Model-Driven Strategy For Aligning Business Motivation With Enterprise Business Processes

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Abstract: As modelling of enterprise continues to influence the way many organisations represent their business strategies and technologies, there is a commensurate growth in knowledge base with resolute lessons gained. This is despite criticism that Enterprise Architecture development should have started by the elaboration of an agreed architecture representation language in order to avoid contemporary perilous proposals. Many practitioners argue that since the advent of Enterprise Architecture (EA), a lot of prominence has continually been placed distinctively on business process modelling and information technology infrastructure with less emphasis on alignment and formalisation. Approaches such as top-down and bottom-up have been proffered with fastidious ambience of best practises for EA development. Without an extensible and comprehensive alignment strategy, it is difficult for enterprise to evaluate the usefulness of architectures as complex architectures are intricate and difficult to understand by stakeholders. This paper explores the adoption of EA models as an effective strategy for aligning EA models with business constraints and goals. It presents an approach for categorization and modelling of EA artefacts with focus on motivation abstraction to alignment of business processes with organizational goals. The paper proposes and exemplifies methods that can segregate domain knowledge from the operational knowledge and facilitates the analysis of the domain structures through formalised decomposition and systematic integration by use of standard modelling notations of ArchiMate. This approach contrasts significantly with other common perspective such as the maturity matrices, balanced scorecard and reference models and espouses the use of interrogative constructs of EA models to confirm that the EA model meets the intrinsic goals defined by their motivation.

Keywords: Alignment, ArchiMate, Business Process, Enterprise Architecture, Modelling, Organizational Goals

1. Introduction to Theoretical Foundation for Modelling

Enterprise Architecture (EA) is increasingly represented as a discipline that is concerned with the design, construction and use of artifacts based on definitive information theoretical foundation. This theory demands that the specifications for enterprise system should include a method for annotating the structure of the enterprise in collaboration with relationships that exist between components distinctively. These relationships can be explicit, inherent or transitive. This is due to the fact that Enterprise systems have direct and measurable influence on the way the organisation carries out its operations, cost of operation and performance irrespective of whether it is applied in socio-cultural systems, information technology systems, workflow systems, and governance systems [1]. The EA theory also demands that potential change should be assessed to ascertain the impact it can have on the organization and its technological infrastructures [2]. However, theories in EA have been unfairly unbounded leaving critical questions that require answers [3]. In an attempt to proffer clarifications, a simple consistent way of annotating and categorizing systems across different types of domains and enterprise is required with evidence of the capability to manage change as well as reduce organisational risks with minimal risks to organisation. Thus, the theoretical foundation for EA modelling as presented in this paper is based on the principles of separation of concerns in recognition of the need for teams to work within a limited context; modularity as a specialization of the principle of separation of concerns, abstraction, change anticipation, generality and consistency which is classified under information systems design theory[26]. Information System (IS) has been defined as a field of research concerned with the effective design, delivery, use and impact of information technology in organizations and society [14]. Information Systems is also said to be concerned with the design of artefacts and their use in human-machine domains and involves theories and practices to achieve these goals [15], [16]. The goal-oriented perspective of IS has created a rising interest in designing theories within the information system community as it enables the enactment of principles from best practices at operational, management or strategic levels. In general, five types of theories can be distinguished in relation to Information Systems: (i) analytical and descriptive theory, (ii) theory for understanding, (iii) prediction theory, (iv) explanatory and predictive theory, and (v) theory for design and action [16]. IS Design Theory (ISDT), which is related to this presentation is considered part of the theory for design and action and is concerned with how to design the artefact (design product) and the design process (method being used to realize the product) [17], [18]. By addressing all these elements in conjunction with each other, IS design theory is often thought of as a complete package of guidance for designers facing particular sets of circumstances. However, IS design theories are also regarded as normative theories. That is, they are prescriptive and evaluative, rather than solely descriptive, explanatory, or predictive. Because IS design theories are intended to give guidance to developers, they must not only pass scientific tests of explanatory or predictive power, they must also pass the tests in practice. Its primary contribution is to formalize, justify, and extend the traditional IS practice of labelling system types (e.g., DSS, ESS, and EIS), describing their characteristic features, and prescribing an effective development approach. The value of an IS design theory is to reduce developer's uncertainty by restricting the range of allowable system features and development activities to a more manageable set, thereby increasing

the reliability of development and the likelihood of success [19]. IS design theory is also based primarily on a theory referred to as kernel theory. This theory provides much more practical implementation methods to practitioners [16], [19]. Many researchers have already used this aspect of ISDT proposed by Walls et al. for emerging technologies [18]. This work follows this same trend and applies ISDT principles [20] for the design and modelling of EA artefacts.

2. Review of Related Motivation Modelling Approaches

Motivation Model is an enterprise architecture concept that facilitates the development and management of business intentions. It enables the identification of factors that aid the actualization of business strategy through graphical representation and relationship between the factors of the business plans. At the centre of motivation model are schemas and structures for developing, communicating, and managing business plans in an organized manner [4]. The Business Motivation model identifies factors that motivate the business plans, identifies and defines the elements of business plans and indicates how all these factors and elements correlate. In Zachman Framework (ZF), the main element of motivation model is specified as Ends represented as Why [13]. In this implementation, elements of the motivation model are developed from a business perspective and stakeholder's viewpoint. In this manner, the motivation becomes the foundation for activities, connecting system solutions firmly to their business model artefacts. Notably, the ArchiMate Modelling Language demonstrates the concepts of motivation modelling very distinctly. In ArchiMate, Motivational models are used to explain the reasons that underlie the design or change in the enterprise architecture [5]. It also influences, guides, and constrains the design of the model by use of artefacts that represent goals, principles and requirements [6].

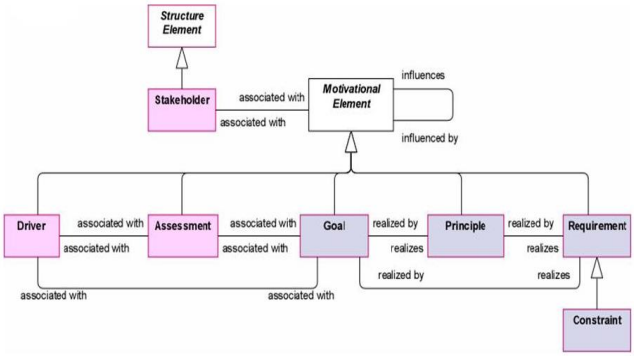

Figure 1: *ArchiMate Motivation Extension Metamodel (Source: [5])*

While Goals represent some desired result or end that a stakeholder wants to achieve, Principles and Requirements represent desired properties of solutions or means to realize those goals. In addition, Requirements also specify formal statements of need, expressed by stakeholders [6]. Thus it has been suggested that Motivation model is a blueprint design that can support a range of EA methodological approaches [7]. Implementation of the Motivation model results in a set of concepts that act as a checklist of factors to be considered in the architecture, a standard vocabulary and a flexible model that supports artefact development processes. Methods such as TOGAF, SEAM and ZF acknowledge the importance of motivation modelling in the development of EAs [27], [29]. Motivation modelling support is needed to specify, document, communicate and reason about goals and requirements [8]. In addition, motivation modelling techniques provide a way to describe structured requirements lists and use cases. Contrary to the significance placed on motivation, many other modelling techniques for EA such as GEAF have focused on products, services, processes and applications with little support available for modelling the underlying motivation of EA [9], [10] and [11]. In terms of stakeholder concerns and the high-level goals that address motivation, many techniques are said to be indistinctive [12]. For many organisations, Enterprise Architecture is often used as a blueprint to deal with change. Many of the methodologies for EA discussed so far are driven by motivation to represent knowledge about information, processes and the use of technology in a concise but comprehensible manner. Therefore it can be said that understanding motivation is critical to achieving this objective, ensuring success in implementing EA initiatives, management of business processes and adaptation to changing business environment.

3. Alignment and Architecture Traceability

One of the responsibilities of the Enterprise Architect is to provide complete alignment and traceability from requirements analysis and design artefacts, through to implementation and deployment [28]. The formal definition of traceability usually refers to the ability to link requirements to stakeholders' rationales and progressively to corresponding design artifacts, code, and test cases. Thus Traceability is intended to support numerous EA activities such as change impact analysis, compliance verification, constraints testing and requirements validation [16]. However in EA, traceability often means different things to different people. Some practitioners refer to enterprise model traceability as prove for alignment to business goals; end-to-end traceability to business requirements and processes; a matrix that maps systems functions back to operational activities; reference across artefacts such as services, business processes and architecture; a footprint between a technical component and a business goal. Traceability has also been used to imply identification of associations between artifacts from business and IT strategy to solution development and delivery [28]. However, despite these divergent perceptions of the bounds of traceability , there is a general concession that by adopting traceability between IT and business inherent in enterprise architecture, it is possible to evaluate the IT portfolio against operational performance and business needs to determine areas where misalignment is occurring and change needs to take place. Unfortunately the practice of constructing and maintaining traceability especially in the form of a matrix is that it is very arduous and over time the traces

tend to erode into an inaccurate state unless date/time stamped or versioned.

4. Business Case for Context Evaluation

The primary data source for this study is a single qualitative case study of graduate employability. Graduate employers, particularly in competitive fields, increasingly view relevant work experience as a must, with employers seeing internship schemes as a filter to identify new employees. Students see an internship as a valuable life experience that can lead to improved academic achievement and a way of making career contacts. Policy development around increased student fees and the sharpening of the student employability agenda requires institutions to respond by demonstrating that they have excellent resources and processes in place to support students in securing graduate employment. The institution seeks to extend the provision to enhance students' experience by engaging students in developing key employment skills as well as enhancing employer engagement and extend student careers support. The project aims to enhance student employability and building better links between the university, businesses and community projects. Building on this background, the institution plans to implement internship or work experience provision at a school level. The key stakeholders in this project are students, businesses community, employment intermediaries and the institution. Among other benefits, the project is expected to take an Enterprise Architecture approach and use ArchiMate as the modelling tool. It will also maximise student satisfaction and make a significant contribution to their readiness for employability. Generally, the project seeks to increase understanding of how EA can help in the implementation of transformation programmes. An EA modelling is planned to concentrate on the goal, information systems, process and services modelling. The project will adopt an Enterprise Architecture approach to review the graduate internship programme, analyse the school/course internship programme stakeholders' requirements and review of the institution technologies and applications. Using EA, the project is aimed to investigate the institution existing systems, with the focus on policy and strategic context including employer engagement, external and internal partner provision and system for student placements. The objective is to build the as-is model of the institution with the focus on internship provision and also to propose a solution model for the programme using an EA approach. This will include the different viewpoints; i.e. the business processes, the information models, the interaction with the institution and external systems, design and development of services and portals. For the Purpose of this paper, the project is tagged UWL-SIP. Sequel to this analysis, the following EA models to-be have been identified for design and modelling;

Motivation models

i. Models for Goal, Constraint and Requirement
ii. Models from Student viewpoint.
iii. Models from Career Support viewpoint.
iv. Models from Employer Viewpoint.

Process models

i. Process for Internship Application to-be.
ii. Process for Internship Matching to-be.
iii. Process for Placement Monitoring to-be.

Business Models

i. Organizational model
ii. Information Model
iii. Functional and Service model
iv. Business processes extended with validation element

5. Motivation Modelling

These models allow the development of a system for the management of internships opportunities and aims at automating the process of matching students with internship opportunities while allowing the career office to maintain complete control over the process. The specification stipulates that students will manage their CV, search for internship listings, request and apply for internship and provide feedback once the internship has taken place. Similarly, the internship providers are required to provide information about their internship to the institution, track progress on internship listing, partake in the assessment of applications and provide feedback on student internships during the duration and completion of the internship. The Career Support plays administrative roles to guide the success of the projects. Figure 2 depicts the model of the goals and constraints of the project.

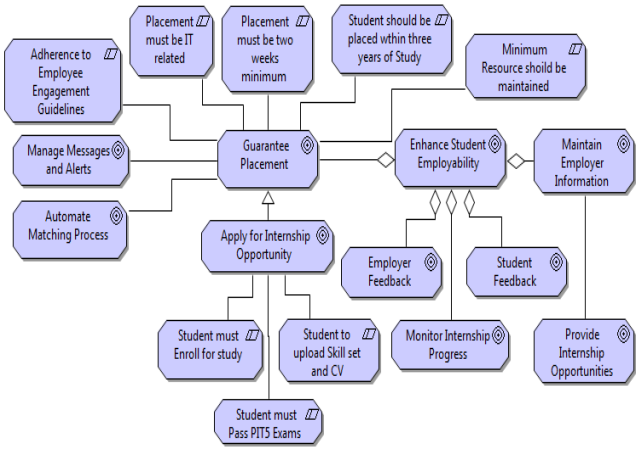

Figure 2: *Business Goals and Constraints Model*

The Business Goals and Constraints model consists of constraints which bind the principles and requirements in order to establish congruency and to ensure that validation criteria can be developed. The primary Goal is to Enhance Student Employability. For this to be achieved five sub-goals are aggregated to the primary Goal. These five sub-goals have constraints in some cases directly or indirectly through their specific tangential sub-goals. These Constraints are assessed and effectuated through the motivational Requirement element.

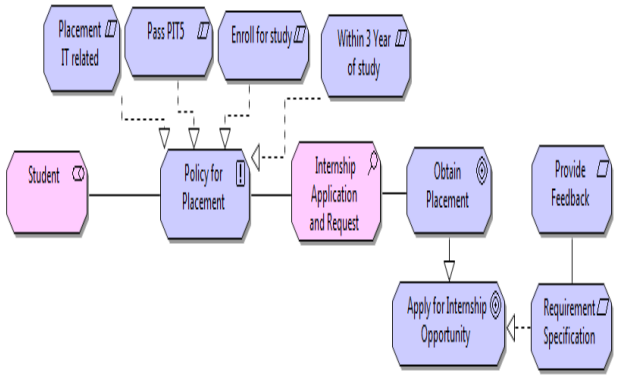

Figure 3: *Goal/Constraint model - Student viewpoint*

The goals that have been modelled (Figure 3) express the relationships between assessment of the constraints and the requirements to be validated. This is required in order to enable rationalization of the business processes as well as measurement the model's maturity.

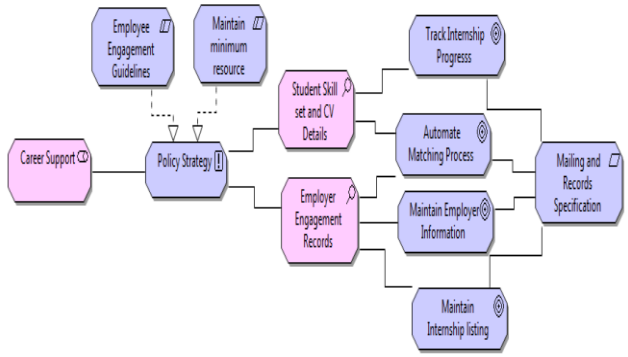

Figure 4: *Goal/Constraint model - Career viewpoint*

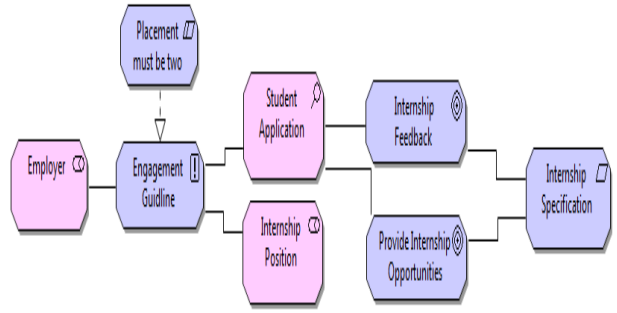

Figure 5: *Goal/Constraint model - Employer Viewpoint*

The values of the business motivation are modelled through different viewpoints. The classification of components required to achieve the goals are decomposed into three auxiliary models from the perspectives of Student, Career Support and Employer perspectives. Specifically the business role here for the student is to apply for internship opportunity, obtain placement and provide feedback (Figure 3); the Career Support to track internship progress, automate the matching process, maintain employer information, maintain internship listing as well as messages and (Figure 4); and the employer to provide and maintain the available internship opportunities as well as send feedback (Figure 5). The three models presented decompose the overall goals of the project into small realizable goals revealing divergent interests between the stakeholders, possible conflicts and overlaps in functionality. Association of the goal models with the stakeholders is crucial as it reveals the essential requirements needed to bridge the gaps that may exist in the processes. The decomposition enables requirement completeness to be measured. As specific goals are also distinctively connected to the validation elements, it facilitates a more thorough validation.

6. Process Modelling

Three process models are distinguished in this project and used as exemplar though more processes can be derived. The objectives of these process models are to track related events that occur within the institution taking into consideration different viewpoints of different Stakeholders. The Process models also establish rules, guidelines and behaviour patterns which lead to the actualization of the goals specified in the goals model. It also establishes an explicit link between artefacts at the business level of abstraction of ArchiMate Business Layer and the requirements that the model needs to fulfil.

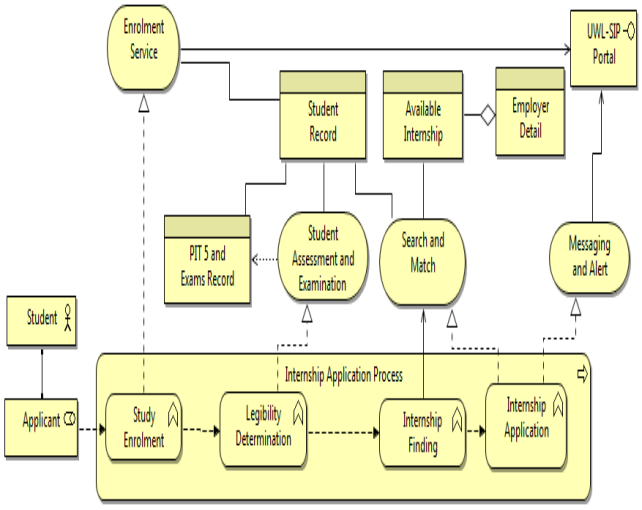

Figure 6: *Modelling Process for Internship Application*

The modelling of the process for Internship Application is depicted in Figure 6. This process is carried out by the student in the business role of an applicant and involves the execution of the Study Enrolment function. The Study Enrolment function uses the Enrolment Service with access to the Student Records object. Model process flow continues to Legibility Determination function which again uses the Student Assessment and Examination service to determine the suitability of the student with access to both the Exam records and the Student Records. Model process flow extends to Internship Finding function which triggers the Search and Match Service to match available Internship with student. Model process flow returns to Internship Application function and uses the results of the Search and Match Service to send the application issuing a message through the Messaging and Alert service to the institution's portal interface that the application has been submitted.

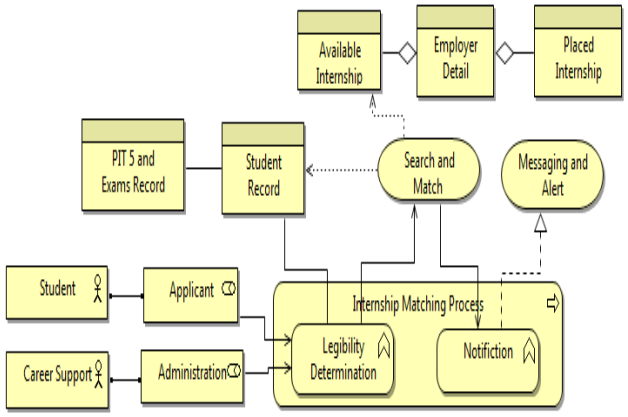

Figure 7: *Modelling Process for Internship Matching*

The process for internship matching can be performed by either the Student or the Career Support as depicted in Figure 7. The Legibility Determination function is performed with access to the Student Record and Exams Record business objects. The Internship Marching process on determination of the student's legibility uses the Search and Match service with access to Student Record and Available Internship data objects to execute the match. Afterwards, a notification is sent through the Messaging and Alert Service stating the outcome of the search.

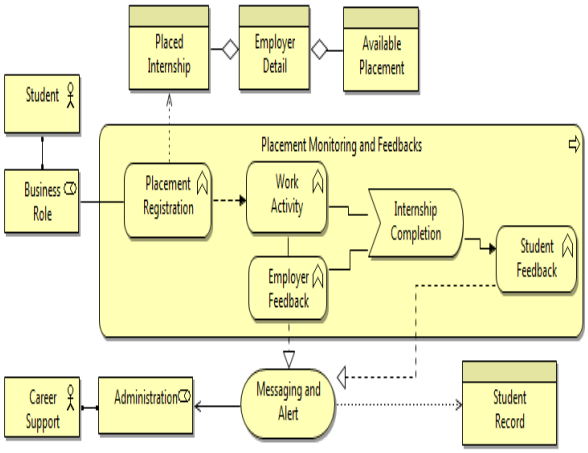

Figure 8: *Modelling Process for Placement Monitoring*

The Process for placement monitoring and feedback are initiated by the Student and Career Support. This is executed from the student's viewpoint or perspective after a due placement registration function has been completed. During the Work Activity function, the Career Support through the Messaging and Alert service may prompt the Employer for feedback. However, on completion of the Internship, the Internship Completion Event triggers a final feedback from the student through the Messaging and Alert Service. This event is a notification that occurs in response to the change in state of the student subsequently, the student record is updated.

7. Business Modelling

The business organizational model defines the structure of the EAF including all the stakeholders identified and associations with each other. It enmeshes a number of elements which identify units, interactions and collaborations that cohere mutually to accomplish the primary goal and sub-goals with specific outcomes. This is depicted in represented in Figure 9.

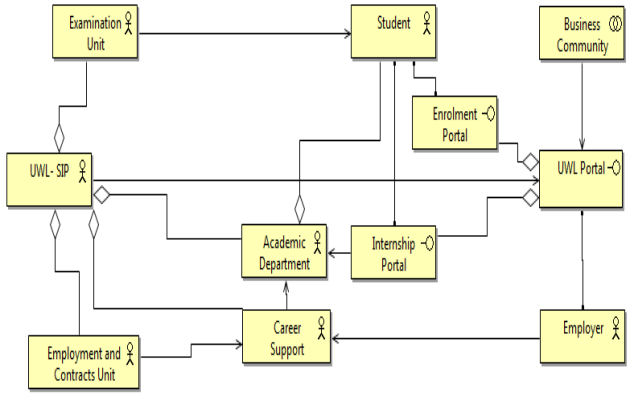

Figure 9: *Organisational model from Business Perspective*

The model also incorporates multiple physical locations internal to the institution such as units, department and portals and external locations such as the Internship Provider (Employer). The conjugating artefact is the institution's portal interface where student enrols and applies for internship; Internship is listed; Search and Match is carried out by Student and Career Support; Employer manages Internship listing; messages, alerts are generated and feedback routed. Figure 10 depicts also the stakeholder viewpoint from the motivation extension perspective.

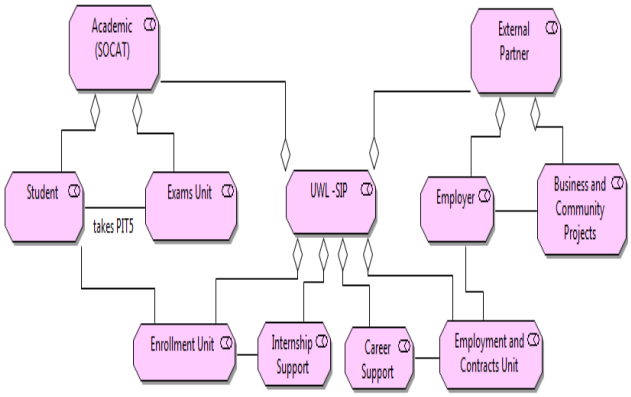

Figure 10: *Stakeholder Viewpoint*

The Information model describes data structures, values defined in the enterprise policies and their meaning in relation to each other and the interoperability provide for the institution. The objective of the Information Model is to define a standardized set of structures used to exchange data between artefacts in the EAF. These structures provide the basis for formalization of data bindings, allowing the EA implementation to create a congruent mapping and transitional processes from motivation to business layer. Thus the scope of the Information model specification is focused on defining interoperability between elements of the motivation extension and the core ArchiMate Business layer of the EAF.

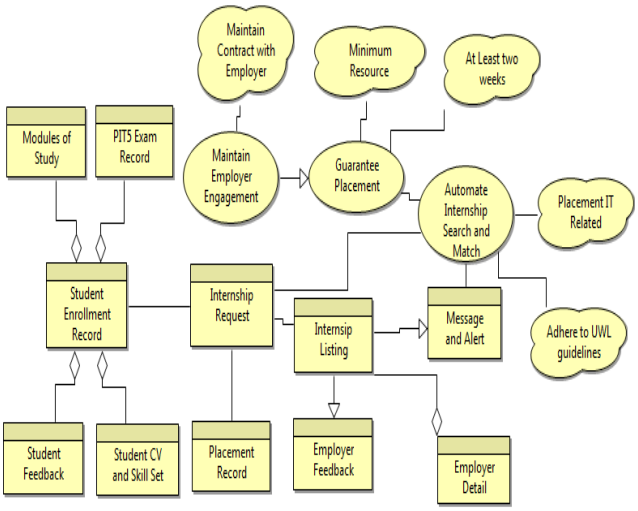

Figure 11: *Information model from Business Perspective*

Central to this information Model is the value Maintain Employer Engagement specialized by Guarantee Placement. To achieve this, there is an association to the value that allows the automation of Internship Search and Match. Various data objects support this paradigm as depicted in Figure 11. The function and service model describes the behavioural specifications of the components of the model. The model typically describes what is needed to be accomplished by the stakeholders as well as requested properties of functions and associated services. Thus it uses the output of the requirement analysis defined by the motivation extension. It describes precisely the essential model elements and their relationship for procedures which determine that specified motivational goals are met.

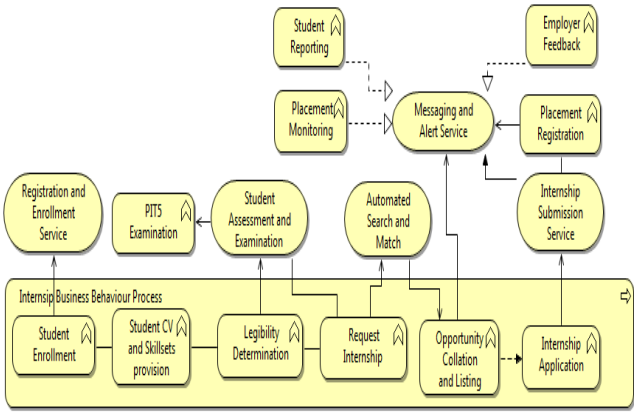

Figure 12: *Function and Service model from Business Perspective*

Annotations of the function and service elements help to avoid overlaps and inconsistencies; allows for accurate extradition of unnecessary redundancies and optimization of resources. It also serves as a unique valuable reference for model mapping and transformation, provides documentation of configuration, and allow for consistent communication among the various stakeholders. The function and service model in Figure 12 provides a precise idea of the motivation to be achieved such that the model design can substantially be aligned.

8. Significance of the EA Models

Most organizations often lack a clear overall view of their business functions, processes, information systems (IS), and motivation which specifies the reasons that guide the design or change of an Enterprise Architecture. This makes it difficult to execute the transformation initiatives in the most beneficial way. As a result, business and IT improvement often takes place in silos, without comprehensively considering the organizational viewpoint and transformation as a whole [5]. The significance of adopting an enterprise architecture approach in this institution is that it can help with the unification and alignment of this business motivation with business processes; improve interoperability between systems and help in harmonizing communications between disparate systems. It will also facilitate the rationalization of systems, reduction of both operational costs and the potential for inaccuracies. Simplifying the visualization of business process and goals also increases traceability, making it easier for different stakeholders to understand the workflow to ensure that the business intentions which include both goals and constraints are met.

9. Conclusion

The enterprise architecture approach has been widely deployed as a planning and governance approach to managing the complexity and constant change, and to align organizational resources toward a common goal [24]. This article delved into the EA benefit-realization process by clarifying how EA benefits are realized modelling. Particularly, the article focuses on the viewpoints and goals which drive EA motivation. First, the article presents a brief theoretical foundation for modelling EA and EA then different perspectives of models and realization. The article then models findings from an in-depth case study and shows relationships between complex and intertwined chain of modelling elements. This article asserts that benefits resulting from the EA processes modelling are numerous. The benefits range from immediate benefits to EA users or the EA stakeholders participating in EA planning (e.g., identify dependencies or provide overview), to indirect benefits, such as improved understanding (e.g., improve decision-making) that are results of the immediate benefits.

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