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Virtual Enterprise integration management based on a Meta-enterprise – a PMBoK approach

L. Ferreira^a, N. Lopes^a, P. S. Ávila^b, H. Castro^a, M. L. R. Varela^{c,d}, G. D. Putnik^{c,d},
R. Martinho^{e,f}, R. Rijo^f, I. M. Miranda^g, M. M. Cruz-Cunha^{a,d,*},

^aIPCA - Polytechnic Institute of Cávado and Ave, Vila Frescaíña S. Martinho, 4750-810 Barcelos, Portugal

^bISEP Institute of Engineering of Porto, Portugal

^cUniversity of Minho, 4804-533 Guimarães, Portugal

^dCentro ALGORITMI, University of Minho, 4804-533 Guimarães, Portugal

^eCenter for Health Technology and Services Research (CINTESIS), Portugal

^fPolytechnic Institute of Leiria, Portugal

^gMunicipality of Guimarães, Portugal

Abstract

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* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .

E-mail address: author@institute.xxx

1. Introduction

Project Management is essential for the development of successful projects, being transversal and having applications in many industries ¹. This is particularly true in large projects, where the complexity involved requires a competent project management structure.

Project management (PM) is the application of knowledge, skills, tools and techniques to project activities to meet the project requirements ². So PM comprehends the planning, delegating, monitoring and control of all aspects of a project, and supports the motivation of the various actors involved, in order to achieve the goals set for the project, accomplishing the expected performance in terms of time, cost, quality, scope, benefits and risk ³.

Project management standards are increasingly recognized as valuable building block in modern organizations. Several standards, referentials and normative provided by recognized bodies and associations offer common language, methods and procedures. For instance, the International Project Management Association (IPMA) offers the “International Competence Baseline” (ICB), The Project Management Institute (PMI) offers the “A Guide to the Project Management Body of Knowledge” (PMBoK Guide) and the Office of Government Commerce (OGC) offers the “PRojects IN a Controlled Environment” (PRINCE2). These Bodies of Knowledge are used by practitioners as ‘Best Practice’ guides to what the discipline comprises ⁵.

Complex projects often involve several organizations working together in partnership or through contractual arrangements to achieve global objectives ³. In this context, a Virtual Enterprise (VE), in broad sense, is a dynamic network of collaborative enterprises, and hence, a project, as addressed in this paper.

The large body of knowledge in the PM domain can be extended to the domain of dynamic, virtual, collaborative, agile and networked organizations⁴. In this context, networked and virtual organizations management is understood as management of collaborative projects.

The objective of this work is to explore and align the project management lifecycle processes, as proposed by the PMBoK Guide, with the Virtual Enterprise management processes provided by a third party or meta-organization, called Market of Resources.

Section two introduces the VE model and the Market of Resources as a meta-enterprise to support the VE lifecycle phases, providing the inherent management processes. Section three explores the management processes provided by the Market of Resources, while in section four the VE management lifecycle is aligned with the project management lifecycle proposed by PMBoK Guide. Section five concludes the paper.

2. Background

Before proceeding, it is important to present the VE lifecycle, and the meta-organization Market of Resources, responsible by supporting providing management services for VE creation, integration and operation.

2.1. The Virtual Enterprise model and lifecycle

Virtual Enterprises are commonly defined as enterprises with integration and reconfiguration capability in useful time, integrated from independent enterprises, with the aim of taking profit from a specific market opportunity; after the conclusion of that opportunity, the VE dissolves and a new VE is integrated, or it reconfigures itself in order to achieve the necessary competitiveness to respond to another market opportunity ⁶. VE reconfiguration is a consequence to keep the permanent alignment of the VE with the market / business opportunity. The VE model is, thus, a reconfigurable network in transition between states or instances (configurations) along time.

Virtual and network organizations span the range from self-organizing to networks that are carefully planned and organized for the purpose of implementing specific projects or processes; a critical determinant in managing distributed network projects is the degree of organizational interdependence among the collaborating organizations ⁷.

The life cycle of a VE can be interpreted as the period between its creation and integration until its dissolution, comprehending its operation and including its reconfigurations.

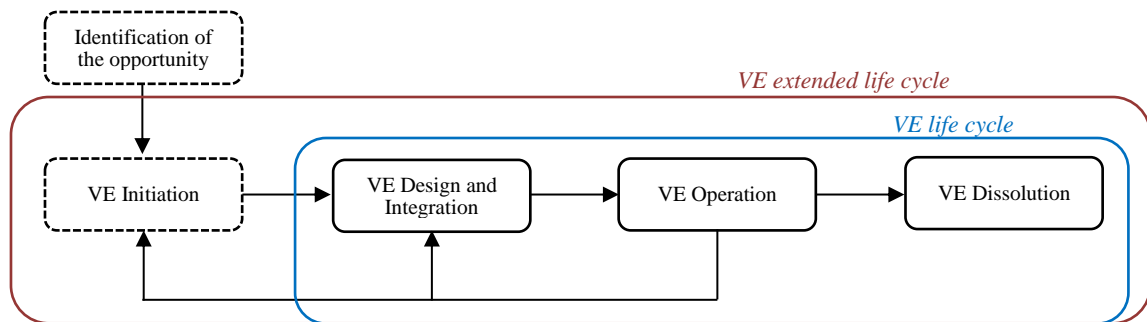
The authors propose the VE extended lifecycle, which incorporates in the VE lifecycle a prior phase, related to the contractualization of the organization that triggers the VE creation (or VE owner) with the Market of Resources. This extended lufe cycle integrates the following phases: (1) VE Initiation: contratualization with the Market of Resources;

(2) VE Creation (VE Design and Integration): design of a VE structure able to respond to a market opportunity, search and selection of resources providers and its integration as a VE instance; (3) VE Operation: operation of the VE instance; (4) VE Reconfiguration: VE redesign and integration as a new VE instance; and (5) Dissolution. Reconfiguration happens during VE operation and implies a redesign of the VE, with search and selection of new partners and integration of the same in a new VE instantiation.

The organisational challenges of (1) partitioning tasks among partners in the distributed networked environment so that they fit and take advantage of the different competencies in a VE, (2) integration of the same, (3) coordination and reconfigurability management in order to keep alignment with the market requirements, are of main concern, and can determine the success or failure of a project⁸. To cope with these challenges in due time, it is proposed a meta-organization, or Market of Resources, as the environment for enabling and management of efficient VE management⁸.

The Market of Resources (MR) supports an extended VE lifecycle represented in Figure 1.

Fig. 1. VE Extended Lyfecycle



2.2. Market of Resources – a meta-organization for VE management

The MR performs the project management activities of the VE extended lifecycle. Its overall functioning in supporting the VE lifecycle management is represented in Figure 2, using an IDEF0[†] diagram. For ease this diagram will not consider the dotted phases of Figure 1, which correspond solely to the extended lifecycle and are not relevant for the current analysis. The management processes provided by the MR are:

- VE Design & Integration Management (Process A.1): This process consists of three main activities, detailed in Figures 3 and 4. The output of this process is a VE contract among the parties integrated in the VE, establishing the work to be done and associated commitments.
 - VE Initiation Management (Process A.1.1), where the request for a new VE or a VE reconfiguration is undertaken, resulting in a VE project that responds to the requirements to produce the desired product; it involves also the search for the eligible resources providers to participate in the VE project and negotiation with them.
 - Resources Selection Management (Process A.1.2) involves the selection of the “best” combination of resources (among the eligible resources identified in Process A.1.1) to be integrated in the VE (re-design or reconfiguration, implying the substitution / integration of new resources is considered also in this process).
 - VE Integration Management (Process A.1.3) consists on formalising the VE (establishment of a VE contract with the parties) and on the establishment of procedures regarding the integration of the participants and the implementation of management and evaluation techniques.
- VE Operation Management (Process A.2): The service provided by the Market controls the operation of the integrated VE, implementing the PM techniques and the VE project plan, tracking the performance of each

[†] IDEF stands for ICAM DEFinition methodology (ICAM – Integrated Computer-Aided Manufacturing). IDEF diagrams illustrate the structural relations between two processes and the entities present in the system. The processes (represented as boxes) transform the *inputs* into *outputs* (respectively the left and the right arrows of a process), using the *mechanisms* for the transformation (the bottom arrows of a process) and constrained by *controlinformation or conditions* under which the transformation occurs (the top arrows).

resource provider, and identifying reconfiguration opportunities, to make possible the achievement of the expected results.

- **VE Dissolution Management (Process A.3):** corresponding to the project finalisation. Dissolution can happen after the project conclusion or the project fails and is no longer viable.

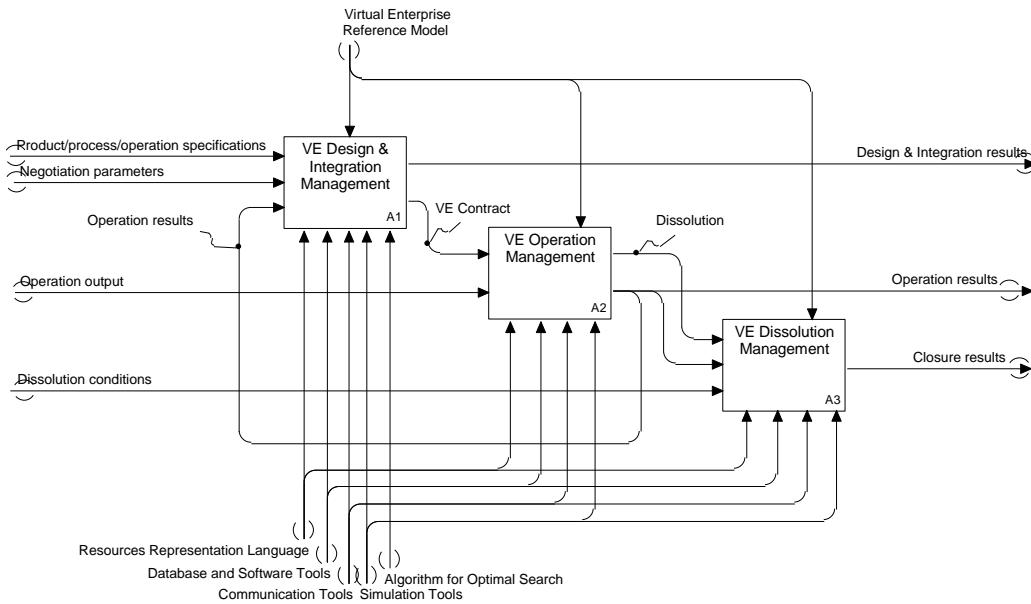


Fig. 2. IDEF0 representation of the global processes of VE management based on a meta-organization Market of Resources

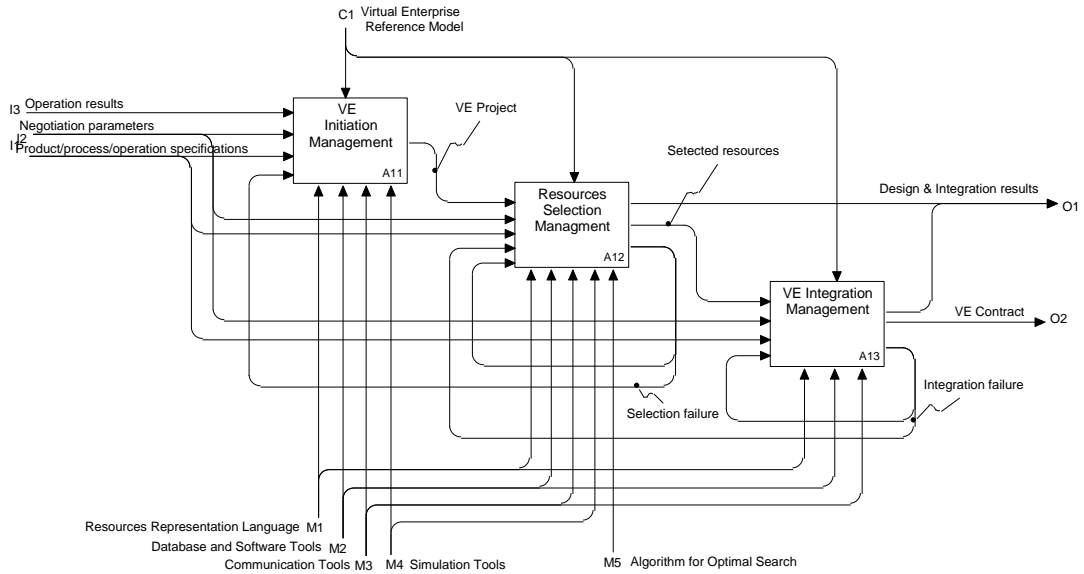


Fig. 3. IDEF0 representation of the VE Design and Integration Management processes (detail of Process A.1)

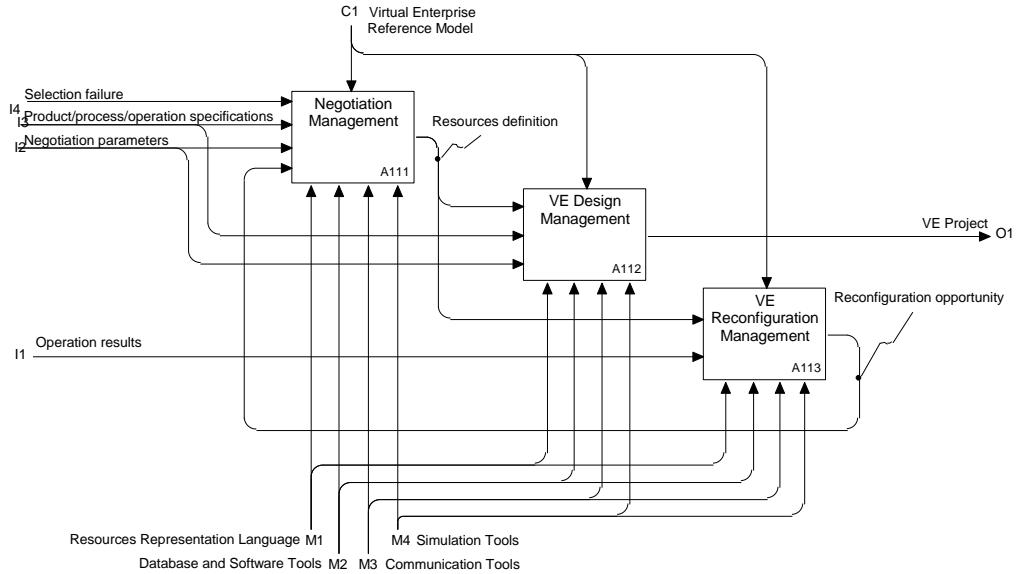


Fig. 4. IDEF0 representation of the VE Initiation Management processes (detail of Process A.1.1)

3. The Virtual Enterprise model as a project

A project is a temporary endeavour undertaken to create a unique product, service, or result ². Every project creates a unique product, service, or result; the outcome of the VE project is the VE able to produce a given product or answer to a market opportunity.

Although repetitive resources / processes / elements may be present in different VE, this repetition does not change the fundamental, unique characteristics of a VE as a project. Because of the unique nature of projects, dictated by the business alignment requirement, that traduces the uncertainty or differences in the products, services, or results that the VE creates, each VE is a project.

The generic life cycle structure of a project, as proposed in PMBoK, includes: Starting the project, Organizing and preparing, Carrying out the project work, and Closing the project. In PMBoK ², Project Management is accomplished through the appropriate application and integration of 47 logically grouped project management processes. These processes are categorized into the following five Process Groups: Initiating, Planning, Executing, Monitoring and Controlling, and Closing ².

Table 1 presents the correspondence between PMBoK project phases and the VE lifecycle management processes.

4. Further work and Conclusions

A Virtual Enterprise can be viewed as a project, and can be managed using the frameworks provided by several bodies. This work presented the several phases of the VE lifecycle and, in an overall way, how can they be managed by a third party, a meta-organization designated Market of Resources. Additionally, it was shown how management of VE life cycle phases is aligned with the project management process groups proposed in PMBoK.

As further work of the current research it is considered the development of a conceptual model of management processes to be undertaken by the Market of Resources in the implementation of the processes presented in this paper.

Table 1. Project Management lifecycle phases and the corresponding phases of the VE Management lifecycle

Project Management lifecycle phases (according to PMBoK 5 th edition)	VE Management lifecycle phases
<u>Initiating Process Group</u> : Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase.	<u>Process A11 – VE Initiation Management</u> : Design of a new VE project or creation of a new instance of a VE (VE reconfiguration).
<u>Planning Process Group</u> : Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.	<u>Process A12 – Resources Selection Management</u> and <u>Process A13 – VE Integration Management</u> : creation of a VE according to the VE Project defined in Process A11
<u>Execution Process Group</u> : Those processes performed to complete the work defined in the project management plan to satisfy the project specifications.	<u>Process A2 – VE Operation Management</u> : operation phase of the VE according to the contract and specifications defined in the VE contract, produced in Process A13.
<u>Monitoring and Controlling Process Group</u> : Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.	<u>Process A113 – VE Reconfiguration Management</u> : operation results are monitored in Process A113, in order to identify a reconfiguration opportunity, to trigger Process A111 and produce a new VE project and integration of a new VE instance
<u>Closing Process Group</u> : Those processes performed to finalize all activities across all Process Groups to formally close the project or phase.	<u>Process A3 – VE dissolution</u> : corresponds to the termination of the VE.

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References

1. Varajão J, Cruz-Cunha MM. Using AHP and the IPMA Competence Baseline in the project managers selection process. International Journal of Production Research. 2013 2013/12/29;51:3342-54.
2. PMI. A Guide to the Project Management Body of Knowledge. 5th ed. Pennsylvania: Project Management Institute, Inc.; 2013.
3. OGC. Managing Successful Projects with PRINCE2. Office of Government Commerce. The Stationery Office; 2009.
4. Shevtshenko E, Poljantchikov I, Mahmooda K, Kangilasski T, Norta A. Collaborative Project Management Framework for Partner Network Initiation. Procedia Engineering. 2016;100:159-68.
5. Varajão J, Colomo-Palacios R, Silva H. ISO 21500 and PMBoK 5 processes in Information Systems Project Management. Computer Standards & Interfaces. 2016;50:216-22.
6. Cunha MM, Putnik GD, Ávila P. Towards Focused Markets of Resources for Agile / Virtual Enterprise Integration. In: Camarinha-Matos LM, Afsarmanesh H, Erbe H, editors. Advances in Networked Enterprises: Virtual Organisations, Balanced Automation, and Systems Integration. Berlin: Kluwer Academic Publishers; 2000. p. 15-24.
7. Archer NP. Project management in network organizations. PMI® Research Conference: Innovations; 2004; London, England. Project Management Institute; 2004.
8. Cunha MM, Putnik GD, Ávila PS. Market of Resources for Virtual Enterprise Integration. In: Putnik GD, Cunha MM, editors. Encyclopedia of Networked and Virtual Organizations. Hershey, PA: IGI-Reference; 2008. p. 918-25.