

Walking a Software Handover Process

Kaleem Ullah, Ahmad Salman Khan, Mira Kajko-Mattsson
The Royal Institute of Technology (KTH), Sweden
kaleemu@kth.se, askhan@kth.se, mekm2@kth.se

Abstract

To assure that process models correctly mirror the industrial reality, they need to be extracted and evaluated in many different contexts. In this paper, we walk a handover process in a Pakistani company, called VAST Pakistan using the EM^3 taxonomy of activities as a roadmap. We walk the process by following VAST Pakistan's software lifecycle phases and by placing EM^3 activities on them. The context studied covers handover of a software system from the vendor conducting system development, evolution and maintenance to an acquirer organization being the end-user and front-end support provider. The study is made from the acquirer's perspective. Our results show that the EM^3 taxonomy of activities covers correct handover activities. Due to its specific context, however, the process studied did not utilize all the activities as defined in EM^3 . Their choice is strongly dependent on the handover process context under study.

1. Introduction

Software handover deals with a transfer of a software system from one party to another. Its design is strongly dependent on who transfers to whom, the criticality of the system to be transferred, its lifecycle phase, system knowledge, technology used and many other factors [3][9]. As illustrated in [3][9], it may be conducted in many strongly varying contexts. One of them is a handover of a software system from the developer to the acquirer.

Software system handover is a critical activity in the software lifecycle process. If not properly prepared and managed, it may jeopardize the system delivery and undermine the credibility of the organizations involved in it. Despite this, there are very few handover process models today. These are [1][4][10][11][12]. One of them is EM^3 : *Handover Process Model*.

EM^3 : *Handover Process Model* is currently being developed. Right now, it only contains a taxonomy of handover activities [2][3][6]. This taxonomy has already been evaluated in three different contexts within three different software companies. EM^3 stand for *Evolution and Maintenance Management Model* [8].

EM^3 's taxonomy only lists the activities taking place during a handover process. It does not however show what a handover process looks like. For this reason, it does not provide the software community with any guidelines for how to define a handover process model.

In this paper, we walk an industrial handover process using EM^3 's taxonomy of handover activities. Our goal is to gain understanding of a handover process, to evaluate EM^3 's taxonomy of handover activities in a real-life case scenario, and provide a basis for creating a handover process model and guidelines.

In striving towards that end, we walk a handover process in one Pakistani company, called VAST Pakistan by following its software lifecycle phases and by mapping EM^3 's activities on them. The context studied covers handover of a software system from the vendor conducting system development, evolution and maintenance to an acquirer being the end-user and front-end support provider [7]. The study is made from the acquirer's and front-end support perspective within VAST Pakistan. Due to the sensitivity of the results presented herein, we do not display the company's real name. Instead, we use its fictitious name, which is VAST Pakistan.

The remainder of the paper is as follows. Section 2 describes method steps taken to conduct the study and the validity of our results. Section 3 briefly presents the handover taxonomy. Section 4 presents the teams/organizations involved in a handover process. Section 5 walks one software handover process at VAST Pakistan. Finally, Section 6 makes final remarks.

2. Method

In this section, we present our method. Section 2.1 presents the steps taken when conducting this study. Section 2.2 describes the validity of our results.

2.1 Research Steps

We conducted our study in four major steps. These are: (1) *Confirmation of the Handover Process*, (2) *EM³ Taxonomy Evaluation*, (3) *Taxonomy Improvement*, and (4) *Walking of the Process*.

We have been offered the opportunity to study a handover process at VAST Pakistan. Due to the fact, however, that the handover process has many strongly varying contexts [3][9], we first evaluated whether the handover process at VAST Pakistan was relevant for our study. For this reason, as a first step, we conducted a series of informal and open-ended interviews whose purpose was to validate the context of the process. This step ended in (1) a confirmation that the context was right for our study, (2) a general understanding of the handover process at VAST Pakistan, and (3) a discovery of new handover activities.

In the *EM³ Taxonomy Evaluation* phase, we studied the handover process at VAST Pakistan. Here, we compared the activities in *EM³: Handover Process* with its industrial correspondences at VAST Pakistan. We did it by conducting a series of open-ended interviews and discussions using a simple questionnaire. For each activity, we asked (1) whether the activity was performed, (2) what role performed it, and (3) where in the lifecycle phase it was performed.

For each process constituent, we verified the need and usefulness of its activities in the organization's transition process. An activity was valid if it was performed. If it was not performed, we investigated the reasons behind. Also, we looked for the activities that were performed at the organization, but not presented in the *EM³* taxonomy.

In the *Taxonomy Improvement* step, we added new activities to the taxonomy and modified the existing ones. The improved taxonomy has been published in [5].

Finally, we walked the process using the improved taxonomy of handover activities. In this step, we studied the process anew, however, from the perspective of a specific handover process instance that had already taken place in the past. Here, we explored how the taxonomy activities were organized in real life.

To elicit as much information as possible while walking the process, we conducted semi-structured and open-ended interviews. The interview questions

focused on (1) general background information regarding the product lifecycle and the handover process at the organization, (2) groups/organizations involved in the transition process, (3) activities performed in the handover process and (4) the sequence in which the activities were performed. They helped us gather details about the handover process, groups involved, activities performed and their sequence. These details were then used for placing the handover activities in different phases of the software lifecycle.

2.2 Validity

We conducted our study in a real-world industrial setting. VAST Pakistan is one of the largest mobile operators in Pakistan. It is part of VAST, which is a mobile communication service provider in 14 countries across Europe and Asia.

VAST Pakistan has been involved in a handover process for many years. Its role is mainly that of the acquirer. It acquires large software systems from a third party who develops, evolves and maintains them. VAST Pakistan uses the system and provides 1st and 2nd line support on these systems [7].

Our contact person and interviewee at VAST Pakistan was a Business Support System (BSS) executive. The interviewee has been involved in multiple system acquisitions for three years. He is part of the team that is responsible for executing the handover and for supporting the system during the post-delivery maintenance phase.

All case studies encounter many validity threats. The main external validity threat to our study was the fact that our evaluation was made within only one company. Regarding construct validity, the main threat concerned the choice and collection of the right measures for the process being studied. The risk was that the researcher might misinterpret the handover process. In order to minimize this threat, the process of gaining the understanding of VAST Pakistan's handover process was conducted in an iterative manner

Table 1 – Management and Administration [2]

MA1	Identify maintenance organization.
MA2	Establish a transition team.
MA3	Create a transition plan.
MA3.1	Determine transition budget.
MA3.2	Create a transition schedule.
MA3.3	Establish transition procedures.
MA3.4	Define transition resource requirements.
MA3.4.1	Define maintenance manpower requirements.
MA3.4.2	Define maintenance facility requirements.
MA4	Develop management plans.

during which the interviewer continuously evaluated the elicited information with the interviewee. Finally, the internal validity is not relevant for our context due to the exploratory nature of our study.

3. EM³ Taxonomy of Handover Activities

EM³: Handover Process Model categorizes handover activities into seven different components [8]. These are: *Management and Administration, Maintenance Environment, Version and Configuration Management, Deployment, Training, Documentation, and Maintainability*. The component activities are all listed in Tables 1-7. Due to space restrictions, we only briefly describe the model and present tables listing the *EM³* handover activities. For more information, interested readers are welcome to study [5].

The *Management and Administration* component describes the activities for managing and administering the handover process. As indicated by Table 1, the activities in this component concern (1) identification of maintenance organization, (2) establishment of a transition team, (3) creation of a transition plan, and (4) development of management plans.

The *Maintenance Environment* component includes activities required for setting up the maintenance environment, installing the system and its data, and handling the modification requests. The maintenance environment for a software system comprises hardware and software suites and maintenance support suites. As listed in Table 2, the component covers activities dealing with the (1) determination/assessment of the need and installation/upgrade of hardware/software suite, (2) determination and assessment of maintenance support suite and supplement of support suite, (3) installation of software support suite, (4) installation of software baseline and data, (5) transfer of modification requests from the developer to the maintainer, and (6) placement of modification requests in a *Modification Request Repository (MRR)*.

Table 2 – Maintenance Environment [2]

ME1	Determine hardware/software suite needs
ME2	Install hardware/software suite
ME3	Assess current hardware/software suite, if any
ME4	Remedy the deficiencies in the HW/SW suite, if any
ME5	Determine/assess maintenance support suite
ME6	Supplement maintenance support suite with new tools
ME7	Install support software
ME8	Install software baseline
ME9	Install data
ME10	Transfer modification requests from development to maintenance
ME11	Place modification requests in the modification requests repository

Table 3 - Version & Configuration Management [2]

VC1	Establish software configuration baseline
VC2	Put software under SCM
VC3	Place software under version control

The *Version and Configuration Management* component consists of the activities needed for tracking and controlling changes in the transitioned system. As shown in Table 3, these activities concern the (1) establishment of software configuration baseline, (2) placement of software under Software Configuration Management (SCM), and (3) placement of software under version control.

The *Deployment* component consists of activities required for the developer or maintainer to deploy the software system at the acquirer's site. As shown in Table 4, the component covers activities dealing with (1) development of installation procedures, (2) installation of the system and operational data, (3) testing the deployed system for all related interfaces, (4) monitoring the deployed system closely for all interfaces while it is delivering the services, and (4) planning of the future releases.

The *Training* component consists of activities for the maintainer's training and gaining system knowledge. As shown in Table 5, it covers (1) training on system, its structure, and operation, (2) training on the maintenance processes, (3) training on the system support processes, (4) training on new technology, (5) providing on-site support, and (6) training on the deployment process.

The *Documentation* component describes the activities for handing over the system documentation and handling it after the system handover. As shown in Table 6, it deals with (1) establishment of a System Documentation Repository (SDR), (2) definition of services to be provided by the SDR, (3) update of SDR as per SCM, and (4) establishment of standards for documentation development.

The *Maintainability* component covers activities for managing system maintainability. As shown in Table 7, the component includes activities dealing with the

Table 4 – Deployment [5]

DP1	Develop installation procedures
DP2	Plan for the system deployment
DP3	Install system
DP4	Install operational data
DP5	Test the deployed system touch-points
DP6	Monitor the system operation
DP7	Plan future releases
DP7.1	Plan updates of future releases
DP7.2	Determine the distribution structure
DP7.3	Determine forms of deploying software
DP7.4	Determine the structure of release notes

Table 5 – Training [5]

T1	Train on system, its structure and operation
T1.1	Create/update training material on system, its structure and operation
T1.2	Provide training on system, its structure and operation
T1.3	Attend to modification requests
T1.4	Conduct white-box testing and debugging
T1.5	Participate in the system deployment
T1.6	Conduct UAT and post-deployment testing for system
T2	Train on maintenance processes
T2.1	Create/update training material on maintenance processes
T2.2	Provide training on maintenance processes
T3	Train on system support processes.
T3.1	Create/update training material on system support process
T3.2	Provide training on system support process
T4	Train on new technology to be used within operation and maintenance
T4.1	Create/update training material on new technology
T4.2	Provide training on new technology
T5	Provide on-site support in critical cases
T6	Provide training on the deployment process
T6.1	Prepare/update training material for deployment process
T6.2	Develop a protocol for planning and executing deployment

(1) assessment of system maintainability and (2) assessment of data maintainability.

4. Teams/Organizations involved in a handover process

Since VAST Pakistan is the acquirer of the system and front-end support provider, it does not include traditional maintenance roles in its handover process. The maintenance roles are on the vendor site. The roles involved in a handover process at VAST Pakistan are the following:

- *Operations Team* managing the transition process. The team is responsible for troubleshooting and for operating and configuring the system. It tests the system before and after the deployment, and monitors the system on a provisional basis to see if it fulfills the organization’s needs as planned.
- *Architects Team* responsible for acquiring business requirements of the software system from business team and for conveying them to the vendor. They transform the business logic into system requirements, communicate these requirements to the vendor and plan for the handover activities.

Table 6 – Documentation [2]

D1	Establish a System Documentation Repository(SDR)
D2	Define services to be provided by the SDR
D3	Update SDR as per SCM
D4	Establish standards for documentation development

Table 7 – Maintainability [2]

M1	Assess system maintainability
M2	Assess data maintainability

- *System Team* responsible for hardware components. It is an optional team in the handover process context. If the hardware deployment is required as part of system deployment, then the system team is included in the handover process.
- *Database team* responsible for the organization’s database. The software system being deployed at VAST Pakistan involves a database. For this reason, the database team plays a crucial role in the handover process. In some cases, the database team is the first one to get involved in the process. They deal with the operational data of the system and make sure that the data is incorporated with the new system.
- *Other teams as per need:* In some cases, there are more teams added to the transition process. These teams may be *Value Added Services (VAS) Team*, *Billing Team*, *Middleware Team*, *Customer Relationship Management (CRM) Team* and the like. These teams are involved in integration tests of the system touch-points and validation of its connectivity and performance at the time of the deployment. They are also involved in monitoring the system on a provisional basis after deployment.
- *Transition team* responsible for planning and managing the transition process. A transition team is established very early. However, its constellation varies with time. Initially, it consists of only business management, vendor representatives, *Architects* and *Operations Teams*. Since the company acquires a system from an external vendor, the vendor representatives are important members of this team as well. *Architects* plan for the system acquisition while the *Operations Team* performs the system handover. With time, the transition team gets expanded with more teams. These include but are not limited to (1) *System Team*, (2) *Database Team*, (3) *VAS Team*, and (4) *CRM Team*. The expansion mainly takes place after *User Acceptance Testing* phase (UAT).

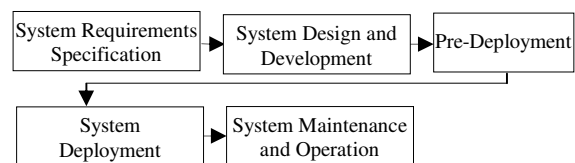


Figure 1. System handover phases

5. Software handover process at VAST Pakistan

We present the software handover process as performed at VAST Pakistan. Section 4.1 outlines the handover process. Section 4.2 presents the handover phases and its activities.

5.1 Handover phases

VAST Pakistan's system handover process is divided into five phases. As shown in Figure 1, these are: (1) *System Requirements Specification*, (2) *System Design and Development*, (3) *Pre-Deployment Activities*, (4) *System Deployment*, and (5) *System Maintenance and Operation*. Table 8 presents the EM^3 activities as conducted in these phases. The sequence of presenting these phases and activities mirrors the sequence of the phases and activities as run within the VAST Pakistan's system handover process.

5.2 Handover process phases and activities

In this section, we describe each phase of the handover process and its constituent transition activities.

5.2.1 System Requirements Specification. The handover process commences when a team starts working on system requirements. Within the *System Requirements Specification* phase, the handover activities are the following:

- *Identify maintenance organization (Activity MA1 in Table 1):* The maintenance organization is identified at the start of the process. It is the VAST Pakistan's vendor company. This company develops, evolves and maintains the VAST Pakistan's system throughout its lifecycle. For this reason, the identification of the maintenance team is made by default. This team continuously accepts system requirements as defined by the VAST Pakistan's business team and architects.
- *Establish a transition team (Activity MA2 in Table 1):* A transition team responsible for the system handover is formed already during the *System Requirements Specification* phase. The team consists of business management personnel, the vendor representatives, *Architects Team* and *Operations Team*. *Architects* plan the handover activities while the *Operations Team* performs the actual handover.
- *Determine/assess hardware/software suite needs (Activity ME1 and ME3 in Table 2):* The

determination of hardware/software/database suites for new systems takes place as early as during the *System Requirements Specification* phase. This is because it may take time to acquire them from their respective vendors. VAST Pakistan conveys its current software/hardware/ database capabilities to the vendor along with the system requirements to determine the optimal suite needs for the new system. Vendor recommends a suitable solution.

- *Determine/assess maintenance support suite (Activity ME5 Table 2):* The determination of maintenance support suites takes place during the *System Requirements Specification* phase. The suite needs are discussed together with system requirements. Both parties are involved in discussions. However, it is the vendor who determines the needs for each requirement specification.
- *Create a transition plan (Activity MA3 in Table 1):* Transition plans are created as soon as requirements are identified. The plans determine transition budget (handover related costs like training, deployment, travelling and the like), transition schedule, transition procedures and the transition resources (manpower and facility requirement).
- *Develop management plans (Activity MA4 in Table 1):* Management plans such as plans for SCM, software quality assurance, system testing and system training are made on an as-needed basis.
- *Plan future releases (Activity DP7 in Table 4):* System releases for both newly developed system and the enhancements are planned during the system requirements specification phase. The vendor and the *Operations Team* both plan for the future system releases. They plan release dates, structure of installation patches and procedures for installation. This activity is not conducted when acquiring off-the-shelf products.

5.2.2 System Design and Development. The *System Design and Development* phase starts after the *System Requirements Specification* phase and the initial planning. It is performed at the vendor's site. VAST Pakistan does not have much involvement in this phase other than discussing the requirements, if needed. Here, the vendor analyzes the system requirements, designs, implements and documents them. VAST Pakistan, on the other hand, makes sure that the vendor performs the following activities.

- *Develop installation procedures (Activity DP1 in Table 4):* System installation procedures are developed during and/or after the system

Table 8 – VAST Pakistan handover process.
V stands for Performed by Vendor. S stands for Performed at Vendor's Site

1- System Requirements Specification
MA1: Identify maintenance organization
MA2: Establish a transition team
ME1,ME3: Determine/assess hardware/software suite needs
ME5: Determine/assess maintenance support suite
MA3: Create a transition plan
MA4: Develop management plan
DP7: Plan future releases
2- System Design and Development
DP1: Develop installation procedures (V,S)
T1.1: Create/update training material on system, its structure and operation (V,S)
D4: Establish standards for documentation development. (V,S)
3- Pre-deployment Activities
Perform UAT on the system (S) - Part of T1.6: Conduct UAT and post-deployment testing for system
M2: Assess data maintainability (S)
Re-define transition resource requirements, if needed - MA3.4: Define transition resource requirements.
ME2,ME4: Install/Upgrade hardware/software/database suite needs
ME6: Supplement maintenance support suite with new tools (V)
T6.2: Develop a protocol for planning and executing the deployment
DP2: Plan for the system deployment
D1: Establish a SDR (V,S)
D2: Define services to be provided by the system documentation repository (V,S)
ME7 - Install support software (V)
4- System Deployment
DP3 - Install software (V)
VC1: Establish software configuration baseline (V)
DP4 - Install operational data
VC2 - Put software under SCM
DP5 - Test the deployed system touch-points
DP6 - Monitor the system operation
5- System Maintenance and Operation
T1.2 - Provide training on system, its structure and operation, if required
D3 - Update SDR as per SCM (V,S)
DP7 - Plan future releases.
6- Training activities
T3 – Train on system support processes
T4 – Train on new technology to be used within operation and maintenance
T6 – Provide training on the deployment process

development. Vendor and the maintainer use these procedures while installing the system at VAST Pakistan.

- *Create/update training material on system, its structure and operation (Activity T1.1 in Table 5):* Training material for the developed system is created. This includes documentation on (1) system's service logic, (2) system's architecture, and (3) system administration, installations and operations.

- *Establish standards for documentation development (Activity D4 in Table 6):* Vendor and maintainer/acquirer agree upon the standards for documentation development.

5.2.3 Pre-deployment Activities. After the vendor has developed the system, it creates a software baseline and informs VAST Pakistan about it. VAST Pakistan then prepares for *User Acceptance Testing (UAT)* and performs the pre-deployment activities.

In the *Pre-Deployment* phase, VAST Pakistan performs the UAT on the system. If the system passes tests, it is declared ready for deployment. *Operations Team* plans for the system deployment activities and expands the *Transition Team* with all the roles relevant for the deployed system. This phase includes the following handover activities:

- *Perform UAT on the system (Activity T1.6 in Table 5):* *Operations Team* performs the UAT. UAT does not only validate the user requirement but also serves the purpose of training on the system's structure and operation.
- *Assess data maintainability (Activity M2 in Table 7):* VAST Pakistan considers its future data processing and storage requirements. These requirements, in turn, are used for defining requirements for system architecture and data maintainability. Using them, VAST Pakistan validates the system for its data maintainability.
- *Re-define transition resource requirements, if required (Activity MA3.4 in Table 1):* Manpower and facility resources required for the system handover process are revised, if needed. Since the system is developed and tested, the resource allocation for the system handover and maintenance can be determined more accurately in this phase.
- *Install/Upgrade hardware/software/database suite needs (Activity ME2 and Activity ME4 in Table 2):* VAST Pakistan acquires and sets up the required software/hardware/database suite as recommended by the vendor.
- *Supplement maintenance support suite with new tools (Activity ME6 in Table 2):* The vendor provides and sets up the maintenance support suite as needed for the new system.
- *Develop a protocol for planning and executing the deployment (Activity T6.2 in Table 5):* The deployment protocol constituting a checklist of tasks to be performed when planning and executing the system deployment is developed by the *Operations Team*. The protocol should not only contain guidelines for preparing deployment but also for performing it. It includes technical level details and

guidelines on (1) how to shut down the current system, (2) how to go live with the new system, and (3) how to make deployment plans (see Activity DP2 in Table 4). Also, it suggests the optimal time for performing the system related deployment activities. For example, the protocol entries for shutting down the system may look like: (1) The *Database Team* should block all the business users from logging in the application for 30 minutes, (2) *CRM Team* should shutdown CRM services until system goes live, (3) *Billing Team* should suspend payments until system goes live, and the like.

- *Plan for the system deployment (Activity DP2 in Table 4)*: Plans for the system deployment are made in this phase. The plans include (1) system rollback plan, (2) contingency plan, (3) post-deployment monitoring plan, (4) cutover activity plan, and (5) system outage plan.
- *Establish a system documentation repository (Activity D1 in Table 6)*: The vendor creates a documentation repository that serves as single point of access for all the system related documents.
- *Define services to be provided by the system documentation repository (Activity D2 in Table 6)*: The vendor defines the services of documentation repository. The services mainly deal with how to maintain the distribution lists for system updates and track the documents related to the system changes.
- *Install support software (Activity ME7 in Table 2)*: The vendor installs support software at VAST Pakistan's site as a preparatory step for system deployment.

5.2.4 System Deployment. Being the owner of the system, *Operations Team* is required to attend the deployment process. In most cases, the actual deployment lasts for several consecutive hours (10-30 hours). Within this period of time, it is important to have at-least one member of the *Operations Team* present all the time. At this phase, the vendor establishes the software configuration baseline and the *Operations Team* puts the software system under SCM and optimizes it for its needs. In addition, the *Operations Team* installs the operational data. The *Operations Team* gets a chance to acquire system knowledge by actively participating in the deployment process. The handover activities performed during the *System Deployment* phase are:

- *Install software baseline (Activity DP3 in Table 4)*: Here, the system gets deployed by executing the system deployment plans. The vendor performs this activity in the presence of the *Operations Team*.

- *Establish software configuration baseline (Activity VC1 in Table 3)*: The vendor performs the basic software configuration activities and creates a software configuration baseline.
- *Install operational data (Activity DP4 in Table 4)*: Here, the operational data is installed in the deployed system. VAST Pakistan's *Database Team* usually performs this activity.
- *Put software under software configuration management (Activity VC2 in Table 3)*: The *Operations Team* performs the advanced SCM to optimize the deployed system for its specific needs.
- *Test the deployed system touch-points (Activity DP5 in Table 4)*: The *Transition Team* performs the system testing for all the system components. It is very important that the owners of every touch-point system (the already working systems in the organization which interact with the deployed system) check and validate the connectivity and performance of their systems. This can save many problems later on. System testing also serves the purpose of system training.
- *Monitor the system operation (Activity DP6 in Table 4)*: The *Operations Team* closely monitors the system when it is delivering the services after deployment. This activity helps in monitoring the system performance and problems and in verifying whether the system provides the required functionality.

After testing and monitoring the system for a pre-determined period of time, the *Operations Team* signs the system acceptance to complete the system acquisition process.

5.2.5 System Maintenance and Operation. After system acceptance, the system acquisition process terminates and the system maintenance phase starts. Since the transition starts during the pre-delivery maintenance phase and continues for some time during the post-delivery phase, we are addressing this phase even though the system acquisition process has been completed. The handover activities relevant in this phase mainly concern release updates. They are the following:

- *Provide training on system, its structure and operation (Activity T1.2 in Table 5)*: If the *Operations Team* is unable to perform its duties based on current system knowledge, VAST Pakistan may request vendor to train its personnel on system, its structure and operation.
- *Subject system documentation repository to SCM (Activity D3 in Table 6)*: Since the vendor is responsible for providing the system documentation,

it updates the system documentation repository with information about all new system changes and their configurations.

- *Plan future releases (Activity DP7 in Table 4)*: If the system's proposed lifetime is about to end, the *Architects Team* either plans for future releases or considers acquiring a new software system. The choice depends on system maintainability of course.

5.2.6 Training activities. Training activities are performed along the whole handover process. Their choice, timing and intensity strongly depend on whether the system is a newly developed system or an enhanced one. At VAST Pakistan, the training activities are the following:

- *Train on system support processes (Activity T3 in Table 5)*: Since VAST Pakistan is the acquirer and front-end support provider of its systems, the *Operations Team* is trained on the support processes. It is VAST Pakistan's responsibility to provide training on the support processes to its support personnel. Usually, this form of training does not require major teaching effort. It is mainly conducted in form of interactive sessions and guidance to be provided to all the support personnel, including new hires and senior staff.
- *Train on new technology (Activity T4 in Table 5)*: If there is a new technology used for system support and operation, the *Operations Team* is trained on the new technology. Some of the operations team members explore the new technology and share it with the rest of the team.
- *Provide training on the deployment process (Activity T6 in Table 5)*: The *Operations Team* responsible for the system deployment is trained on the system deployment process. Preparatory sessions are executed on test systems to help planning and conducting the actual deployment. To facilitate the deployment, VAST Pakistan has a defined protocol to support the planning and execution of the deployment. This protocol or the guideline document focuses on a specific system and describes its pre-requisites for the deployment, lists important issues to be considered, tasks to be performed during deployment and includes the lessons learnt from the past system deployment experience.

5.2.7 Activities irrelevant for the studied context.

There are few taxonomy activities that are mentioned in EM^3 's taxonomy of handover activities [5], but not used in the process studied. This is because these activities are context specific required for transferring

product from developer to maintainer. In our case, developer itself is the maintainer. The activities that are irrelevant for the context studied are:

- *Transfer modification requests from development to maintenance (Activity ME10 in Table 2)*,
- *Place modification requests in a modification request repository (Activity ME11 in Table 2)*,
- *Attend to modification requests (Activity T1.3 in Table 5)*,
- *Conduct white-box testing and debugging (Activity 1.4 in Table 5)*,
- *Train on maintenance processes (Activity T2 in Table 5)*,
- *Provide on-site support in critical cases (Activity T5 in Table 5)*,
- *Assess system maintainability (Activity M1 in Table 7)*

6. Conclusion and future work

In this paper, we have walked a handover process at VAST Pakistan using the EM^3 's taxonomy of handover activities as a roadmap. We have walked the process by following VAST Pakistan software lifecycle phases and by placing EM^3 's activities on them. The context studied covers the handover of a software system from the vendor conducting system development, evolution and maintenance to an acquirer organization providing front-end support and using the end product. The study is made from the acquirer's and front-end support perspective.

Our results have shown that the EM^3 's taxonomy of activities covers correct handover activities. Due to its specific context, however, the process studied does not utilize all the activities as defined in EM^3 . Their choice is strongly dependent on the handover context under study. Our study also shows that handover is a complex process spanning across the whole system lifecycle process.

Our study presents what a handover process looks like. It provides the software community with details on sequence in which the EM^3 's handover activities can be performed. We elicited a basic handover process model that provides guidelines on handover activities to perform during the product's lifecycle. However, more studies need to be made to evaluate the handover model presented in this study.

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