

Strategic Planning to build Transformational Preparedness: An Application of Enterprise Architecture Practice

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Abstract

Enterprises are continuously evolving systems; this evolution can be directed or emergent. Enterprise transformation has special aspects due to the enterprise being a socio-technical system whereupon evolution happens on the levels of individuals / humans / organisation, on the level of the technology and on the level of the Information Systems that integrates the activities performed by humans and by technology. Furthermore, changes are typically continuous, due partly to external factors and partly to strategic foresights. Either way, transformation needs to happen so that the enterprise can keep satisfying its objectives. An important transformation mechanism is to perform mergers or acquisitions (M&As). Interestingly, literature reveals that an unacceptably high percentage of M&As do not achieve the aimed objectives and (as we demonstrate) the success of such trajectory depends on several factors. This article proposes a methodology to overcome potential problems by making necessary anticipatory transformations opening up a possibility to perform M&As with a better chance of success.

Keywords

Mergers, Acquisitions, Post-merger Integration (PMI), Strategic Planning, Preparedness Building

INTRODUCTION

The enterprise, as a socio-technical system is the result of continuous evolution. This evolving nature requires enterprises to change from multiple aspects so as to better satisfy the conditions arising in the context of the environment in which they operate. The purpose of this research is to demonstrate, with an example, the use of Enterprise Architecture (EA) concepts in organizing strategically important transformational activities. For an example of enterprise wide transformation, we consider Mergers and Acquisitions (M&A) due to the level of complexity involved in such transformation, and the high failure rate that characterizes such transactions.

In order to demonstrate the use of EA in M&As, firstly we briefly summarize what literature suggest about issues that cause problems with the success of M&As. Secondly we summarise the concepts of EA used in this article. Thirdly, we demonstrate how with strategic intent a multi-aspect transformation of the enterprise can be organised to achieve a state where the enterprise is ready for strategically desirable transformation such as M&A. Finally, we summarise the results and future work. Due to the fact that the presented results are based on a conceptual-analytical investigation, the authors propose further validation through case studies and expert reviews (which at the time of writing is a current project).

M&A AND ITS PROBLEMS

To start with the overall view of the example transformation: the rate of M&As is currently increasing, but too many deals fail to achieve synergies and desired levels of integration (Rodriguez 2008, p.65). The precise failure rate varies according to industry, but is generally agreed to be >50% (Alaranta and Henningsson 2008; Mehta and Hirschheim 2007; Rodriguez 2008). This fact is the major reason for selecting M&As as an example of complex enterprise transformations for this study.

We reviewed a wide range of M&A literature to identify typical issue types (or issue-categories) that have significant impact on the result of M&A deals. The major issues having the highest impact on M&A success are claimed to be in the domain of information systems- (IS), and organizational integration (Larsen 2005; Mehta

and Hirschheim 2007; Mo and Nemes 2009; Rodriguez 2008; Schuler and Jackson 2001). Major M&A issues have also been highlighted in (Baro, Chakrabarti and Deek 2008; Chatterjee 2009; Epstein 2004; Hwang 2004; Larsen 2005; McDonald, Coulthard and Lange 2005; Mehta and Hirschheim 2007; Rodriguez 2008; Stylianou, Jeffries and Robbins 1996; Walsh 1989). As a result of our analysis, the following three issue types (or categories) could be identified (illustrated by a non-exhaustive list of specific issues below):

Management Issues/concerns, resulting from

- Merger motive, expectations and planning,
- Level of Coherency of Integration Strategy,
- IS/IT Involvement in M&A planning,
- Organisational integration management.

HRM Issues, due to the

- Requirement of strong integration team, executive leadership,
- Need to consider not only HR issues but (individual) human side of M&A,
- Need for top-down communication of vision, M&A strategies, and M&A planning,
- Personnel concerns (such as benefits, retention and cut-offs),
- Lack of supporting programs, advanced notification, extended benefits, outplacement activities.

IT and IS Issues, resulting from

- IT Attributes,
- IT Integration Management,
- ICT vision,
- Enterprise Systems / Applications integration such as ERP, SCM, CRM, etc.,
- Technical compatibility.

The example of M&As illustrates that strategic transformations have three aspects: (1) Management aspect, (2) Information Technology and Information Systems aspect, and a (3) Human / Organizational aspect, and that three types of corresponding issues emerge during strategic transformations. Therefore solving just one issue (for example HR issues without considering their relationships with other issues would be less effective than expected or altogether ineffective). Hence for any enterprise wide transformation methodology we must jointly consider how to solve these three types of issues. In the following section, we introduce Enterprise Architecture (EA) concepts and how they can be used to make multi-aspect considerations of transformation issues and their relationships.

M&A ISSUES AND ENTERPRISE ARCHITECTURE

To be able to succeed in a dynamic environment of transformations, “change and adaptation should be a natural dynamic state rather than something occasionally forced onto the enterprise” and EA as a discipline aims at organizing the body of knowledge necessary to identify, organize and perform transformations of enterprises as large scale systems (IFIP-IFAC Task Force 1999, p4).

For the purpose of demonstrating how EA can be used to organise such transformations, several basic concepts of the EA discipline will be used, namely the concepts of Enterprise Entity, Lifecycle, Life History and Viewpoints. Appendix gives a brief explanation of these concepts (for further detail, see ISO 15704 -2000; 2005 or (IFIP-IFAC Task Force 1999). There exist a number of examples on how to use EA concepts in transformations management, integration management and other strategic enterprise-wide needs; in this research we propose an extension of the use of EA to *transformational preparedness building*.

One important way the strategic intent of an enterprise can be expressed by management is the adoption of a business model which helps derive the mandates and roles of different parts of the enterprise in the business. We will demonstrate, how EA can be used to identify and organise the necessary transformations once management defines the strategic intent regarding the type and possible targets of M&As. This transformation can then enable a less risky, cost-effective and potentially more successful post-merger integration.

To demonstrate who has what role in an enterprise-wide transformations, a so-called ‘dynamic business model’ can be used and we shall demonstrate how to use such a model on the example of M&As. Based on the discussion of M&A Problems, it is evident that individual solutions addressing independent issues is not possible; e.g. a technology solution addressing one of the technology issues will not necessarily work. Therefore a systemic approach is needed where we consider all issue types and their relationships. Unfortunately, at the time an actual merger or acquisition is considered, there is typically not enough time to spend on comprehensive planning of post-merger integration. Thus there seems to be a contradiction in realities, having to make fast decisions to seize the opportunity and the need to perform comprehensive planning.



Figure 1: Traditional view of M&A Process

To solve the above problem, as exposed in detail in (Vaniya 2011) and as shown in Figure 2, we could consider desirable life trajectories of an enterprise prior to having actual merger or acquisition plans, instead of using the conventional view of a three stage M&A process (see Figure 1). During this prior stage, some ground work can be completed to better position the enterprise, so that by the time an opportunity is sighted, the enterprise is in the position to quickly make necessary decisions and finalise comprehensive planning. We call these activities ‘Preparedness Building’ through which we aim to achieve systemic properties such as flexibility, agility, interoperability, etc. as enablers of future transformations. In the next section we explain the possible structure of such a Preparedness Building exercise (using the example of the Merger of two Banks).

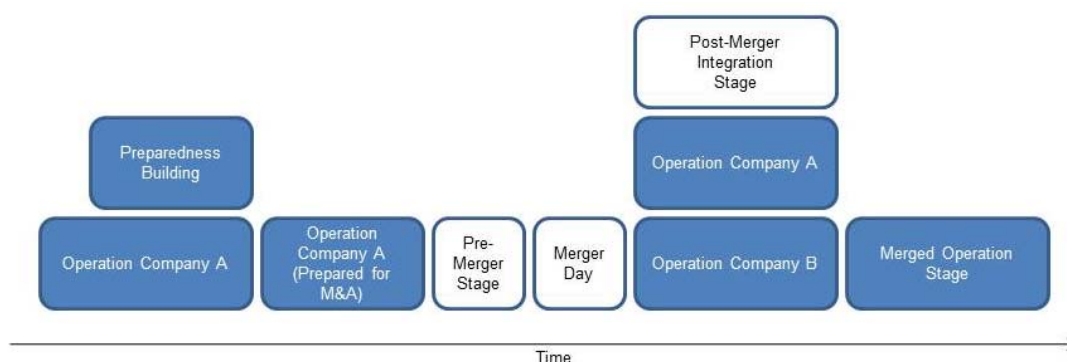


Figure 2: Preparedness Building in M&A Process

M&A PREPAREDNESS BUILDING

Researchers and Practitioners share the same view of project and program based planning and implementation for significant transformational efforts. Researchers from the enterprise architecture discipline recommend a long term program (or programs) governing other program(s) and/or project(s) to conduct change, for example (Molina and Carrasco 2003; Noran 2010; Tolle, Bernus and Vesterager 2002). These examples (note that there exists many more) use concepts of ISO 15704 / GERAM to systematize the design of program(s) and/or project(s) in order to conduct enterprise wide change efforts.

Similarly, practitioners follow the concepts of program and project based change in order to plan M&A implementation. Sprott (2008) in his discussion of M&A planning recommends task specific program(s) and project(s) in order to plan and implement the M&A and post-merger integration. Other practitioners following similar concepts are Greens (2010).

Therefore, we shall demonstrate the structure of an ‘M&A Preparedness Building Strategic Program’ (M&A PBSP). In such situations of planning and organizing complex transformation tasks, Noran’s (2008) step-by-step meta-methodology can be helpful because of its generic (strategy-agnostic) nature

- Identify the involved enterprise entities
- Show life-cycle relationships of entities involved in the transformation
- Map the identified life-cycle activities onto the timeline

The focus here is to demonstrate how to use EA concepts to organize transformation activities (i.e., identify key tasks, actors and major outcomes) and demonstrate a possible sequence of the M&A preparedness building process for a merger of two banks. Note that what follows is only an illustrative example, and the actual structure and timeline of preparedness building would be different case by case.

Before Preparedness Building

The preparedness building exercise initiates by identifying entities and their respective activities which are involved in, or affected by, preparedness building. There are two types of entities involved: affected entities (i.e. existing entities involved in Preparedness Building, either as actors or as entities that need change) and additional entities (new entities required) due to the transformation. The identification of entities can be done by

carefully considering the issues that need to be addressed to build preparedness. For the M&A of two banks, the entities identified are shown in Figures 3 & 4 (for details see Vaniya (2011)).

Figure 3 demonstrates the affected entities, namely Headquarters (H.Q.), Business Units (including branches, employees, suppliers and other stakeholders), Technical Infrastructure and IT Applications/Services. In an M&A, enterprises are required to satisfy the terms set by regulatory bodies. Regulatory bodies can be governmental bodies, legal bodies, industrial bodies and (if any) environmental management bodies. In our case, the example bank has various controls from the Central Government, the Finance Ministry, the Reserve Bank, and from legal bodies. These regulatory bodies provide operational guidelines in terms of reference models consisting of rules, regulations, policies and principles that the bank has to follow during its daily operations and during an M&A process (Relationships 1 & 2). Reading the lifecycle relationships represented in Figure 3, H.Q. defines and sets goals of Business Units, Technical Infrastructure, and IT Applications/Services (Relationships 3, 4 & 5). In turn, responsible Business Units designs and implement Technical Infrastructure and IT Applications/Services (Relationships 7 & 8); Business Units can also redesign and reengineer themselves to meet the goals set by H.Q. (Relationship 6). Here, we only highlighted those entities and their relationships which are important for M&A Preparedness Building. For example, we did not represent in this model, the operational relationships, such as the Technical Infrastructure and IT Applications/Services supporting the operations of business units.

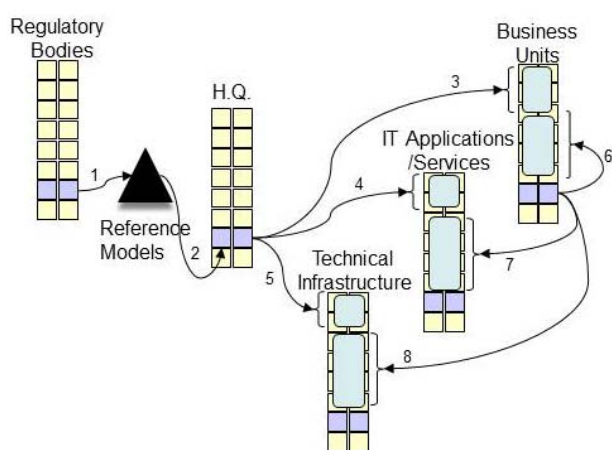


Figure 3: Dynamic Business Model of example bank before Preparedness Building

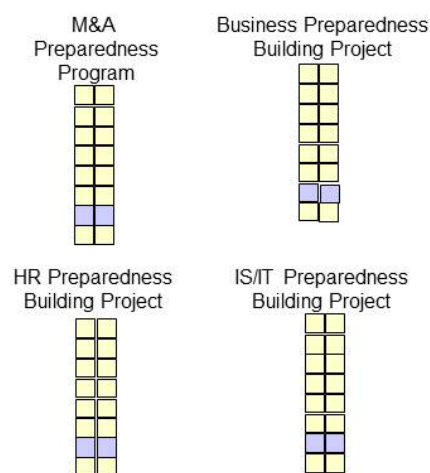


Figure 4: Needed Program/Project Entities for M&A Preparedness Building

Figure 4 highlights the least new entities that are needed to conduct preparedness building exercise, which are the M&A Preparedness Building Strategic Program (PBSP), Business Preparedness Building Project (BPBP), HR Preparedness Building Project (HRPBP) and an IS/IT Preparedness Building Project (ISPBP).

Note that the list of entities and types (program, project or task) can vary case by case and it could be different for different organisation types, structures and needs. Some of the known decision alternatives are program versus project, and project versus task, meaning whether a set of activities should be a long term ongoing program or a short term project and the same choice exist for project versus task.

After identifying the entities, we shall develop an implementation plan for the transformation and this can be done by developing a so-called 'Dynamic Business Model' (a model representing the lifecycle relationships among entities participating in a transformation).

Preparedness Building Transformation

The relationship demonstration through the 'dynamic business model' can help us identify the role of each entity in the change effort and the role of an entity in the lifecycle of the other entity (Uppington and Bernus 1998, pg. 316-317). From these concise models, it is possible to read the basic structure of an implementation plan.

The terminology used by the dynamic business model uses fundamental concepts of GERAM and provides rich meaning for each of the references used in the following discussion. For example, if we say '*entity A covers lifecycle activities of entity B*', the details of the tasks involved have a detailed explanation of the involved activities based on the scope definitions of each lifecycle phase in GERAM's modelling framework and its viewpoint definitions (see Appendix). As a consequence, the simple statement '*entity A covers the detailed design of entity B*' carries a rich connotation implying a design methodology followed by entity A to perform the detailed design of function, information, resource, human resource, software, hardware, organization and process of the service delivery as well as the management of entity B.

The dynamic business model for our example is shown in Figures 5 & 6. Figure 5 demonstrates a possible arrangement (commonly referred as *portfolio* or *program portfolio*) of preparedness building and its projects and the operation of BPBP, while Figure 6 shows the operation of HRPBP and ISPBP. It should be noted that each of these generative relationships is considered as a contribution of an entity to another entity's lifecycle activities, and according to ISO 15704 for each relationship, the acting entities would typically refer to available reference models / partial models to create the design solution for their particular target entity.

As shown in Figure 5, under agreed terms and conditions, HQ decides to prepare for possible M&As. Therefore HQ decides, identifies, conceptualizes and specifies the requirements (mandate) of the PBSP, structures a strategic management team, and provides the basis for a master plan of the program (Relationship 1). From here on, PBSP management is responsible for the design and implementation of PBSP. In the detailed design, program management designs the program team, and plans their tasks. This planning follows a project-based design to develop the detailed design of the program (i.e. to identify projects, their tasks and prepare a mandate for each project) (Relationship 2).

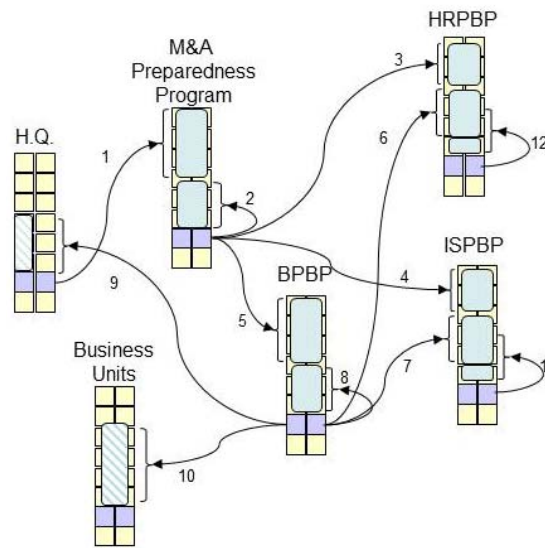


Figure 5: Relationships among involved enterprise entities in M&A Preparedness Building Transformation

For the identified change activities, the PBSP (in our example) defines three separate projects which can be called BPBP (Business-), HRPBP (HR-) and ISPBP (IS Preparedness Building Project) - with the BPBP being the governing project of the other two. This provision is made to maintain the strategic alignment of Business, HR and IS transformation. The PBSP program team only identifies and conceptualises the HRPBP and the ISPBP (Relationships 3 & 4), because the mandate of these projects will have to be defined by the Business Preparedness Building Project (BPBP) (Relationships 6 & 7). Relationships 8, 11 and 12 represent the self-designing and reengineering capabilities of BPBP, ISPBP and HRPBP respectively.

Note that different types of M&A preparedness call for different operational models and therefore the objectives that the BPBP must achieve will depend on strategic choices in terms of M&A preparedness (Ross, Weill and Robertson 2006). For example, if the bank's strategic management wish only to rely on M&As that optimise the use of technology, but do not require information or process sharing among future merged constituents then this will create a specific mandate for the BPBP. In other situations the strategic choice may dictate that M&As of interest will benefit the bank by sharing information among the merged constituents (e.g. for market access) therefore information integration ability and interoperability building will be one of the BPBP mandates. Future research is planned to explore different preparedness building activities based on the different types of M&As.

During the operation of the BPBP, the project team is mainly preoccupied with modifying business processes (discussed later in more detail) of BUs (and possibly of HQ itself). This should be done in such a way that maintains the alignment with the changes that will be made by the HRPBP and the ISPBP. The changes in the current business processes need to be supported by corresponding changes in business units as explained below. This change to business units should be made by the governing change project – the BPBP (with the participation of BU management). Therefore, during its operation the BPBP will perform changes to the Requirement Specification, Architectural Design and Detailed Design of BUs, (Relationship 10) and initiate the Building of the corresponding changed structures (processes, technology and organization). However, the actual release into operation will need to wait until all three components are in place (as designed and implemented by the HRPBP and ISPBP projects) and will be controlled by BU managers.

An example can be helpful to explain possible changes in the current business processes and the impact on the associated business units. For example, a change in a current business process of the bank is discussed here. Suppose we found that the way business units (particularly branch managers in our case) make decisions about loan approval needs to be changed. Assume that creating a separate loan approval department is one of the requirements to standardize the loan approval process. This can cause changes in the current loan approval business process, which has impact on the activities of associated business units (BUs associated with making decisions on loan approvals). Other examples can be considered of achieving other business process characteristics (e.g. functional independency, flexibility or agility to be ready for a merged / acquired entity).

The BPBP management team may realize that in order to maintain the strategic alignment, the strategic management has to customise current strategies (Relationship 9). McDonald, Coulthard and Lange (2005) argue that an effective M&A implementation requires changes in existing strategy, for example the BPBP team may suggest some changes in current corporate strategies to enable the successful preparedness building for the decided M&A types. This might include changes related to the organizational structure, the reporting system in place, the business processes or the monitoring and controlling mechanisms. These changes will then be proposed to HQ which may approve or disapprove; nevertheless HQ will need to reach certain consensus that can maintain the strategic alignment between M&A strategy and corporate goals, and that of the Business, HR and IS strategy for M&A Preparedness building.

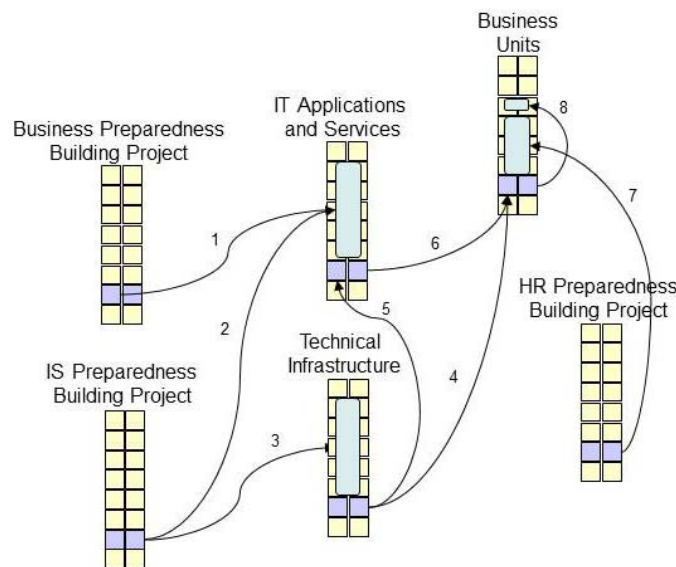


Figure 6: Dynamic Business Model of M&A Preparedness Building Transformation

Following the achievement of an alignment between HQ strategy and M&A preparedness building strategy as well as BPBP objectives, it is important to model the changes caused by the HRPBP and the ISBPB and the way changes are to be made in current business processes. The operation of the HRPBP and ISBPB and a way modifications are performed in current business processes is illustrated in Figure 6.

BPBP and ISBPB identify and perform adequate changes into the IT Applications/Services to support organisational needs and meet business goals (Relationships 1 & 2). Some of the changes could be to make IT Applications service oriented and/or functionally independent; to clean-up application profiles; isolating redundant application/services; etc. To facilitate previously mentioned changes, ISBPB update Technical Infrastructure meaning supporting hardware, networking arrangements and any other related components (Relationship 3). For the HR perspective, HRPBP facilitates necessary changes in culture, employees' perceptions, commitment, involvement and participation in M&A preparedness Building (Relationship 7) based on employees' needs and requirements (Relationship 8). Then the operations of transformed Technical Infrastructure as well as IT applications/Services support the organisation to preserve the established M&A Preparedness (Relationships 4, 5 & 6).

In the above discussion we demonstrated how to use a 'dynamic business model' to demonstrate what entities are involved and their roles and responsibilities in preparedness building transformations as well as how to 'read stories' in form of an implementation plan from such concise models. In addition we have illustrated a possible Preparedness Building Exercises can be planned, such as an enterprise-wide transformations to achieve basic systemic properties/design properties so that the change and adaption can become a natural dynamic state not the occasional forceful load on the enterprise.

Life History

The previously discussed dynamic business model of PBSP allows us to develop and show the life history models of PBSP. In the dynamic business model, the overall organisational structure of the PBSP was mentioned however, the details of tasks involved were not elaborated. This is due to the fact that lifecycle activities of an entity are an abstract form of the life history of that entity (IFIP-IFAC Task Force 1999). See Appendix for details on the Life History concept.

For the problem at hand, it is important to manage in detail the sequence of tasks and activities carried out by different entities during their lifetime in order to sequence and prioritise activities as discussed in the existing literature. Therefore, Life History models can be developed which describe in detail the timing and sequence of the involved tasks and illustrate major milestones of M&A Preparedness building.

For this research a set of life history diagrams were developed (for details see Vaniya (2011)); we only presented here one such diagram as an example (Figure 7). Each 'swim lane' in Figure 7 represents the life history of an entity, similar to a GANTT chart of transformation activities. In the same manner, a complete life history of PBSP can be shown using the format presented below. Such diagrams then help us identify the relative sequence of involved transformation activities and their priorities.

FUTURE RESEARCH

We demonstrated the relationships of enterprise entities in preparedness building transformations based on an example of M&As; now the proposed 'dynamic business models' can be extended to include industry best practices for each of the activities identified, such as concrete tasks for building interoperability, agility, flexibility as informed by the respective literature and practices. Subsequently the Life History models (which we have seen are a special type of GANTT chart) can be developed to show the sequential order and priorities of each of the activities identified. The presented work is the result of a conceptual analytical research aimed to demonstrate the effectiveness of using EA concepts in organizing a complex preparedness building exercise.

Following this conceptual level research, the authors plan to validate these outcomes using case studies and expert reviews to ensure that the result are translated into a feasible, industry ready methodology for building preparedness for M&As. The goal of this planned research is to (1) prepare a checklist of key M&A issues and their solutions, (2) define the state of M&A preparedness and (3) prepare a list of optimal preparedness building activities for different types of M&A. Therefore a mix-methods research approach is planned; at the time of writing, a survey has been designed and is under pilot testing. This survey will be sent out to a large sample of domestic and international participants. In addition to this survey semi-formal interviews will be conducted to validate the findings of survey. The results of this research will be verified by an expert panel comprised of M&A practitioners and researchers. In the end, the planned research is expected to deliver an M&A preparedness building methodology package which can support strategic management to configure, plan and execute M&A Strategy, Integration Strategy and post-merger integration.

CONCLUSION

The discussion above demonstrates how to use EA concepts to organize preparedness building transformations as well as how to consider the coordinated transformation from all aspects influencing the future trajectory of the enterprise rather than performing uncoordinated separate efforts.

We acknowledge that enterprises are changing organically, and therefore enterprise transformation is partly planned and partly emergent. Such considerations as to what kind of transformations are necessary, and why, from the strategic intent point of view should not be considered as a purely top-down planned sequence of activities. What our dynamic business model represents is that due to information that emerges in the operation of an enterprise, management can create abstractions of that information, which abstractions help recognise how emergent change imperatives can be turned into managed change. The dynamic business model illustrates this by saying 'management describes (perceives, models...) the enterprise on an abstraction level that is useful for supporting strategy making. The temporal order of such abstractions is not specified in the dynamic business model. So the demonstrated methodology is not mandated to be either the top-down or bottom-up: it is the life history model that can be used to describe or to specify the sequential order and priorities and illustrate where a bottom-up or a top-down approach is, or should be, used.

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APPENDIX: SOME BASIC ENTERPRISE ARCHITECTURE CONCEPTS

Some concepts of Enterprise Architecture (EA) as defined in GERAM (a standardized generalization of EA framework concepts IFIP-IFAC Task Force (1999) and ISO 15704), are explained below.

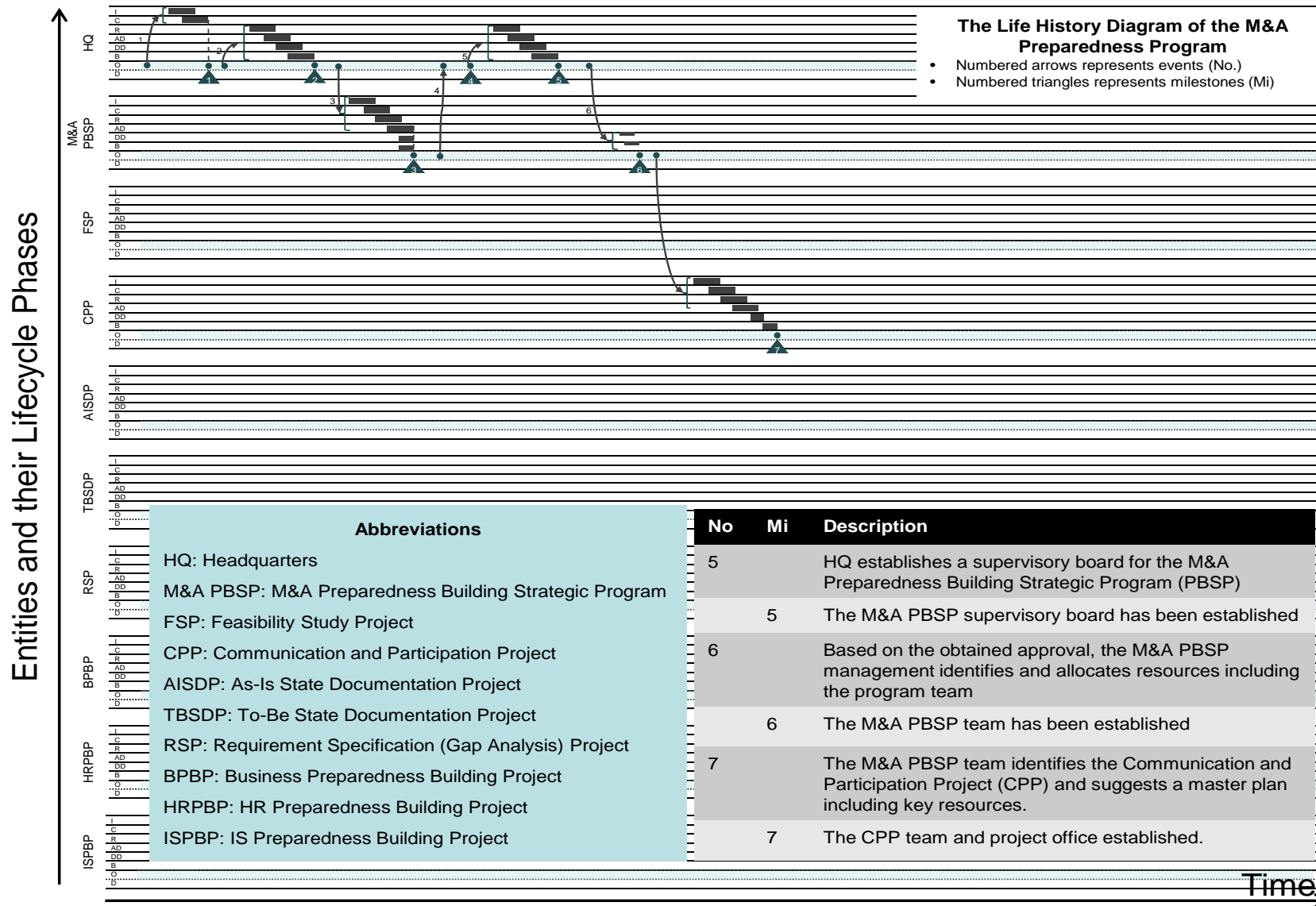


Figure 7: An example of M&A Preparedness Building Life History (for complete set see Vaniya (2011))

Enterprise Architecture: is the discipline that attempts to unify all that knowledge which is necessary to manage change in enterprises throughout their entire life span. Note this is not the same as IT architecture, and the definition originates from the Industrial Engineering / Manufacturing and Control communities, rather than from the IT community where EA has for long been used in a limited sense, to mean the IT Architecture.

Enterprise Entities: GERAM defines the concept of Enterprise Entities (EEs) through exemplification. EEs are managed / controlled systems that have a mandate or purpose. Depending on the type of the operations of the entity, some notable entity types are: Project Entities (mandate is a one-off service), Repetitive Service Entities (those which provide the same service in a repeated fashion such as a Manufacturing Entities), and Products. One can also categorise entities according to how they contribute to the life of other entities. For example, Strategic Enterprise Management Entities may create Change Programmes, Change Programmes may create Change Projects, these in turn may create or change Business Units, which in turn may change or create Products etc. (GERAM calls these 'recursive' type definitions). The fact that one entity's role may be to perform one of more life cycle activities of another entity can be used to create so-called 'dynamic business models'; diagrams that illustrate the tasks of entities in transforming others.

Lifecycle: GERAM defines the concept of life cycle as an ordered list of activity types (or functions) that consider an entity on various levels of functional abstraction. (I.e. the ordering is based on one function's output constraining the next function's input). This ordering is not temporal (because feedbacks exist among life cycle activities). GERAM defines the following life cycle activities: Identification, Concept, Requirements, Design (Preliminary and Detailed), Implementation/Building, Operation and Decommissioning. These are called 'life-cycle phases', or 'life cycle activity types' associated with the life of an entity.

Life History: The life history of an entity is the representation in time of life cycle activity instances carried out on the particular entity during its entire life span (paraphrased from IFIP-IFAC Task Force (1999) and ISO 15704). In a sense by building the life history diagrams of all involved entities in an organizational change effort, one can describe all required organizational processes and operations to carry out that organizational change. Interestingly such life history diagrams can help to anticipate and systematize the operational structures of processes; for example, identification of all involved processes, prioritization of those processes, identification of sequence of processes, identification of parallel processes, etc. At any moment in time multiple activity instances may be active on the same entity, in parallel.

Viewpoints: Viewpoints (originally called views in GERAM 1.6.3) are categorized in GERAM's GERA 'modelling framework', and represent types of models which may be created at various levels of abstraction to answer various concerns about the Enterprise Entity. These types of models may be categorized according to Model Content, Entity Purpose, Entity Implementation and Physical Manifestation. The following discussion briefly explains these four types.

Firstly, according to 'Model Content' four different model types are defined: Functional (model types that represents the entity using some form of functional abstraction from the physical structure, e.g., models representing functional decomposition, flow of control, behaviour, etc.), Information (model types describing knowledge about objects in the entity), Resource (model types describing the physical structure/components of the entity, such as human, technical/technological). Organization (model types concerned with the mapping of physical structure to functional structure, e.g. mapping between the responsibilities and authorities / roles to jobs in the given entity, and mapping of manufacturing, service, information management etc. functions to hardware or software modules).

Secondly, according to 'Purpose' models may represent what the entity does to satisfy its mandate, i.e. models of the Service / Production, and what the entity does to Manage or Control itself. The subdivision according to Entity Purpose helps model both the mission fulfilment part and the management part of an enterprise entity.

Thirdly, according to the 'Means of Implementation' models may represent human activities and activities performed by non-humans (technology, or other means). Finally, according to 'Physical Manifestation' models may describe Software or Hardware. These subdivisions of model types are orthogonal and may be combined, e.g. model types that describe mission support technology as opposed to management and control technology.

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