used to present SRC artefacts:

- *MVC* = $\underline{\cup}$ DIA + $\underline{\cup}$ REL (A1)
- *MVC* = $\underline{\cup}$ MVC + $\underline{\cup}$ REL (A2)
- *sBB* = $\underline{\cup}$ SRV + $\underline{\cup}$ REL (A3)

- *SBB* $= \bigcup i$ SRV + $i \bigcup$ REL (A4)

A ETP has various Viewpoints, like "O" for organizational, "A" for EA, "S" for Security … In this article the Viewpoint "C" (which combines all Viewpoints and "S" is central) that uses a Polymathic approach.

2.4. A Polymathic ETP Approach

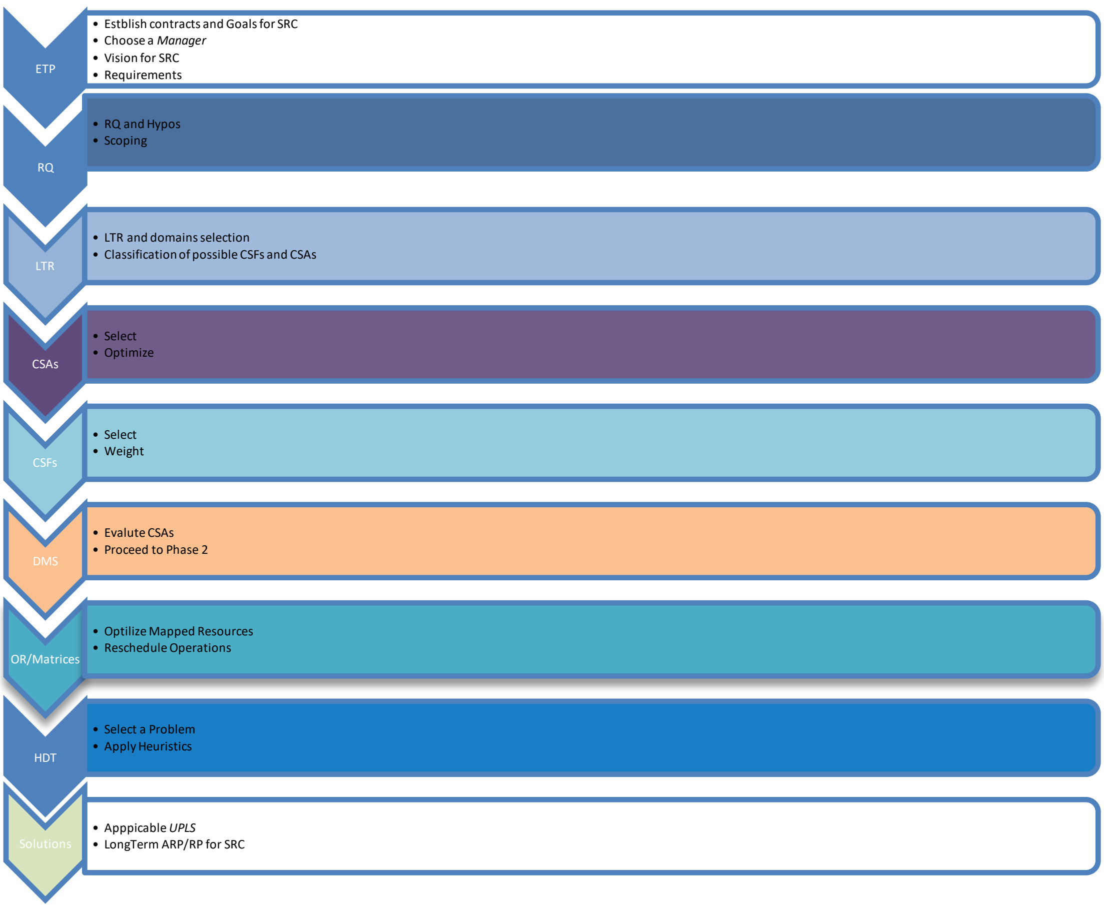

Figure 4: ETP*'s* Polymathic approach.

UP and SRC for legacy Units' components has created a paradigmatic shift in ETPs, where these archaic components use sets of heterogenous structures, ICS/technologies, and methodologies. The transformation of such components in the form of sCBBs/sIBBs is supported by an adapted the ETP-HSC. As shown in Figure 4 and Viewpoint "C", the ETP-HSC focuses on refactoring of Unit's components. The main Viewpoint: "C" or Combined elements are:

- 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)
- SRC $= \sum$ UP (C6)
- sETM $= \sum$ SRC (C7)

- sSUPL = ∑ sETM (C8)
- sUnit = ∑ sSUPL (C9)
- *ENT*(C) = ∑ sUnit (C10)

Transformed sArtefacts are identified, classified in repositories and are classes and objects that interact using GIDs, where sArtefacts has its GID. The RDP4SRC proposes the ETP-HSC to support *Managers* and ETP teams in refining Unit's platform components. SRC's main activity is to extract domain scenarios and relate them to sArtefacts. The RDP4SRC presents the author's configurable research methodology and the implementation and the related ACS and PoC, which are based on the EUBank. Figure 5 shows the Polymathic-holistic approach used by the SRC based ETP for EUBank. RDP4SRC's first step was to establish the Research Question (RQ) and achieve an in-depth Literature Review Process (LRP) for SRC (LRP4SRC).

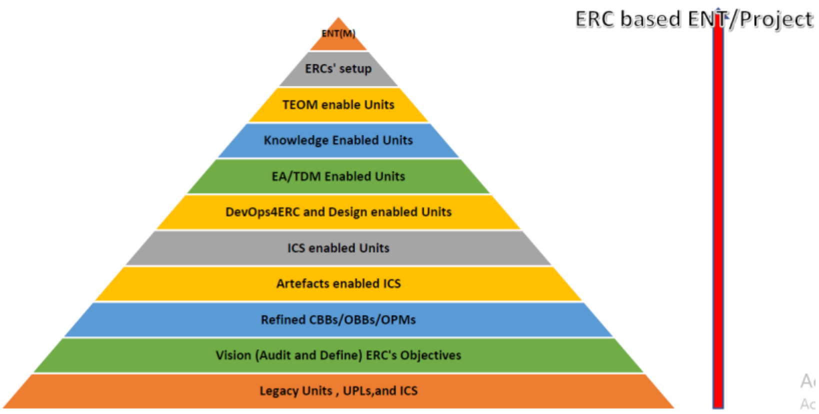

Figure 5: SRC based ETP's Holistic Approach.

2.5. The RQ and LTR4SRC

The RDP4SRC's RQ is: "Can the ETP-HSC support the implementation of SRC for Units?". Where this article's auxiliary RQ is: "How can sArtefacts support ETP's SRC?". The RDP4SRC uses: EA inspired TDM, AHMM4EAS, CSFMS, and the DMS4SRC. LRP4SRC's processing and analysis showed that there are no similar concepts and approaches to the author's Transformation Research Architecture Development framework (*TRADf*), that includes: TDM, UP, SRC, and AHMM4EAS, RDP4SRC, … *TRADf* just shows how to implement an IHI transformation framework. But there are a small number of relevant industry and scholar usable resources that are related only to the ETP and SRC; and they mainly limited. Like TOGAF, which is can considered as usable framework, but it is very limited, a simplistic cookbook, and tackles minor ETP topics, like EA. Therefore, the AHMM4EAS based RDP4SRC related author's works, are pioneering, innovative and covers an important gap, between SRC and existing complex refinement solutions. Such works can irritate major locked-in drivers, but *TRADf* persists in this approach. ETP related gaps and the high failure rates were again confirmed by the LRP4SRC [9]. These failures are mainly to the intentional lack of a Polymathic-holistic approach to ETPS and ETP-HSC; and the related SRC operations, which today are done manually or by the use of commercial products, which intend to resell the same concepts again and again with having the same failure rates. The LRP4SRC used the following resources: 1) Articles and resources related to SRC, ETP-HSC, sOPM, ICS reengineering, and

ETP*s*; 2) The author's RDP/LRP works, TDM, and *TRADf*; 3) SRC's feasibility and capacities; 4) Initial sets of CSAs/CSFs; and 5) RDP4SRC's use of the Empirical Engineering Research Model for SRC (EERM4SRC). All the author's works are based on *TRADf*, AHMM, TDM, UP, and RDP; which are today mature and can be applied in various transformation domains like the ETP and related SRC*'s* risk management. The RDP4SRC proved the existence of an immense gap and the necessity to deliver SRC and ETP-HSC recommendations. The main gap is due that there nothing similar to the SRC; but there are primitive *ENT* refinement approaches that concern exclusively software (code-sources), and which are manual processes. As shown in Figure 6, the next step is to select and classify the sets of CSFs and CSAs in the CSFMS.

2.6. CSAs and CSFs Management System

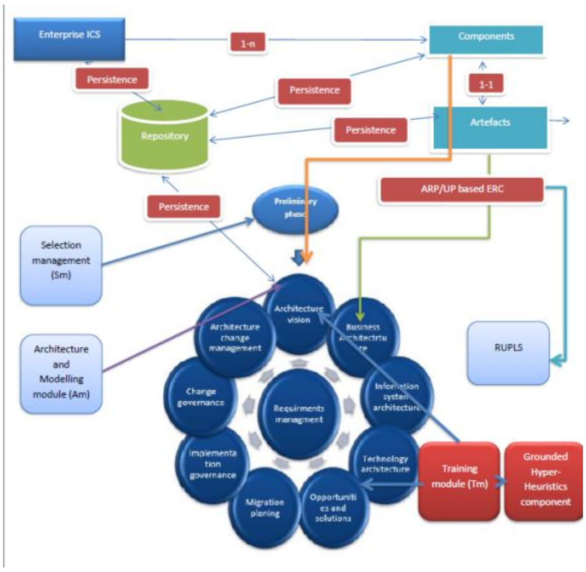

Figure 6: The SRC and CSFMS' integration with RDP4SRC [1].

A CSA is a of CSFs where in turn a CSF is a set of Key Performance Indicators (KPI), where a KPI maps (or corresponds) to a single common or ETP and SRC requirement, feature, or sArtefact. For a given requirement or SRC problem, the *Manager* (or enterprise architect), identifies the starting sets of CSAs, CSFs and KPIs, to be used by the Heuristics Decision Tree (HDT) based DMS4SRC and maps them to the sets of sArtefacts and requirements. Hence the CSFs are important for the mapping between the requirements, knowledge constructs, SRC, sArtefacts, Units, and DMS4SRC/KMS4SRC [11]. Therefore, CSFs reflect constraints/goals that must be met in the ETP-HSC. Evaluations and measurements methods, which are offered by *TRADf*, which is able to estimate each ETP's CSA, in which CSFs can be: 1) ETP, SRC, or ETP-HSC' status; 2) Mapping SRC's levels of resulting sArtefacts; 3) ETP's and SRC's gap analysis; and 2) DMS4SRC/KMS4SRC requests serving in real-time, as shown in Figure 6. KPIs can be integrated in sArtefacts as concrete source-code variables or attributes, so HDT's based evaluation engine can automatically estimate the values of CSAs, CSFs, and KPIs (simply Factors) [11,12]. As shown in Figure 6, Factors and ETP's risks estimations can have the following characteristics [14]: 1) Understanding SRC activities; 2) Factors based TDM implementations' complexity and problems; 3) ETP's risk mitigation strategy; 4) Factors are key elements that are linked to KPIs which are sArtefact variables; and 5) CSAs, CSFs, and KPIs are configured and tuned by the ETP team members, by using *TRADf*. Sets of

Factors are weighted by the DMS4SRC/KMS4SRC to offer sets of solutions for a SRC or ETP-HSC problem. The HDT-based DMS4SRC is used all the *TRADf's* modules. RDP4SRCS' phases: Phase 1 (represented in decision Tables), forms the empirical part of the RDP4SRC; which checks the following CSAs xxx : 1) The RDP4SRC, which is synthesized in Table 1; 2) The Methodology and sMDTCAS, which is synthesized in Table 2; 3) The sCBBs and sIBBs based sIBBs approach, which is synthesized in Table 3; 4) The Polymathic SRC model, which is synthesized in Table 4; 5) The ETP-HSC based ETP, which is synthesized in Table 5; and 6) This article's RDP4SRC outcome, which is synthesized in Table 6. *TRADf* based ETP-HSC delivers a set of (managerial and technical) recommendations and solutions, and a strategy for a ETP *and UPL*.

2.7. SRC's Integration with TRADf

As shown in Figure 7, *TRADf*, TDM, and its new module, the SRC supports the transformation of legacy Units and their UPLs into agile sArtefacts which are designed, generated/assembled, and implemented using sMDTCAS, independently of the types of: 1) ICS/technologies; 2) APDs; 3) Unit (re)structures; and 4) Methodologies of formalisms. The sMDTCAS ensures that *ENT's* ETPs are not locked-in by global actors or the hyper-evolution of business technics, methodologies, and ICS/technologies [14].

Figure 7: *TRADf's* implementation interface.

The SRC is complex and risky, that is due to the unviable, heterogenous, and archaic UPL's and ICS' components siloed integration formalisms which are chaotic; [2]that makes the extraction of sArtefacts very complex. SRC's Polymathic-holistic approach supports complex Unit and UPL's integration activities [15]. In which the SRC for various APDs, automates and refactors Unit modules and structures. The SRC is a part of *TRADf's: Software engineering or the Implementation module* (Im), and *Architecture module* (Am); where it is recommended to build a similar IHI framework and TDM, which can be based on TOGAF's ADM. The TDM based SRC that supports DevOps4SRC, to extract and manage sArtefacts, which circulate through its implementation phases. The elements contain their sets of Factors. The RDP4SRC reuses the author's works like *TRADf*, LRP4SRCs, sArtefacts, which are used to solve this article's RQ. So, it is an iterative research process and all related topics are only referenced, because otherwise it would be tedious to understand this work. The RDP4SRC is a non-conventional and pioneering concept, in the field of ETP*'s* topics. The SRC and ETP-HSC are Polymathic and is founded on a genuine and EERM4SRC that in turn is based on *TRADf*, HDT, SRC, DMS4SRC/KMS4SRC, TDM/EA and ICS concepts [30,31].

2.8. EERM4SRC's Usage

The EERM4SRC based RDP4SRC is optimal for ETPs and uses *TRADf* (where it applies a multi-level mixed research by using the HDT) that can be considered as different from conventional research models [11,12,16], and it includes: 1) Pseudo heuristics-Basic reasoning; 2) Quantitative Analysis for SRC (QNT4SRC); 3) Qualitative Analysis for SRC (QLT4SRC) research methodologies, to deliver empirical methods and concepts as a possible approach for complex tuned mixed methods research; and 4) A Learning Process based on the HDT for SRC (LP4SRC), which was inspired by Action-Research oriented LP4SRC [11].

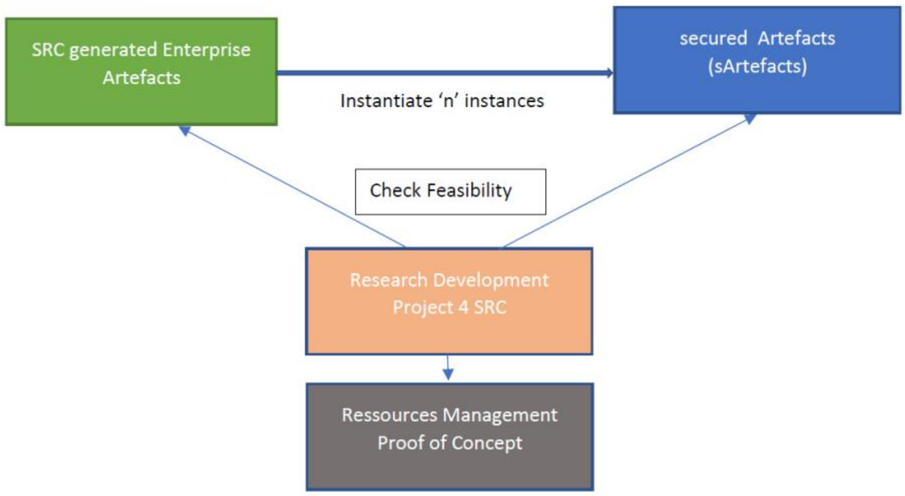

Figure 8: RDP4SRC's environment.

TRADf can interface any existing research methodology, and the main differences are just in the scope and depth of the applied research. Empirical research validity checks if the RDP, like the RDP4SRC, is acceptable as an important contribution to existing scientific (and engineering) knowledge and to convince the reader(s) that the presented recommendations and PoC (or engineering experiment), are valid and reusable for various types of SRC or sSUPL operations. In engineering, a PoC is a software prototype of a testable RQ (and hypothesis) where one or more Factor (or independent variables, in theoretical research) are processed to evaluate their influence on RDP4SRC's dependent variables. As shown in Figure 8, PoCs support the evaluation with precision of Factors and if they are related, whether the cause–effect relationship exists between these CSFs and CSAs. The TDM based SRC and ETP-HSC are transformation centric and use existing standards [31]. SRC and ETP-HSC' author's related works are: 1) Using Applied Mathematical Models for Business Transformation [1]; 2) Applied Holistic Mathematical Models for Dynamic Systems (AHMM4DS) [1]; 3) Business Transformation ETPs-The Role of a Transcendent Software Engineering Concept (RoTSEC) [49]; 4) Business Transformation ETPs-The Role of Requirements Engineering (RoRE) [6]; 5) Business Transformation ETPs based on a Holistic Enterprise Architecture Pattern (HEAP)-The Basic Construction [2]; 6) Integrating Holistic Enterprise Architecture Pattern-A Proof of Concept [3]; 7) A Transformation Framework Proposal for Managers in Business Innovation and Business Transformation ETPs-Intelligent atomic building block architecture [19]; 8) A Transformation

Framework Proposal for Managers in Business Innovation and Business Transformation ETPs-An Information System's Atomic Architecture Vision [20]; 9) Organizational and Digital Transformation ETPs-A Mathematical Model for Building Blocks based Organizational Unbundling Process [7]; and 10) Organizational and Digital Transformation ETPs-A Mathematical Model for Enterprise Organizational Models [48]. But ETPs should not underestimate SRC's complexity, which is due to a long and complex process; which needs R2C based transformation readiness checks.

2.9. SRC's Transformation Readiness Checks

The SRC is complex and is the major cause of ETP's failure; which are mainly due to the UP complexities, which generate various types of problems [22,23], like the ones presented in *The Chaos Report*, produced by the Standish Group over the last fifteen years; they assert that: … *only about 29% of transformations come in on time and budget*… SRCs use UP refactoring processes are the main ones, and they need skills, IHI tools, synchronized extraction processes, and TDM capabilities. ETPs with successfully finalized SRCs, had similar: Strategies, Legacy organizational and ICS (by configurations), Structures, APDs/discipline, Skills, Decision model, and Transformation roadmap for localizing needed skills. The SRC supports various types of refinement action, to restructure legacy Unit's structures, Application/Components portfolio, to align ETP's transformation management plan, and defined requirements' mappings. The SRC and ETP-HSC needs the following types of skills [31]: 1) TDM based SRCs and generated sArtefacts support *Business Transformation Readiness Assessment* capacities; 2) Supports SRCs' executions; 3) Establishes execution capacities; 4) DMS4SRC based LP4SRC, to build SRC experiences; 4) To build a sMDTCAS; and 5) Design and implement sOPM System (sOPMS) and sETM.

2.8. RDP4SRC's CSFs

Based on the AHMM4EAS, LRP4SRC and DMS4SRC, this CSA's CSFs/KPI were weighted and the results are shown in Table 1. This CSA's result of 9.25, which is high, is mainly due to the fact that the iteratively used RDP4SRC is mature and that the UP to deliver sBBs was successful [7]. But that does mean that the SRC is feasible. As the RDP4SRC's CSA presented positive results, the next CSA to be analyzed the role and evolution of sMDTCAS compatible methodologies.

Table 1: This CSA has the average of 9.25.

Critical Success Factors	KPIs	Weightings
CSF_RDP4ERC_Polymathic_Approach	Proven	From 1 to 10. **10 Selected**
CSF_RDP4ERC_Factors_Integration	Proven	From 1 to 10. **10 Selected**
CSF_RDP4ERC_RUPLS_Integration	Complex	From 1 to 10. **08 Selected**
CSF_RDP4ERC_EERM	Feasible	From 1 to 10. **09 Selected**
CSF_RDP4ERC_Transformatio_Readiness	Feasible	From 1 to 10. **09 Selected**
CSF_RDP4ERC_Needed_Skills_Profiles	Feasible	From 1 to 10. **09 Selected**
CSF_RDP4ERC_IHI_TRADf	Possible	From 1 to 10. **09 Selected**
CSF_RDP4ERC_LTR4REC	Proven	From 1 to 10. **10 Selected**

valuation

2. The Role of sMDTCAS for Artefacts

3.1. Fundaments

There are many security tools, frameworks and architectures concepts, and they are advanced, but unfortunately, they apply siloed punctual models and integration patterns. But the SRC based EAS supports a holistic ETP and APD transformation concepts which use automation of all its security architecture, design, and integration operations. The application of ETP-HSC to traditional security solutions, is an important and complex challenge, because of the probability of failure and ETPR. The SRC provides the base for registries of secured services for the future *ENT*. ETP-HSC controls uses sets of interrelated SArtefacts from various domains like EAS, finance, governance and legal constraints. All that can be used to avoid financial crimes, business disruptions and corruption. Existing security fields like Cybersecurity is the state of a *ENT's* capacities to prone to any type of danger or threat; where the ETP-HSC delivers a secured ICS to provide maximum security. This section presents the Factors that influence the ETP-HSC; and the first major step is to successfully implement a Digital Transformations (DT).

3.2. The Role of Digital Transformation and Strategy

The SRC and ETP-HSC are mandatory and they are critical ETP*'s* phases. SRC's goal is to create a common platform of sArtefacts, services and resources for a sustainable *ENT's* sOPMS, UPL, and ICS platforms. sArtefacts are instantiated to support of DT, which improves Time-to-Market (TtM) pressures and adapts to changing APD requirements. UP based SRC which enable DTs are strategic objectives and that implies the need for the high-adoption rate of ICS/digital technologies. Unfortunately, ETP based digitization are complex and more than 70% fail, du to team members' concerns what results in R4Cs. The SRC breaks down *ENT's* UPL and ICS silos into a dynamic DT based ICS. DTs use TDM and sMDTCAS experts to integrate digitized APD models and to define DT's strategy [24]. DTs based sETMs are managed by the TDM to face various types of ETP challenges, where the goal is to digitally transform sArtefacts, sOPMs, SRVs, and resources. The TDM synchronizes *ENT's* SRC, ETP-HSC, UPL, and ICS operations and the DT serves as a digital platform for future business activities [25]. DTs are difficult to define and manage, because they depend on the type of the targeted APD, sOPMS/sETM implementations, and sMDTCAS' incorporation capacities. A successful DT supports ETP's SRC and future APD's functions and (re)organization, which enhances functional performances. sArtefacts based APD models' development needs a stable DT in order to process with business transformation activities [25]: 1) Legacy UPLs and underlying sOPMS; 2) To coordinated sArtefacts based choreography; 3) DT based sOPMS/sETM, makes an *ENT* capable of conquering new markets; 4) Units' (re)structuration, by redefining needed skills, sOPMS/methodologies, and capabilities; 4) The capacity to execute SRCs for all APD's sub-domains; 5) Adopt an all-inclusive DT based SRC, ETP-HSC and sMDTCAS/sOPMS, with an optimal ETP plan; and 6) Include legacy Units' reengineering skills to enable DTs to be the basis of Units' restructuring processes.

3.3. Legacy Units and the sMDTCAS

A ETP must define an IHI sMDTCAS, which is a mix of existing methodologies and (internal and external) practices, which can be used by the SRC and ETP-HSC. The sMDTCAS can include Object Oriented (OO) Methodology (OOM) concepts and traditional legacy methodologies, like the Structure Analysis and Structured Design (SA/SD). In the case of legacy implementations, SRCs can use the following technics: 1) SRCs are to transform legacy-modules into SA/SD compatible; 2) To implement the sMDTCAS that is mainly based on OOM concepts; 3) To adapt sMDTCAS to the dominant UML based models; 4) To interface sMDTCAS with EA methodologies like TDM, TOGAF, and ADM; and EA modelling languages, like ArchiMate; 5) To offer an sArtefact based sOPMS; and 6) To interfaces sMDTCAS with decision notation languages like the Decision Making Notation (DMN). The SRC recommends avoiding the very risky conversion from the legacy ICS components directly into EA methodologies like TOGA and ADM, which was a major failure for the included EUBank case. Instead it should have to use an IHI sMDTCAS and SRC generated sArtefacts based sOPMS; which ensures an IHI non-locked-in approach. To transform existing ETP models/diagrams-based components into well-designed/mapped UML/Choreography models, using classes, sequences, communication models, Entity Relationship Diagrams (ERM), and sOPMs/BPs and their Models (BPM) diagrams. For the sMDTCAS the OOM is the central methodology to support SRC generated sArtefacts.

3.4. OOM based sMDTCAS support for sArtefacts

sMDTCAS is used to interface standard methodologies and SRC generated sArtefacts by using OOM concepts, which mainly are OO features, inherited from three OOMs, namely Rumbaugh, Booch, and Jacobson methodologies. These methodologies are the fundaments of the most known architecture, modelling/ICS standards, the UML [27]. All known methodologies, like the ADM, are developed using an UML profile or metamodel, which makes OOM a generic concept. OOM was influenced by various OO streams like Booch's methodology, which focuses on OO Analysis (OOA) and OO Design (OOD) phases which are used to implement sArtefacts. The ADM based TDM can manage the DevOps4SRC. The Use Case (UC) diagram can help the SRC in the analysis and extraction of sArtefacts. Where a UC diagram can include: OOM diagrams, non-formal source-code, Events flows, and Actors. OOM based sMDTCAS and UCs are the basis of the actual EA modelling languages that are used to implement sArtefacts to be used by the sETM. Like ArchiMate, which has many artefacts, diagram types, views, and that is why in this article only its UC View (UCV) will be presented, to show how sMDTCAS can include common sArtefacts and sOPMS, EA/ArchiMate diagrams.

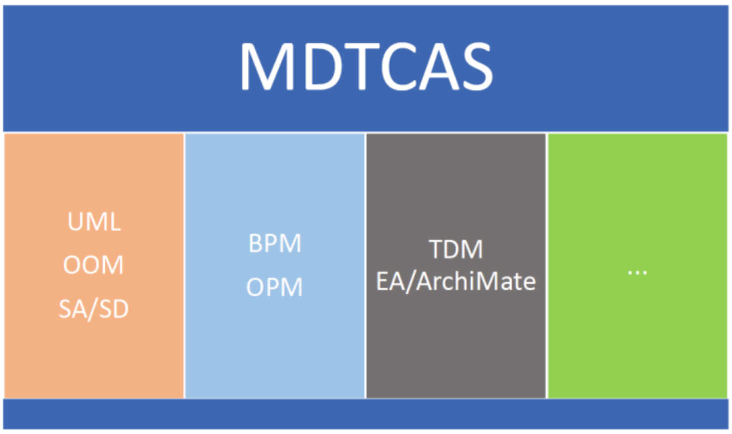

Figure 9: sMDTCAS' Implementation.

Combining sArtefacts and sOPMS with TDM in complex ETPs can be supported by the sMDTCAS. The SRC and ETP-HSC uses sArtefacts to support sOPMS and sETM, in the *Business Architecture* phase [28]. ArchiMate's UCV can be incorporated in an sArtefact to be used for analyzing APDs' scenarios from the functional perspective. sArtefacts can map to *Application Services* or SRVs. Architecture diagrams can be elements of an sArtefact which can represent the behavior of an sOPM. The ETP needs an TDM to implement an sOPMS to provide business models, EA models, … sOPMs have a key role in developing APD competencies, and where *Business Architecture* and ICS architecture are vital. As shown in Figure 10, the key to linking these two EA domains are sOPMs which are subsets of an *ENT* process architecture(s). An *ENT* process architecture supports APD's Finance, Human Resource, Supply chain, … Can also have interdependencies with other Units and external *ENTs*. Analyzing APDs requirements in a siloed manner can have negative impacts on the ETP and there a need to have a holistic approach to capture interdependencies, and for that goal the SRC to build sArtefacts with various elements that influence the sOPMS. A Polymathic-holistic overview across all CSAs, helps ETP *Managers* and implementation teams, to predict the problems [27]. Where BPs, sOPMs, and BPMs are incorporated in sArtefacts based sETMs.

3.5. BP, BPM, sOPMS based and sETMs

To align BPs, BPMs, and sOPMs (simply *Model*) with TDMs, sArtefacts, and Units, there is a need to use ADM based TDM's implementation life-cycles. The SRC generates: 1) Common and generic sArtefacts for the sMDTCAS; 2) Business Process Architecture (BPA) usage; 3) EA and *Models'* tools; 4) TDM and DevOps4SRC synchronization; 5) Test scenarios' management; 6) Best practices; 7) Units' control; and 8) An *ENT* Security concept [29]. For the SRC and hence sETM the role of an *ENT* Polymathic security concept is important which uses measurable security and governance security risks CSFs, which are mitigated and tuned, to ensure ETP's successful evolution and block Cyber or classical misdeeds. The actual exponential rise of Cybercrimes has become a major concern for *ENTs*; and that obliges ETP*s* to integrate Polymathic-holistic security strategies.

3.6. A Holistic Security Strategy

ENT's resilience, control, and security concepts are insufficient and concentrate only on platforms' infrastructural aspects. Global crimes are closely related to global events and phenomenas, like financial greediness, insecurity, conflicts, … The holistic security strategy proposes that the SRC's: Interfaces existing security standards, Promotes internal ENT architecture blueprints, Automated business and application's engineering, Multilevel sArtefacts' interoperability, and UP. Secured ETP*s* are very complex to finalize, because of various transformation related problems, and they depend on the SRC capacities. The *ENT's* structure depends on secured sArtefacts, which are stored in pool(s). Secured composite sArtefacts are used to [7,20]: 1) Reorganize secured Units and takes into account intangible objectives. A security concept avoids locked-in strategies; 2) Use a secured sMDTCAS and TDM to integrate standard methodologies, like TOGAF and the SABSA [8]; and 3) To use a secured ICS'.

3.7. Methodologies' CSFs

Based on the AHMM4EAS, LRP4SRC and DMS4SRC, this CSA's CSFs/KPI were weighted and the results are shown in Table 2. This CSA's result of 8.0, which is low, is mainly due to the fact that the sMDTCAS is complex. But that does mean that the sMDTCAS is impossible. As this CSA presented negative results, the next CSA to be analyzed is SRC's approach for transformations. To organize various types of generated sCBBs (and SBBs) there is a need to adopt the SRC and sCBB based approach.

Table 2: CSFs that have the rounded average of 8.0.

Critical Success Factors	AHMM4ERC enhances: KPIs	Weightings
CSF_MDTCAS_ERC_DT_Implementation	Complex	From 1 to 10. **08 Selected**
CSF_MDTCAS_DT_Strategy	Complex	From 1 to 10. **08 Selected**
CSF_MDTCAS_Legacy_Units	Complex	From 1 to 10. **08 Selected**
CSF_MDTCAS_Support_Artefacts	Complex	From 1 to 10. **08 Selected**
CSF_MDTCAS_OPMS_TEOM	Complex	From 1 to 10. **08 Selected**
CSF_MDTCAS_Security_Strategy	Complex	From 1 to 10. **08 Selected**

valuation

4. SRC BASED APPROACH

4.1. sArtefacts based Vision

The TDM needs a directed vision on how to integrate generated sArtefacts; and the ETP and SRC must establish an sArtefacts based Architecture Vision (AAV), as shown in Figure 11, to support: SRCs, ETP-HSC, sABBs, and to reuse AAV principles.

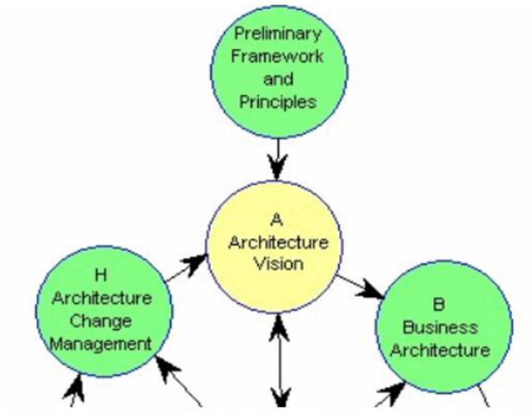

Figure 11: ADM based TDM's vision phase.

An adaptive UPL/ICS is based on various SRC generated atomic resources like sArtefacts, Services (SRV), Model View Control (MVC) which are managed in various TDM phases to support: 1) sArtefacts' integration; 2) To apply AAV patterns; 3) Control and monitoring activities; 4) Interaction of MVCs (Palermo, 2012); 5) Relate AAVs to CSFs, 5) Viewpoints, like: "C", "U", Process management, Stakeholders reporting, sCBBs' usage in TDM models, and ICS' standards application; and 6) DMS4SRC to quantify ETP vision's applicability by using the following CSFs:

- Coalition to Support the Vision (CSF_ETP_VIS_CSV).
- AAV's Adoption (CSF_ETP_VIS_CVA).
- SRC's Capacities (CSF_ETP_VIS_RPC).
- Time for Execution (CSF_ETP_VIS_T4X).
- Tooling ADoption (CSF_ETP_VIS_TAD).
- sCBB's concept adoption (CSF_ETP_VIS_CBB).

- MVC adoption (CSF_ETP_VIS_MVC).
- Process Control and Monitoring adoption (CSF_ETP_VIS_PCM).
- Transaction Capability Adoption (CSF_ETP_VIS_TCA).
- Strategy for avoiding Resistances (CSF_ETP_VIS_SRE).
- PoC's capabilities (CSF_ETP_VIS_PCC).

The AAV supports the interaction of the ICS, SRVs, AAVs and sCBBs; where the TDM manages AAVs and uses the following TDM/ADM's phases: 1) Preliminary that aligns ETP*'s* vision with AAV; 2) Phase "A", establishes the AAVs and relates them to sCBBs/sIBBs and UPL/ICS; 3) Requirement ensures that requirements are managed accordingly to AAV, where a requirement is linked to an instance of a sArtefacts; 4) Phase "B" develops APD Diagrams (DIA) based on sArtefacts; 5) Phase "C", develops implementation DIAs based on MVC, and sArtefacts; 6) Phase "D" develops technical DIAs based on MVC, and sArtefacts; 7) Phase "E" uses the HDT based DMS4SRC to estimate the iteration's GAP value and offer possible solutions/opportunities; 8) Phase "F" delivers migration plans; 9) Phase "G" analysis the ETP's plans and defines governance mechanisms; and 10) Phase "H" manages requested changes. A TDM iteration generates sets of refined sArtefacts.

4.2. Refined sArtefacts

A sCBB is a set of sBBs that has a AAV that is based on a mapping-patterns that are managed by the TDM/EA [15]. ETP*s* apply sCBBs driven implementation which needs specific implementation skills and an sArtefact based model-first or a Pseudo-Bottomup-Approach (PBA), where sArtefacts are built on IHI and resources; to support sOPMs' integration, modelling strategy, methodology, and productivity environment.

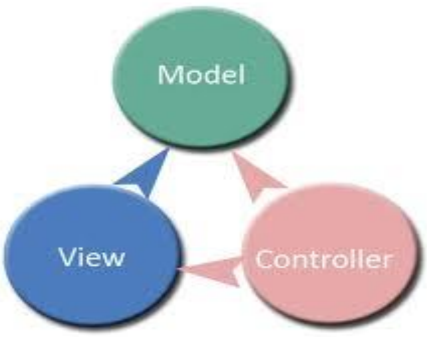

Figure 12: The Model-View-Control pattern [32].

ETP-HSC supports upstream sArtefacts that are generated by the SRC and coordinated by the MVC pattern, as shown in Figure 12. TDM manages SRCs in which sArtefacts are templates for instantiating SBBs. The TDM manages AAVs which provide conceptual and logical views of SRVs across various APDs. The SRC uses EA's generic sBBs, and a set of internal sBBs to compose sArtefacts, where a sBB has the following characteristics [33]: 1) Packages requirements, functionalities, and sArtefacts to meet APD's needs; 2) Standardizes interfaces to access all its resources and functionalities; 3) Interoperable with other sArtefacts; 4) Defines functionalities that will be implemented and captures requirements: 5) It is technology aware and is standardized and is used as a template to build SBBs; 6) Aggregates with other sArtefacts; 7) Has a GID, respects the "1:1" mapping concept and enables interoperability; and 8) An sArtefact is a set of sBBs. An sArtefact corresponds to an APD Transaction (ATR) or Cybertransaction. The way in which ATR's functionalities and resources are combined into an sArtefact vary between APDs. The TDM/ADM manages the implementation sCBBs, to serve SBBs [32]. An SBB has the following characteristics: 1) Defines which SRVs and sArtefacts will implement APD's functionality; 2) Uses implementations of sArtefacts; 3) Fulfills ATR's or Cybertransaction's requirements; 4) Is traceable and interoperable; and 5) Enables dynamic implementations and supporting sArtefacts Reference Models (CRM). The TDM depends on requirements, sArtefacts, and ATRs architecture which supports the related SRVs, interfaces, and standards that satisfy APD needs [33,34]. The SRC and sSUPL follow technology trends which are driving the ETP*'s* vision. The SRC tries to reengineer AAVs, this approach ensures that the ETP succeeds. Because it aligns: Requirements, (re)Structure/governance Units, and UPL/ICS. The ETP uses the SRC for: 1) Breaking-down legacy Unit components into a set of classified unique sArtefacts based ATRs; and 2) To align on the base of the "1:1" mapping concept; which needs an IHI format or a standard solution, like eXtensible Markup Language (XML) Interchange (XMI); and 3) All the mentioned features enables the development of IHI sArtefacts.

4.3. IHI sArtefacts

The sMDTCAS includes common and coherent sets of IHI sArtefacts to compose SBBs. The SRC generates feasible sArtefacts, which can also emerge from *the best architecture & modeling practices*. SRCs has to apply *architecture & modeling extraction techniques*, which can fail because it causes: 1) Bad design, and is unmaintainable; 2) Lacks evolution and scalability; and to 3) sArtefacts are un-usable. SRC generated sets of sArtefacts for modeling, designs and implementation activities, and the PoC checks their feasibility. sArtefacts instances can be used to create generic types of *Models*. sArtefact instances are stored in an SBB, which is suitable for implementing various ETP architectures to interface standard methodologies like TOGAF, UML... sArtefacts map to different types of ETP constructs [31], which need the reduction of silos complexities and the adoption of a PBA. The PBA is based on a *1:1/1:n* mapping concept. The sMDTCAS needs sArtefacts to interface existing standard sOPMS by using [7,34,35]: 1) Quick support by offering sets of sArtefacts to be used by the TDM/ADM, Enterprise continuum, CRM, Catalogs, ….; 2) Domain logic patterns; 3) Data-source architectural patterns; 4) Enterprise Service Bus (ESB) patterns; 5) Enterprise Application Integration (EAI) patterns; and others… There are many redundant categories of standard and internal sArtefacts, which makes the SRC difficult to implement. That is why the sMDTCAS must support a set of transcendent patterns-based sArtefacts, like the MVC and intelligent sArtefact-based Data sBBs (DBB).

4.3. sArtefacts and DBBs Interaction

SRCs redesign and restructure a Unit by extracting various types of complex data structures/patterns to form DBBs, like: 1) Business Data or Interaction Modeling Patterns, that extract business data and offer interaction models, which are indepenednt of the databases types. Atomic data services for business activitities and focuses primarily on the encapsulation of data and behavior schemas and is the basis of the *Business Knowledge Management Pattern* [35,36]; 2) Business Knowledge Management Pattern, includes *Models*, which persist forms of knowledge classes; and 3) A combination of sArtefacts' assembling model.

4.4. sArtefacts Assembling Model

sArtefacts' assembling model includes: 1) The Requirements Integration Pattern (RIP) that is used by SRCs to extract types of common sArtefacts to be used and mapped to the ETP*'s* requirements and the needed sArtefacts/SBBs. The extracted sArtefacts are orchestrated by the AHMM4EAS's actions that process the refinement processes. SRC actions map requirements to the various sArtefacts and *Models*, which are located in repository [31,33]; 2) The Code Blocks Integration Pattern (CBIP) is complex to use. To use CBIP based SRC, it is recommended to use the sMDTCAS approach, which minimizes sArtefacts overhead. The CBIP based SRC determines critical process/resources regions, and then applies refinement processes [37]; 3) Supports of implementing sETMs; and 4) The SRC and ETP-HSC support IHI predefined SRC models. UPs generate basic sBBs and SRCs extract standard/common sArtefacts and *Models* to be included in the sMDTCAS. As there are many standards and types of artefacts, the Object Management Group's (OMG) DMN will be presented; and it is used for modeling operational decisions. DMN's decision models are shared between different systems and the sMDTCAS interfaces DMN's implementation environments to: 1) Refine and map DMN patterns which are similar to *Models* [38]; 2) Use diagrams and elements like the: Decision Requirement Diagrams, sArtefacts, *Models*, Business Knowledge Model, and Decision Tables, similar to *TRADf's* Tables that are used in this RDP4SRC; 3) SRCs processing results in a set of sMDTCAS elements and *Models*; 4) SRC models include the following steps: Defining sMDTCAS main artefacts and basic *Models*, Transforming. legacy-code-base to deliver sArtefacts by using BPM, UML, TDM/TOGAF/ADM, and to integrate DMN; and 5) SRC and ETP-HSC have to avoid that SRC delivers sArtefacts' hairball, and it uses the PBA to offer a set of sArtefacts to be included in sMDTCAS [34,35,36].

4.5. sArtefact-based Approach CSFs

Table 3: This CSA's average is 8.40.

Critical Success Factors	AHMM4ERC: KPIs	Weightings
CSF_Artefacts_Vision	Feasible	From 1 to 10. **09 Selected**
CSF_Artefacts_Refinement_Extraction	Complex	From 1 to 10. **08 Selected**
CSF_Artefacts_DBB_Generation	Complex	From 1 to 10. **08 Selected**
CSF_Artefacts_Assembling	Complex	From 1 to 10. **08 Selected**
CSF_Artefacts_Persistence	Feasible	From 1 to 10. **09 Selected**

valuation

Based on the AHMM4EAS, LRP4SRC and DMS4SRC, for this CSA's CSFs/KPI were weight and the results are shown in Table 3. This CSA's result of 8.40, which is just limit, and that is due to the fact that the sArtefacts-based SBBs concept is difficult to integrate. And that does mean that it is impossible. To implement the SRC the author will propose a Polymathic SRC approach.

5. A POLYMATHIC SRC APPROACH

5.1. Evolution and Risk for ETPs

The refinement and evolution of SRC generated sArtefacts, which are used to build components, take a very long time, and UPL's and ICS evolutions are extremely fast, therefore there is a need to find a Polymathic methodology that respects the median of these two evolutions. The AHMM4EAS based ETP uses various mathematical domains to deliver a unique AHMM [1]. As shown in Figure 14, a ETP must select the optimal ETP's risk mitigation concept, which is based on the following types of risks: 1) Risk avoidance and prediction; 2) Risk reduction; 3) Offers AHMM4EAS actions to reduce risks; 4) Actions to transfer risks to third parties; and 5) Risk acceptance, like in the case of R2C. ETP and SRC risks' estimations include [1,39]: AHMM based analysis, Remediation, Compliance, Coherent/Synchronization, User experiences, Reporting, Basic-advanced integration, Digital asset discovery, and Real-time control based assessments. Risk mitigation artefacts are linked to the Polymathic AHMM4EAS basic elements.

Figure 13: Quadrant for ETP risk management [39].

AHMM4EAS's nomenclature is presented in a basic form to be understandable by the readers. The AHMM4EAS based ETP and its main artefacts and characteristics are:

- SRC actions = supports UP operations, DevOps4SRC activities, for finalizing the SRC.
- ETP parts = ∑ SRC(S) (for the UPL, ICS, sArtefacts, and its infrastructure/networks).
- SRC = transformation of ETP*'s* parts + the defined goals of ETP operations.
- SRC = includes ETP*'s* parts + ∑ SRC.
- APD's (AHMM) = ∑ SRC.

5.2. ENT's SRC based Model

As shown in Figure 14, the symbol Σ indicates summation of all the relevant SRC members, while the indices and the set cardinality have been omitted.

The Generic AHMM's Formulation

TDM	*is a **Transformation Development Method**, which can be ADM based…*	
AHMM	$= \bigcup$ TDMs + $\bigcup$ DMMs	(G1)

AHMM's Application and Instantiation for a Domain

Domain	$= \bigcup$ APD	(G2)
AHMM4(*Domain*)	$= \bigcup$ TDMs + DMMs(*Domain*)	(G3)

Figure 14: The AHMM4EAS main formulas.

The summation should be understood in a generic sense, more like a set. The AHMM4EAS uses services model to support the SRC and is represented in a simplified form. The SRC interfaces are based on the TDM and uses services to enable the Polymathic transformation model. The AHMM4EAS based TDM is the combination of TDM and AHMM4EAS as shown in Figure 14.

5.3. The Polymathic Transformation Model

The AHMM4EAS based TDM model:

AHMM4EASbTDM = AHMM4EAS(TDM) (G4).

The SRC transformation model is the combination of an AHMM4EASbTDM and *IterationGap* that can be modelled using the following formula:

ETP = AHMM4EASbTDM(*IterationGap*) (G5).

The ETP*'s* model is based on the extraction of choreographies or *Models*.

5.4. Extraction of sArtefacts based Models

The SRC depends on the results of UPs' operations, which extract *Models* (or BPM/choreography). The extracted *Models* are based on the HDT that uses sArtefacts to support sETMs. The AHMM4EAS is composed of large number of interconnected nodes, to solve SRC types of problems. SRC generated sArtefacts are connected to each other, like nodes of the HDT and there is a WGT (a real number) and CSFs.

5.5. The Model's CSFs

Based on the AHMM4EAS, LRP4SRC and DMS4SRC, for this CSA's CSFs/KPI were weight and the results are shown in Table 4. This CSA's result of 9.60, which is high, and that is due to the fact that the Polymathic SRC approach is based on the AHMM which is a mature model; and that it can be used.

Table 4: This CSA's average is 9.60.

Critical Success Factors	AHMM enhances: KPIs	Weightings
CSF_AHMM4ERC_Elements	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4ERC_Risks	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4ERC_ARP/UP	Proven	From 1 to 10. **10 Selected**
CSF_AHMM4ERC_TDM	Possible	From 1 to 10. **09 Selected**
CSF_AHMM4ERC_Choreography_Models	Proven	From 1 to 10. **10 Selected**

valuation

Table 5.

The AHMM4EAS and sMDTCAS' artefacts are used to support the SRC and ETP-HSC based ETPs.

6. SRC AND ETP-HSC BASED PROJECTS

6.1. The Strategy and the Decision Model

The SRC ETP-HSC are supported by a predictive the KMS4SRC based DMS4SRC that depends on the selected CSFs, like the types of SRCs activities, types of ETP risks, R2C, financial situation, types of BPMs, skills, … A

ETP should be adapted to a SRC and ETP-HSC that can offer complex designs and eventual problems, which can be the source of risks and failures... SRC problems can be measured and weighted, where the ETP*'s* risks are not easy to measure. This explains the difficulty of estimating ETP*'s* risks related to consequential sets of SRCs operations. The DMS4SRC and selected weightings are used to deliver a set of possible ETP-HSC actions. Weightings' DMS4SRC concept supports the SRC and ETP-HSC to deliver solutions in the form of recommendations. The DMS4SRC used the HDT to solve SRC and ETP-HSC types of problem(s). The SRC adopts a holistic-systemic approach, which makes the ETP robust and the sArtefacts management subsystem the basis of a successful ETP. sArtefacts are managed .by the sMDTCAS based TDM, which provide support for refined components and the SRC synchronizes ETP's plans. The TDM supports interactions between strategies, global processes, services, and ICS' platform. The DMS4SRC controls SRC and ETP-HSC risks to implement sArtefacts pools to support the implementation of sETMs. The SRC and ETP-HSC contains the following concepts: 1) Agile DevOps4SRC for SRC, to managed sArtefacts; 2) sMDTCAS structures sets of artefacts; 3) TDM's interfacing capabilities; 4) Mapping sMDTCAS elements; 5) sArtefacts' granularity; and 6) Requirements mapping to sArtefacts. SRC and ETP-HSC' capabilities to integrate emerging avant-garde domains, like *Models*, AI, EA, Refine techniques, and scalable UPLs/ICS platforms [39,40].

6.2. The sMDTCAS and Avant-garde Domains

sMDTCAS supports the SRC and its capacity to refine legacy *Models*. Refined sArtefacts can be used with existing standards by implementing the sMDTCAS and its TDM. The SRC uses sArtefacts-based Models to deliver sABBs that instantiate Unit parts. SRC is able to reuse refined sArtefacts and existing SRC initiatives have the tendency to *reinvent the wheel* when creating sArtefacts. The SRC delivers refined sArtefacts for architecture/modeling, designs, and implementation constructs for the reengineering of sETMs. Mixing sArtefacts that can be mapped by the TDM and the ETP, must implement generic sArtefacts [30,31]. Using sMDTCAS enables the reduction of complexities and the adaption of a PBA cycle based on a "1:1" mapping approach. The SRC applies standardized: 1) Methodologies; 2) Business or APD architecture; 3) *Models*' choreography; and 5) Mapping *Models*. Applying the mentioned standards and the classification of behavior and interoperation of sArtefacts, has positive impacts on ETPs. The SRC relies on the mentioned standards to deliver an adequate sMDTCAS which is based on: 1) The evolution and stability of *Models* and enables TDM based agile management activities; 2) BP Integration (BPI) enables the integration of refined *Models* by the use of EAI's infrastructure; 3) APD's documents standards, like XML; 4) Governance standards are important for control operations; 4) Avant-garde methodologies, applications and technology standards: 5) SRC's stack standard that includes various levels of APD and ICS resources and sArtefacts; and 6) The IHI TDM supports the SRC to implement sETMs. Technology evolves faster than ETP*'s* evolution, and it is difficult to finalize the ETP with the initial goals and defined UPL/ICS structure. That is why it is important to define sMDTCAS elements that are transcendent to time and to all ETP*'s* iterations. As already mentioned, the sMDTCAS for avant-garde domains includes: 1) *Models*, UML/OOM basics and other; 2) DIAs, like sOPM/collaboration, UC or DMN diagrams; 3) Delimiters, actors and interfaces; 5) Circular implementation methods, like DevOps4SRC or TDM; and 6) SRVs' technologies, abstracted by sArtefacts. TDM's integration with the the SRC, enables the automation and auto-generation of sMDTCAS' sArtefacts, which go-through TDM's phases which uses cyclic iterations. The SRC is generic and its interface with the TDM supports legacy-components refinement, mapping, and integration. That all enables APD's integration and inter-operability.

6.3. APD's Integration and Inter-operability

sArtefacts' integration and inter-operability capacities have the following characteristics: 1) Supports the integration of refined sArtefacts and installs long-term compatibility, by using the following artefacts: *Models'* inter-operability, TDM's interfacing, An anti-locked-in strategy, sMDTCAS' artefacts exchange, A generic inter-operable APD communication layer; 2) APD's inter-resources operability that is supported by the XML based on XMI or any *Model* format which can be IHI; 3) ETP management and *Models* serialization in standardized or IHI format files, like the *business interaction matrix* shown in Figure 15, which shows the mapping between APD's services and functional domains.

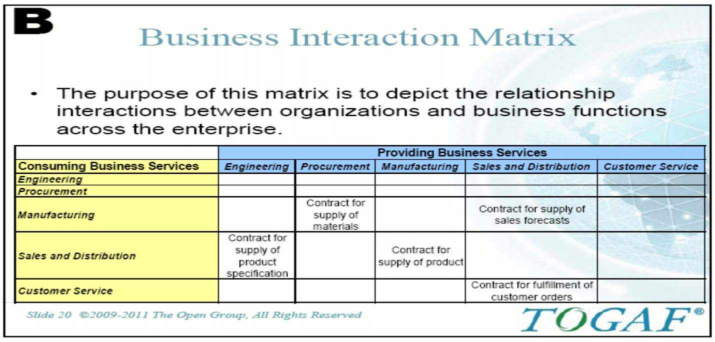

Figure 15: The Business Interaction Matrix [41].

APD's integration/inter-operability depends on CSFs, like APD's UPLs. Managing UPLs by the ETP team, implies that they transform it into an agile cloud platform. The SRC and ETP-HSC manages sArtefacts to create *Models* which are deployed on UPLs. This is needed for the management of sArtefacts repository that are to be used by the ETP to use sOPMS/sETMs for Unit's reorganization.

6.4. Models based Unit Reorganization

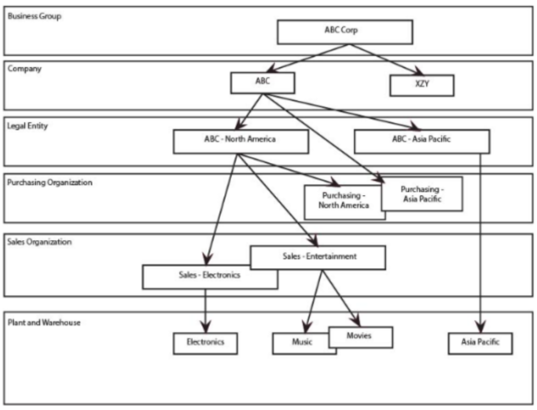

Figure 16: Typical organization model [42].

The sOPMS explains various types of inconsistencies and uses the AHMM4EAS based DMS4SRC to take the decisions to deliver optimal actions on how to reorganize Units. Using the right sequence of SRC and ETP-HSC actions can determine ETP's success. Such actions are based on *organizational routines* or *known actions*, knowing that there are various types of reorganizational *Models* [41,42]: 1) The Rational Actor *Model* (RAM), in which decisions (or sets of actions) of a large *ENT*, are under central control; the RAM can be an sOPM actor; 2) The sOPM, examines *ENT's* actions of an *ENT* as a whole and these actions are considered as an output of a subsystem that is based on organizational routines. The sOPM depends on the critical Management's Political

Model (MPM); and 3) The MPM focuses on the group of important decision makers and it considers actions as bargaining activities to take policy decisions. The MPM decisions are a result of negotiating among stakeholders. The ARM, sOPM, and MPM support organizational modelling (org sETM) of an *ENT*. *ENT's* (re)organization represents an enterprise, department, cost-center, division, sales-unit or any other Unit. As shown in Figure 16, typical *ENTs* are as follows: Business Group, Company, Legal *ENT*, Sales Organization, Purchasing Organization, Plant and Warehouse [42]. sArtefacts and Models support sETMs' building or (re)assembling.

6.5. sETM's Building or (Re)Assembling

The SRC support *ENTs* to work efficiently and there are various manners to implement sETMs, and they depend on the ETP*'s* goals. A sETM has the following characteristics [43]: 1) It visualizes an *ENT* and distinguishing between its *operating* and *support* activities; it also clarifies relationships between Units *support* functions and implemented sETMs; 2) It shows how employees report to their management and helps depict how sETM based Units are structured; 3) *ENT's* goal is to bring together employees with a common objective and sETM can help it with defining: The scope of the group of employees and predict R2C, The formal relationships between employees and reporting lines, The functional role for each employee, and The interfaces between Units' functions; 4) Has the following sETM elements: a- Types like value chain, units, matrix, functionally-oriented, market-oriented; b- Roles which define skills and responsibilities; c- Interfaces (interactions) between Units; d- Organizational or sETM charts; and e- Influencers are employees who manage information, direct, and generating advice/recommendations; 5) Support work includes: a- Policy that has sets rules and governs Units; b- Champion that proposes work sETM actions' optimizations; c- Shared sETM services support customer/supplier relationships; and d- Core-resources provide support for Units; 6) There are different ways to structure the Unit's operating work that include the following sETM types: Value chain, Matrix, Functionally-oriented, and Market-oriented; 7) sETM based Units are a form of *ENT's* robotization which may provoke R2C.

6.6. R4C and Related Topics

ETPs in general and SRC specially can face ETPR and/or R2C, that is why the *Manager* must implement a R4C in the ETP*'s* vision. R4C can be evaluated in all TDM's phases. R4C must be integrated in a Secured EA (SEA). The TDM needs the AAV, to support: SEA, SRC, and sArtefacts reusability principles. An adaptive SRC is based on various secured UPs which are coordinated by the secured ADM based TDM phases as shown in Figure 17. The SRC also generated applications' cartography.

Figure 17: Integration of SABSA with TOGAF [8,45].

6.7. SRC and ETP-HSC CSFs

Based on the AHMM4EAS, LRP4SRC and DMS4SRC, for this CSA's CSFs/KPI were weight and the results are shown in Table 5. This CSA's result of 7.20, which is very low, and that is due to the fact that the SRC is very complex to implement and would probably fail. All the presented CSAs can be verified in the PoC's implementation.

Table 5: This CSA's average is 7.20.

Critical Success Factors	KPIs	Weightings
CSF_ERC_Project_Strategy	Complex	From 1 to 10. 08 Selected
CSF_ERC_Project_MDTCAS_Avant_Domains	VeryComplex	From 1 to 10. 07 Selected
CSF_ERC_Project_APD_Inter-Operability	Complex	From 1 to 10. 08 Selected
CSF_ERC_Project_Units_Reorganization	VeryComplex	From 1 to 10. 07 Selected
CSF_ERC_Project_TEOM_Assembling	Complex	From 1 to 10. 08 Selected
CSF_ERC_Project_RelatedTopics	VeryComplex	From 1 to 10. 07 Selected
CSF_ERC_Project_cross-ENTs_Models	VeryComplex	From 1 to 10. 07 Selected

valuation

7. THE PoC's IMPLEMENTATION

7.1. SRC's Basic Preparations

The first step PoC's step is to prepare environment by setting-up the AAV, sMDTCAS/TDM, and the SRC extracted sArtefacts for EUBank, as shown in Figure 18 [7].

Figure 18: PoC's preparations.

This PoC uses various TRADf modules, like the UP and SRC, which focus on the extraction of sArtefacts [7], that can support EUBank's secured ATR (sATR).

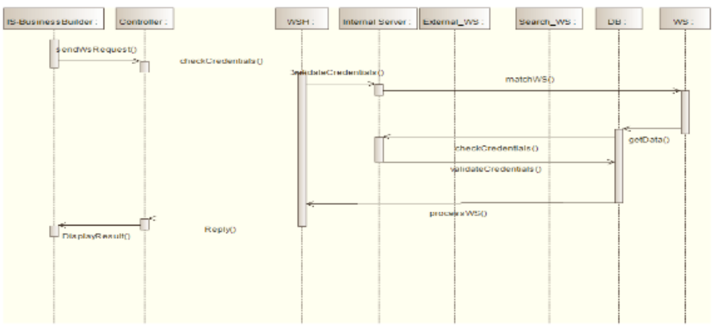

Figure 19: The ATR's activity diagram.

sBBs are assembled to build sArtefacts' based scenarios and sATRs, which need the optimal level/approach of granularity that respects the "1:1" mapping [45,46] concept. A logical view of a series of sArtefacts based ATRs is presented in Figure 19, and their consumption of SRVs, in the form of an activity diagram in which all the events are exchanged between various sUPLs' nodes, require encryption which is managed by the TDM. The sATR uses a set of sCBBs which are presented in Figure 20. The ADM based TDM phases B and D, implement the needed sATRs.

UPL-APD Environnement	Provide APD sArtefacts
Controller	Passes a SRV request
Find sArtefacts/SRVs	Execute
Data Source	Return information

Figure 20: sATR's elements.

7.2. SRC's Design and Implementation

PoC's essential constraint is to use existing ICS and security standards in a reduced form, what corresponds to sMDTCAS' main objective. In this case the sMDTCAS transcendent sArtefacts, and diagrams are used. These standards include sArtefacts to be used to integrate Models and sETMs in the existing sUnits. To identify the initial sets of CSAs' CSFs and test whether the RQ's of CSFs affect SRC' or ETP-HSC' integration. The PoC uses the HDT based mixed qualitative and quantitative method. The PoC in the beginning uses Phase 1 that is mainly based on the HDT tables, which use WGTs. Phase 1 is used to weight the relative importance of CSAs and CSFs for the usage of SRC or ETP-HSC and that is done using a decision-tables [47].

7.3. PoC's Phase 1

LRP4SRC's outcome proves the existence of a major knowledge gap and it's (or Phase 1's) outcome supports the RQ's credibility, by the use of the LRP4SRC and *TRADf*'s archive or knowledge-base, of an important set of references, previous author's works, documents, and links.

Table 6: PoC's phase 1 outcome is (rounded) 8.50.

CSA Category of CSFs/KPIs	Transformation Capability	Average Result	Table
The RDP4ERC's Integration	Usable-Mature	From 1 to 10. 9.25	1
The Methodology/MDTCAS support for refined Artefacts	Transformable-Possible-Complex	From 1 to 10. 8.00	2
The Artefacts based ERC's approach	Transformable-Possible-Complex	From 1 to 10. 8.40	3
The Model's Approach	Transformable-Possible-Mature	From 1 to 10. 9.60	4
The ERC based Project	Heterogenous-VeryComplex	From 1 to 10. 7.20	5

/ Evaluate First Phase

After selecting the SRC's Factors, they are linked to various HDT scenarios. The PoC is based on the CSFs' binding to specific RDP4SRC resources, where the SRC and ETP-HSC were prototyped using *TRADf*. The HDT represents the relationships between this RDP4SRC's RQ/requirements, sArtefacts, and selected Factors. PoC's interfaces were achieved using Microsoft Visual Studio .NET environment and *TRADf*. The SRC uses calls to resulting sArtefacts, to execute HDT actions related to SRC requests. CSFs were selected and evaluated (using WGTs, HDT, and DMS4SRC) and the results are illustrated in Table 6, which shows that the SRC is a central phase and not an independent one. In fact, it is essential for the ETP*'s* risk concept. HDT's main constraint is that CSAs having an average result below 7.5, will be ignored. This fact, leaves the SRC's CSAs (marked in green) effective for RDP4SRC's conclusion(s); and drops the CSAs marked in red. Phase 1, shows that the SRC part of the ETP will probably fail and is a very complex one because of the SRC's and ETP-HSC' complex refinement operations. The PoC can proceed to Phase 2.

7.4. PoC's Phase 2

Starts with sMDTCAS/TDM's setup and Factors selection. Phase's 2 setup includes: 1) Sub-phase A or the AAV and Architecture Vision phase's goals, establishes a SRC approach and goals; 2) Sub-phase B or the Business Architecture phase establishes ETP-HSC' target TDM/EA and related SRCs' activities; 3) Sub-phase C shows and uses the Application Communication Diagram to describe SRCs activities; 4) Sub-phase D or the Target Technology Architecture shows the needed SRC and ETP-HSC' optimal infrastructure landscape; and 5) Sub-phases E and F, or the Implementation and Migration Planning, presents the transition AAV based architecture, which proposes intermediate situation(s) and evaluates SRC's and ETP-HSC' statuses. sArtefacts and HDT based DMS4SRC has mappings to *ENT's* resources and the SRC defines relationships between sArtefacts, sMDTCAS' artefacts, and Requirements/PRBs.

7.5. PRBs Processing in a Concrete HDT Node

The DMS4SRC solves SRC and ETP-HSC' PRBs, where Factors link to specific SRC PRB type and has a set of actions that are processed in a concrete HDT node. For this goal, the action *CSF_SRC_or_ETP-HSC_Extraction_Procedure* was called and delivered SOL(s). Solving PRBs involves the selection of actions and possible SOLs for multiple ETP activities. The HDT is on mixed quantitative/qualitative and has a dual-objective that uses the following steps:

- In Phase 1, *TRADf's* interface implements HDT scripts to process the selected CSAs. And then relates PoC's resources to *CSF_SRC_or_ETP-HSC_Extraction_Procedure*.
- The DMS4SRC is configured to weight and tuned to support the HDT.
- Link the selected node to HDT to deliver the root node.
- The HDT starts with the *CSF_SRC_or_ETP-HSC_Extraction_Procedure* and proposes SOL(s) in the form of SRC actions/improvements.

HDT scripts support AHMM4EAS's instance that are processed in the background to deliver SRC or ETP-HSC risk procedures and value(s). The AHMM4EAS based DMS4SRC uses sArtefacts to deliver ETP-HSC operations; which are a set of SRCs actions.

8. CONCLUSION AND RECOMMENDATIONS

Legacy systems' unbundling and securing the transformed sArtefacts, are the major cause of ETP*s'* failures and success rates can be improved by using an IHI framework, ETP-HSC, and AAVs based strategies. AAVs uses an optimal approach and the PoC proved its application's complexities [15,16]. The SRC and ETP-HSC support sArtefacts and Models based AAVs concept to facilitate sUnits and their sUPLs reorganizations. The proposed PBA is an optimal approach for the SRC and ETP-HSC which supports ETP*'s* unbundling activities; and the LRP4SRC presented a knowledge gap, that is mainly due to the fact that are no similar research approaches and that there is a lack of a Polymathic-holistic approach. There are manual refinement technics for legacy-sOPMS, but the SRC presents the possibility to implement an IHI concept [8].

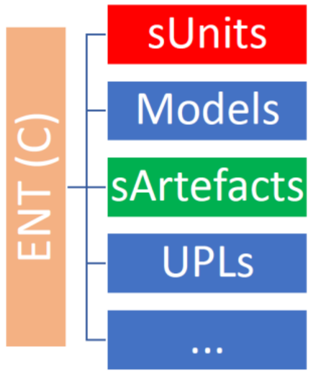

Figure 21: Viewpoint's "U" evolution roadmap.

The RDP4SRC is a part of a series of publications on ETPs, Security strategies, SRC, TDM/EA, Polymathic models… The ETP uses the HDT and CSFs/CSAs to support ETP-HSC activities. And the SRC focuses on managing complex UPs and synchronizes a structured relationship between: refinement, risks' management, TDM/EA, constraints, and HDT based DMS4SRC. ETP's most important recommendation, is that the *Manager* must be skilled to manage transformation and SRC activities. The PoC's Table 6 result of (rounded) 8.50 that used CSFs' binding to a RDP4SRC resources, the DMS4SRC/KMS4SRC, RQ, and sArtefacts, shows that the SRC is very complex due to risky secured UP operations. The SRC uses an IHI process/methodology and framework; and this article's set of recommendations are:

- This article presents the IHI SRC which tries to avoid locked-in strategies and ensures success.
- The sMDTCAS based SRC fits in the TDM.
- TDM's integration in the SRC enables the automation of all its refinement activities.
- SRC constraints are controlled and monitored by the UPL and ICS.
- *ENTs'* sustainability is orthogonal to its SRC capacities.
- To avoid any form of locked-in scenario the *ENT* must build its own SRC and ETP-HSC.
- The ETP can face ETPR or R4C, which should be predicted by using the R2C.
- The high demand for ETPs*'* and the hyper evolution of technologies, create fatal problems because of the differences in their evolution's rate.
- All author's works are based on *TRADf*, AHMM, TDM, and RDP; which are today mature and can be applied in various APDs.
- SRC like the UP, is a ETP*'s* critical phase.
- A ETP must build a holistic TDM and sMDTCAS to support the SRCs activities.

- The SRC unbundles the legacy-sOPMs to support Units, UPLs, which can face problems in the alignment of various refined sArtefacts.
- Each *ENT* constructs its own IHI SRC and ETP-HSC.
- The SRC replaces legacy environments using conversion concepts in order to ensure ETP*'s* success.
- ETP-HSC interface *ENT's* TDM and delivers the pool of sArtefacts based DIAs.
- The ADM based TDM, manages design, SRC, DevOps4SRC, and governance activities.
- TDM's and DevOps4SRC' integration with the SRC and ETP-HSC, enables the automation of all ETP*'s* SRC activities.
- *ENT's* sArtefacts stability and coherence are crucial for its evolution.
- sArtefacts can be (re)used in an IHI Models; where a Unit is a set of sETMs and different Units can share Models, and hence sETMs.
- sArtefacts are used in sOPMs based sETM.
- Unit's transformation needs an IHI Methodology, Domain, and sMDTCAS that manages sArtefacts.
- Avoid consulting firms and to build internal SRC mechanisms.
- SRC and ETP-HSC are very complex and will very probably face failure.
- Each *ENT(S)* constructs its own IHI security strategy.
- The SRC unbundles legacy system and modules to support sArtefacts, Models and sETMs, which form new Units; and this an *ENT(C)*.
- Viewpoint's "C" presents a structured evolution's roadmap for ETP-HSC, as shown in Figure 21.

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