Using Six Sigma (DMADV) Method to Improve Site Rollout Projects in MTN-Yemen Company [1]

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ABSTRACT

Telecom companies make a huge investment in telecom projects, which reflects the factual need for creative project's management. MTN-Yemen use generic project model which has shortcomings in achieving the company's ideal objectives and affect the reputation of the company in local market. This paper is to identify the issues and proposition in performance, and subsequently to explore the applicability of using Six Sigma into PM through using DMADV improvement methodology model. Data collected by unstructured interviews, survey questionnaire with PM employees and consultants in the PM department and site rollout projects documentation files. The study outcomes recommend the DMADV method as a good technique used to reduce the errors, adjust and strengthen the processes and performance of site rollout projects management. Also, the project assurance team would contribute positively in the fulfilment of site rollout projects objectives. And it will provide MTN-Yemen significant roles to achieve the company's objectives.

Keywords: MTN, Six Sigma, DMADV Method, Site Rollout, Project Management (PM), Telecom, Yemen

1. INTRODUCTION

Telecommunications service is considered as one of the most important supporting services. It plays a vital role in the economy and society through its productivity outcomes (Venkatram &

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Zhu, 2012). Telecommunication sector is one of the most encouraging sectors in Yemen for business investment. A modern study demonstrates that Yemen's telecom companies are growing more quickly in comparison to the other telecom companies in Arab countries. The mobile telecommunications sector in Yemen comprises of one public CDMA Sector supplier (Yemen Mobile) and three GSM privately owned businesses (Sabafon, MTN and Y) (Al-Mamary, 2015). Figure (1) shows the mobile phone market and the cellular networks operating lines by the four companies in Yemen in 2013 (Halewood & Decoster, 2017).

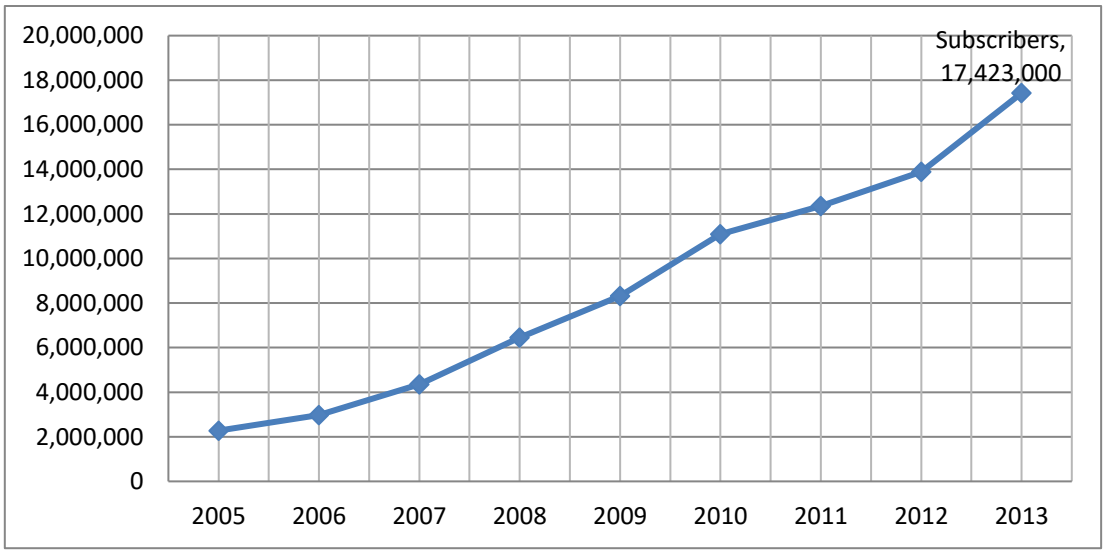

Figure (1): Numbers of subscribers in the mobile industry between 2005 -2013 (Al-Mamary, 2015)

The number of mobile phone subscriptions had increased five-fold from 3 million in 2006 to 16 million in 2016, leading to an almost 56.9% penetration for a population of about 28 million. Still, the mobile penetration rate is one of the lowest in the Middle East and North Africa (MENA) region. According to World Bank data, the number of mobile phone subscriptions was 15,297,789 mobile phones in 2018 which is 54% of the total population of Yemen see Figure (2).

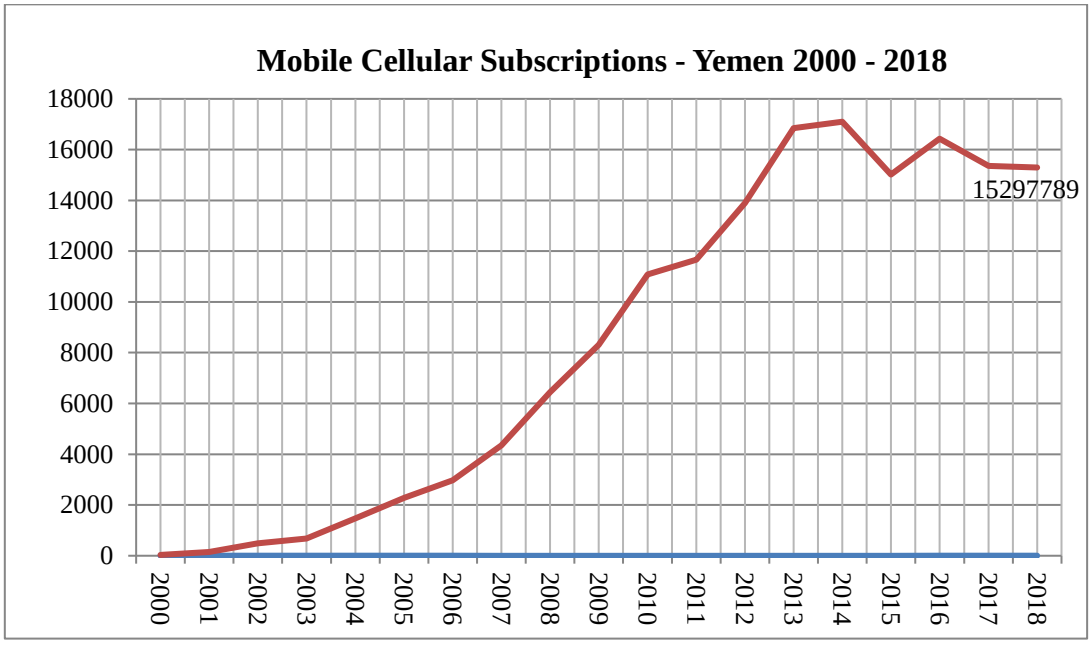

Figure (2): (World Bank, Mobile cellular subscriptions - Rep. Yemen, 2020) *Online: https://data.worldbank.org/indicator/IT.CEL.SETS?locations=YE*

MTN-Yemen was established in September (2000) as a local and international sharing company, to later become the community's first choice as a GSM company in Yemen. The company created under the brand name Spacetel Yemen. Spacetel Yemen Company started business as local mobile service in February (2001) and since that time it gained a great reputation for providing a high-quality GSM mobile service.

(a) MTN Coverage areas **(b) SabaFon Caverage areas**

Figure (3): MTN and SabaFon Coverages in Yemen in May 2020

Sources: (https://www.gsma.com/coverage/#443) and (https://www.gsma.com/coverage/#587)

Figure (3) shows maps of the coverage areas of Sabafon Telecom Company, which covers wider areas than the coverage areas of MTN-Yemen Co. Telecommunication Companies need to satisfy

their existing subscribers in order to prevent moving of their clients to the other competitors, as well as the need to have effective techniques that enable it to lead competition and success for its growth strategy (Heimerl, Hasan, Ali, Brewer, & Parikh, 2013).

Telecom projects are associated with high cost, complexity, risk, geographical locations. It involved with many critical issues that require well-investigation. The projects management in MTN-Yemen has shortcomings in achieving the company's' ideal objectives, which affect the reputation of the company in the local market. Therefore, there is a need for investigation on the causes of delay and the performance of site rollout projects.

In brief, MTN-Yemen Company currently uses generic project model in implementing projects as well as other telecommunication companies in Yemen. Due to the high competition between the Telecom companies, they need to improve their performance in Telecom Projects in order to increase the service quality and coverage area see Figure (3) So, a research was made on the MTN-Yemen Telecommunications Company due to its membership of the MTN Telekom Group and they are looking forward to improving the performance in Telecom projects. The unacceptable efficiency of Telecom projects performance such as time, cost and performance are not meeting the project objectives. Generic Projects Management Model has a negative effect on the performance of site rollout projects which led toa shortage in achieving the company's goals and objectives.

The study contributes to the practical aspects through different methods, by helping telecom project management (PM) and employees in determining the importance of using Six Sigma (DMADV) method in improving site rollout projects in Telecom companies generally and in MTN-Yemen particularly as it used as a case study for research investigation.

2. LITERATURE REVIEW

Project Management is to plan, organize, direct, and guide organization resources for reasonably short-term goals which have been established to accomplish specific objectives and aims (Kerzner, 2017). Project management practices attempt completion of the project as intended; getting it done most efficiently by minimizing cost and achieving external goals related to customer needs. Project management methodologies are not designed to be generic but applicable to all projects at any given time (Al-Hajj & Zraunig, 2018).

2.1 Six Sigma

Many scholars defined Six Sigma, (Goh, 2002) defined it as an important advance and strategy in quality management and process efficiency improvement in the last two decades of the 21st

century. "The benefits of Six Sigma included but are not limited to cost reduction, customer satisfaction improvement, and sales revenue growth" (Pande, Neuman, & Cavanagh, 2000). Six Sigma provides two methodologies which are;

First one is (DMAIC) which refers to (Define, Measure, Analyze, Improve, and Control). It uses when a project's goal can be accomplished by improving an existing product, process, or service.

The Second one is (DMADV), which refers to (Define, Measure, Analyze, Design, Verify), which used in designing a new or radically redesigned product, process or service (Pyzdek, 2003).

2.2 DMADV Methodology

Accomplishing Six Sigma execution enhancements is utilized by a few frameworks such as the DMADV methodology. The DMADV phases can also employed if an existing process requires more than just incremental improvement (Agarwal & Nonika, 2008). According to (Pyzdek, 2003), DMADV is systematic quality tool approach, which depends on determining time and date for measure of success.

2.2.1 Define:

Define stage includes the project definition, problem definition, desired enhancement, benefits of the project to the company and customers. In this step the project team members and project leaders are announced and admitted by the project sponsor (He & Goh, 2015).

2.2.2 Measure:

Measure is the second phase in DMADV methodology, this stage focuses on customer requirement. Customer complaint information and customer surveys collected for purpose to identify service quality of (Critical To quality) from the view of the clients (Knowles, 2011).

2.2.3 Analyse:

According to (El-Haik & Roy, 2006), the analysis phase represents the key element which is to change the identified Critical to Quality (CTQ) into the project parameters that contain a special physical design followed by a methodical identification of the design parameters that are critical. So, the connection between the factors with their input and output actions will be established.

2.2.4 Design:

The Design Phase aims at determining and compiling all substitutes to the projects' management existing models and develops them using the knowledge previously made in the projects. There is an endeavor to recognize where errors may happen and address them by modifications which

can take place by decreasing the activities' costs that done once more at later stages (He & Goh, 2015).

2.2.5 Verify:

Verify is considered the last stage in the DMADV approach (Pyzdek, 2003). (Knowles, 2011), holds the gains and verify, measure again and set new operating standard. To set up a change that keep up the improvement over time can be a challenge and it was approved that this part of project management (PM) does not change so quickly.

2.3 Telecom Site Rollout Project Team in MTN-Yemen

According to MTN-Yemen hierarchy of 2015 in (Figure 4), the size of the project team consists of two departments which are:

(1) Microwave team; consist of two sections:
- Office work and monitoring contain six employees.
- Field work contains nine employees.

(2) Radio Team; consists of two sections:
- Office work and monitoring contain two employees.
- Field work contains eight employees.

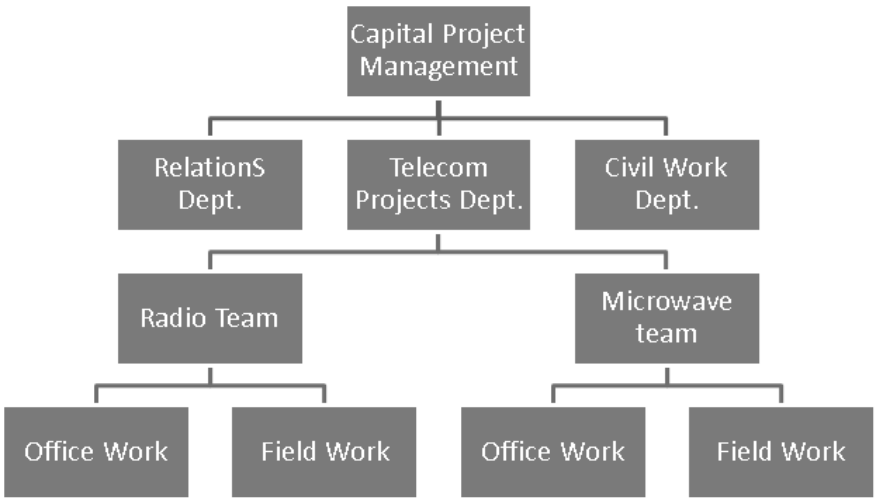

Figure (4): Structure of Site Rollout Project's Team (MTN Yemen, 2015)

According to MTN-Yemen Project documentation, providing a complete team for the whole project will not be only a satisfactory process, but also it helps the project's successful implementation, as well as it needs the direct support and assistance from the functional specialists. It requires many aspects that change the general criteria to be more specific. As the

project advances through its different phases, team members change depending on work requirements on site. Some technicians and specialists can be changed during the work according to required assignments. Some employees stay with the project throughout its work implementation, while others are only hired for specific tasks in certain phases and are called again in another project.

3. RESEARCH METHODOLOGY

The method to conduct the study is based on expert interview, survey and documents for the primary data and desk research for the secondary data.

3.1 Methodology Design:

Methodology design summarized as shown in Figure (5) on following page.

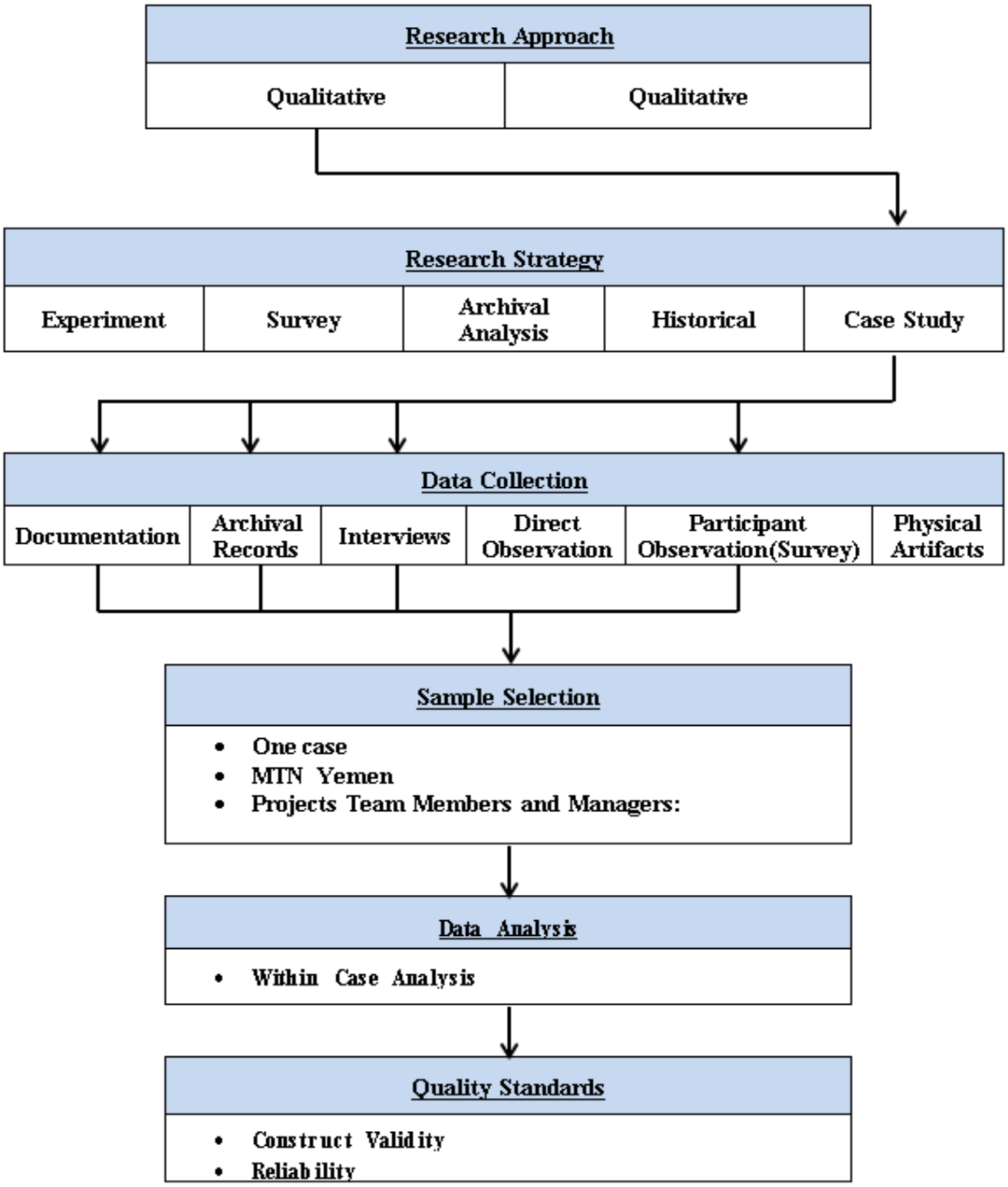

Figure (5): Methodology Design (Yin, 2008)

In order to obtain this purpose, data collected by sing three techniques for deep understanding of site rollout process and then make analysis for collected data. Three sources of data collected are:

(1) Interview Questions: most research questions have been stated as openly as possible about the procedures used in site rollout projects process. The Interview questions provide us by details information of site rollout projects process.

(2) Survey: this method used to investigate the process effectiveness of MTN-Yemen site rollout Projects.
(3) Desk Data as a secondary data which are gathered from scientific journals, course literature books, PM reports, technical reports, web sites and databases.

3.2 Data Collection

Data collected mainly by making Interviews and Survey Questionnaire with all employees in Site Rollout Project Management Department such as Capital Project Management, PM Manager, PM Supervisors and PM Team, in addition to the Consultants and Support Experts from Huawei Company who are working for MTN-Yemen Company's Site Rollout Projects.
Unstructured interviews are also involved to give accessing to the way projects are implemented at present by the interviewee. The investigation results of the interviews were accomplished based on collected information on Improving PM Performance on telecom site rollout project. This provides a detailed understanding of the important aspects related to performance improvement before the process is mapped and Six Sigma DMADV design improvement method is used so as to identify performance improvement opportunities.

3.3 Sample size

According to (Saunders, Lewis, & Thornhill, 2019) all sampling was selected because there must be a better understanding of a problem. A case study has been chosen to conduct on the aspects that could lead to a successful implementation of improving site rollout projects in MTN-Yemen.

MTN-Yemen Project Management Department has been conducted and all target employees have been met who are working in site rollout projects. Most employees (20 of 24) in site rollout projects department chosen as respondent and participate in answering the interview questions and survey questionnaire.

3.4 Data Analysis

In this part of the study, the researcher will inspect, classify, organize or otherwise recombine the data used for the used. When performing a case study, there are two common analytical approaches, namely:

(1) The findings reached by previous studies are compared to the findings reached by the researcher in the case study. For this study, this approached is used since it is the most preferred strategy.

(2) The researcher develops a descriptive framework for organizing the case study (case description), This approach is adopted when there are previous studies on the subject.

4. EMPIRICAL DATA

This study has concentrated on addressing the below points during data gathering:

4.1 Mobile Telecom Site Rollout Project

MTN-Yemen Projects in Site Rollout Projects could be classified into two types depending on the location of the projects which are:

(1) Greenfield Sites: They include all the sites which are located in an undeveloped land in a city or a rural area such as fields, deserts, mountains, forests, etc. This type of sites is usually established with a tower and is usually expected to provide coverage in a large open area for several kilo meters.

(2) Rooftop Sites: They include all sites which are commonly placed on rooftops in urban and densely populated dwelling areas and are usually required to provide coverage in densely populated area in towns and cities.

Figure (6) shows that Telecom Site Rollout Project implementation consists of some steps as follows:

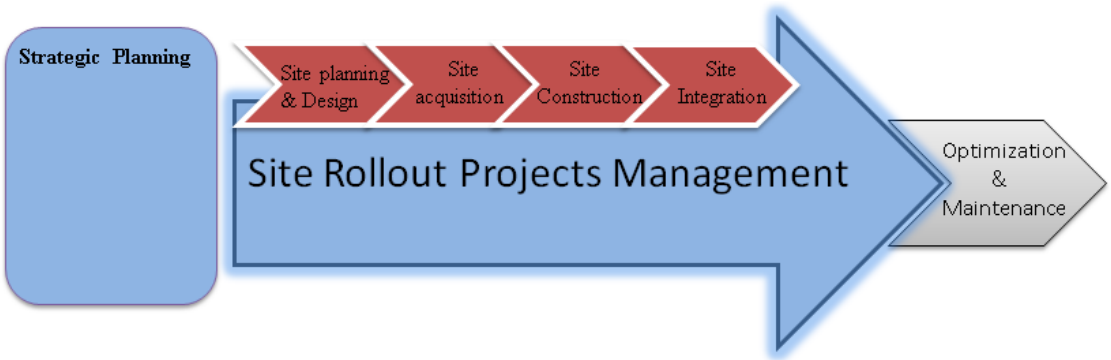

Figure (6): Phases of standard mobile telecom site rollout project

4.1.1 Data Collection for New Coverage Areas:

The Site Rollout Project location indicated in the plan list of top management for the areas that need covering during the coming period. The selection of site location determined by management depends on collected information by the marketing team. Data sources used to collect information

about the new site locations is represented below:

(1) Call Center Team: they used application which called Help Desk. It is used when the client calls for complains of poor coverage. Then, the Help Desk Employee inserts all the details of the problem in the application Figure (7). Then after each period the Marketing Department gets reports through the Help Desk program.

Figure (7): Snapshot of Customer Complaint Form Used in Help Desk Application (MTN Yemen)

(2) Customer Service Team insert all complains which are relieved from customer in the Help Desk Application
(3) The Citizens' Complaints: all complaints received by the MTN-Yemen Employees are forwarded and inserted in the Help Desk Application by assigned employee.
(4) Request Submitted from a Region's Residents: sometimes the company receives a request for resident in specific area to install mobile coverage.
(5) Report from the Technical Department: (site call traffic or site is full and needs an expansion).
(6) Field Visit or field survey: the engineers test the mobile coverage, and then make detailed reports.
(7) Survey for new areas needs covering and prepares an annual work plan to include uncovered areas.
(8) Relying on the number of subscribers: visit areas of very few subscribers to know reasons behind this matter to be solved.

(9) Hotline Number: company provides hot lines for receiving calls from company employees about the client's complains.
(10) Employees' complaint of the mobile coverage.
(11) Sales Department: there is also valuable input concerning the potential customers requiring the mobile network.

4.1.2 Mobile Telecom Planning:

In any mobile network coverage, the first stage starts with planning and this accomplished by the top management of the Company. The top management is the only one responsible for the network architecture, design, strategic coverage plan and rollout roadmap is setup typically for long time period with form of monthly rollout projects. The annually operational coverage plan is always adapted and adjusted to meet the business objectives of the mobile operator to serve customers as best as possible.

4.1.3 Site Rollout Processes:

Site rollout process consists of four main steps illustrated as follows:

(1) Site Planning and Design: During this stage, the Project Management Department receives the yearly plan for sites need implementation either for new sites or expansion for existing sites.
(2) Site Acquisition: The process of acquiring the land for site rollout project though team from administration department, legal and finance department.
(3) Site Construction or Civil Works (CW): The process for preparing the project location to be ready for operations by preparing all construction, civil works of site and technical equipment installations which they performed by projects team .
(4) Site Integration (Radio and Microwave "Telecom"): In the last phase of the site rollout process, the network components, hardware, software and applications are integrated and configured into the current infrastructure network, and a usual set of investigations is carried out for each element of the implemented site. Figure (8) illustrates the flowchart of the site rollout different processes.

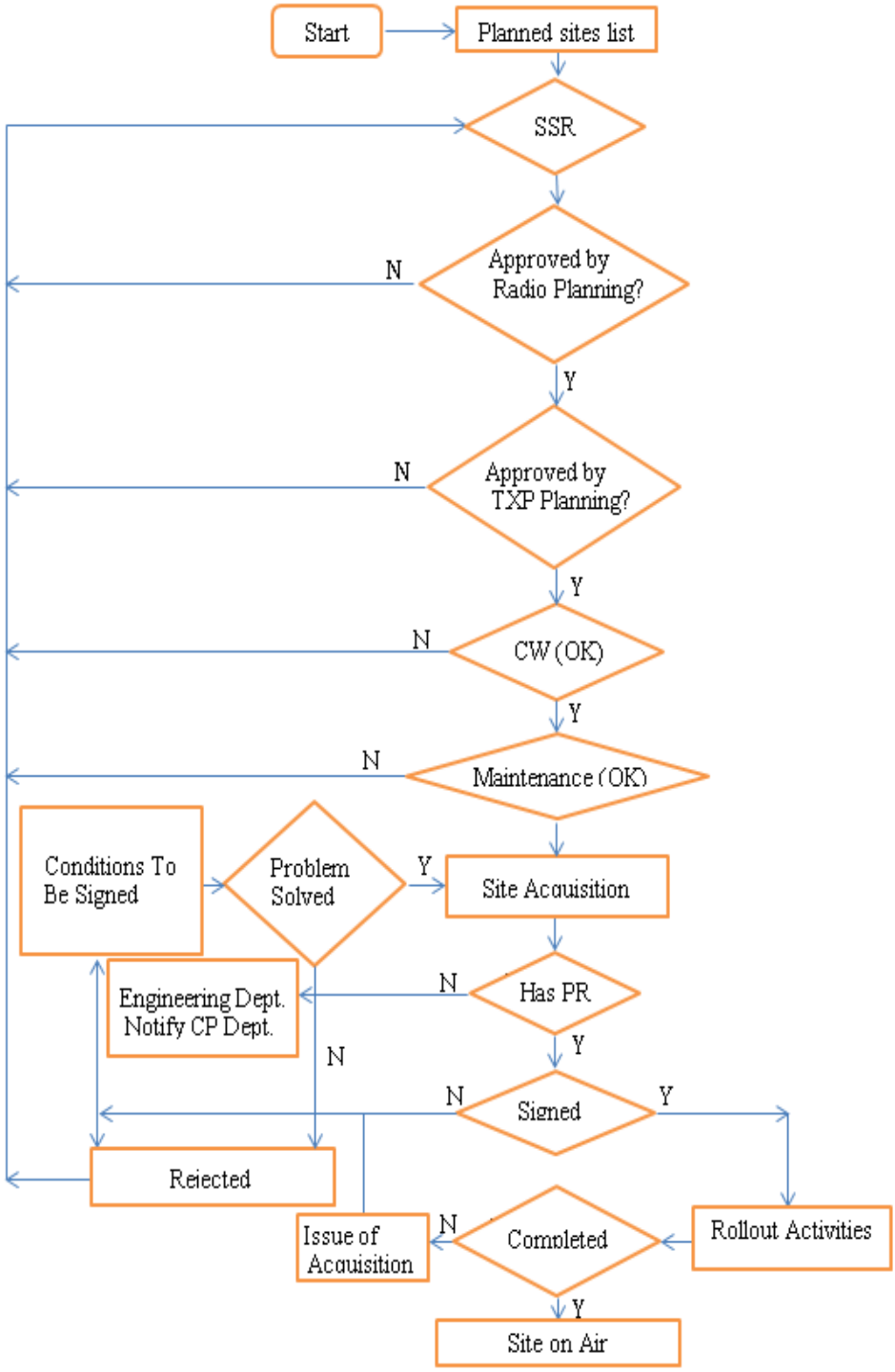

Figure (8): Flowchart of the site rollout different processes

4.1.4 Optimization and Maintenance:

The process in which the project team delivers the project to maintenance for operating the site

and optimization that helps in improving the site efficiency.

4.2 Project Management and the Technical Department Structure

The Technical Department contains all the sections needed for delivering the MTN mobile services to the mobile customers in all areas of the Republic of Yemen. The Technical Department responsibilities are distributed between different departments such as the planning, operations, maintenance and capital projects, which are to carry out the daily work. The infrastructure of the Technical Department illustrated in Figure (9).

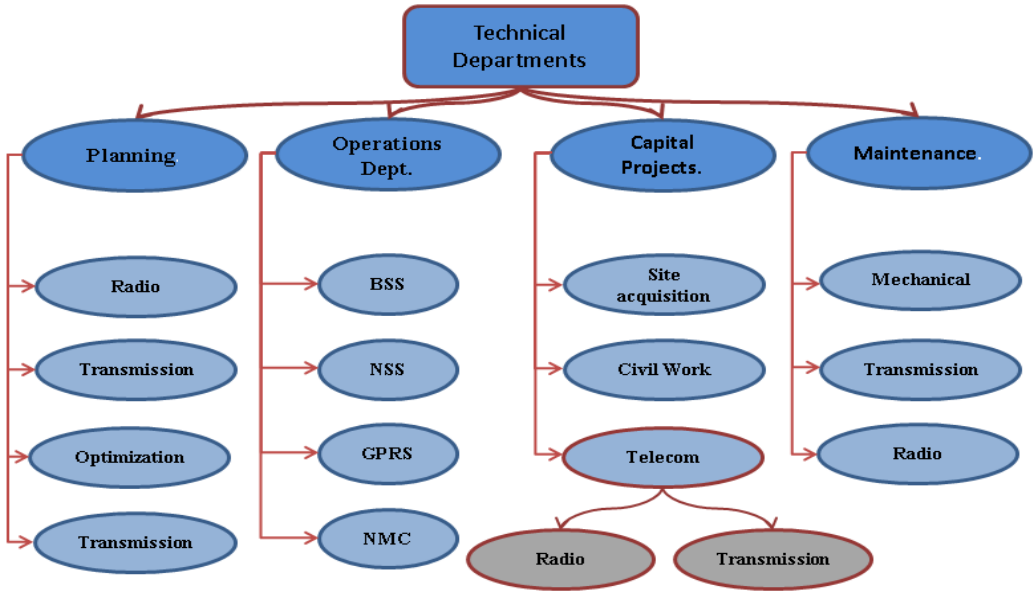

Figure (9): Technical Department Structure

Capital Project Management is under the Technical Department and it contains many project managers. All the Technical Departments contribute in a project implementation depending on their responsibilities and can be divided into four departments as follow:

(1) Planning Department plays a main role in the site rollout projects.

(2) Capital Projects Department: The main role this department is to implement new sites for network expansion or modifying sites for improving the service quality in accordance with the strategic time plan, capital projects participate in many duties such as in site acquisition , general relations, and site Installation including civil work, electrical work and labelling work….etc.

(3) Operations Department: The department plays a main role in managing, controlling, modifying, mentoring and maintaining the mobile network traffic and services. Some main responsibilities participated in the site rollout projects by the transmission of sub department.

(4) Maintenance Department: The department's role is to maintain the current network devices and operations to ensure the services availability and reporting to the relevant department if any diagnosis or actions are needed from specialist engineers.

4.2.1 The function of the project manager in the site rollout project:

A Project Manager is an employee working for the MTN-Yemen Company in the Capital Projects Department with specific roles and responsibilities. The Site Rollout Project's Manager in the mobile telecom has to find the balance between utilizing the available resources while operating to come together with the stakeholder's needs and expectations within the project's plan, scope, budget and time. The biggest problem faced by Project Manager is the shortness in budget in order to cover all the needed duties such as upgraded sites, congestion relief and optimize channels capacity of telecom.

4.2.2 Project Management Model Used for Site Rollout Project at MTN- Yemen:

The Technical Department at MTN-Yemen is using a generic project's model that includes four main steps during the projects lifecycle. The generic projects model has different stages with clearly defined deliverables from every stage as illustrated in the Figure (10):

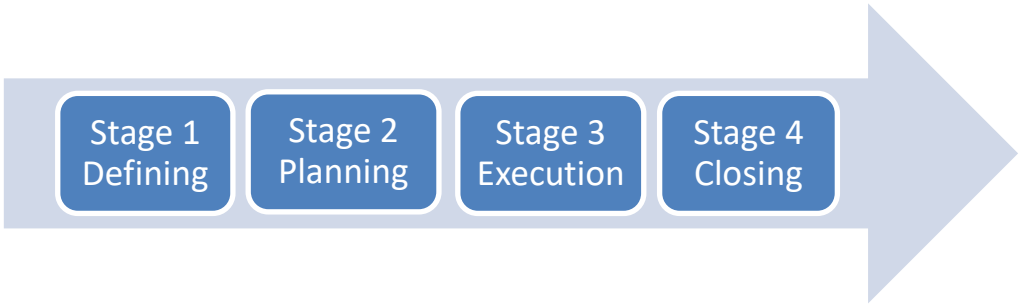

Figure (10): Generic Model of MTN Site Rollout Projects

a) Project's Definitions Phase:

The essential role of this phase is the process of setting project objectives, determining the project's specifications, requirements and realizing the required outcome depend on these requirements and specifications. At the completion of the Defining Stage, the project goals and objectives, specifications, stakeholders, and establishing general framework for the project, the project progress would be moved to the Planning Phase.

***b) Project Planning Phase*:**

In this phase, the project will be properly planned and then its comprehensive level of success will be reported to the sponsor. This phase covers;

- Planning the project scope
- Scheduling the project activities
- Planning project resources
- Budgeting and cost allocation

To sum up, the Project Planning process is, in any project, the most challenging phase that a project manager handles, as it is needed to make an educated estimate of the staff, resources and equipment required to complete the project.

c) Project Execution Phase:

The project Execution Phase is always of a long process nature during the project life cycle and it usually utilizes the most of the energy and the resources provide for execution. In order to performing the planned work, it required a developing for attaining the best results or excellent service for which the project was intended to provide. The execution phase is essential to put the rollout plan into action.

In the rollout plan, some of the sites cannot be brought on air in accordance with the schedule. It is due to the major reasons behind the delays which are:

(1) Many steps in the site rollout tack long time because of the many internal factors concerning the project different processes, or to external factors concerning logistics, governmental and legislative, weather conditions.
(2) Shortcomings related to the way the project is managed such as: (lack of sufficient control, communication inadequacy in department, coordination issues, etc.).

d) Close Phase:

In this phase, it will properly show the closing process of the project and then will be reported with its overall level of success to our sponsor.
In brief, the closing phase emphasizes the realization of the final deliverables to the clients or buyers. Project manager will deliver project documentation to the business, supplier contract termination; release staff and equipment back to the business, and communicate the project closure to all stakeholders.

4.3 Applying Six Sigma into Site Rollout Project's Management in MTN

Project Management doesn't provide specific method for improvement. Hence, telecom site rollout projects improvement methods can be adapted and combined with other tools of Six Sigma to help in project investigation. The intent of Six Sigma (DMADV) method is to understand customer's requirements and the Critical to Qualities (CTQs) which are most often expressed qualitatively. DMADV method allows the PM to inspect and analyze the current project model,

recognizing obstacles and weaknesses in the process and develop a model that solve issues in the previous model which lead to enhance process performance and project performance at all.

Figure (11) shows that (DAMDV) method consists of five major phases which it will be adapted for use in site rollout projects in MTN-Yemen as an improvement model.

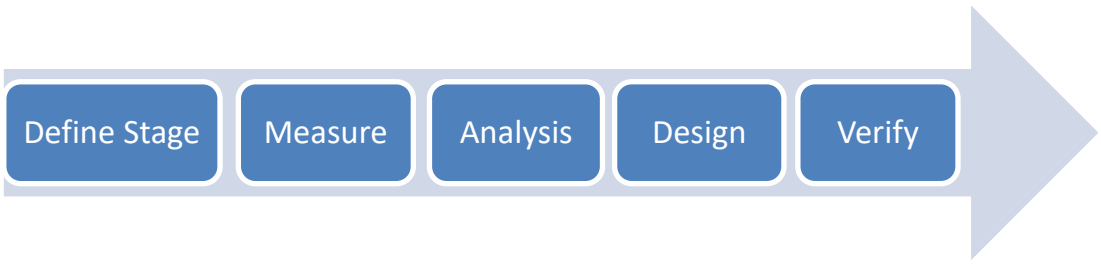

Figure (11): Six Sigma DMADV Methods

4.3.1 Define Stage:

The main goal of this stage is to design goals that are consistent with customer demands and enterprise strategy. Project Managers identify believed requirements to be considered most important to achieve the projects goals by thoroughly examining and identifying how work is currently accomplished.

Interview with projects team, specialist and managers have been done in order to collect information about the site rollout projects process. The questionnaire also distributed to investigate and to measure process effectiveness and discover the problems that associated with work process during project implementation. There are some problems such as:

(1) Lack of warehouse system which means more time for making decision about the devices in the stock
(2) Site rollout project managers have only monitoring, coordination and reporting characters over the project duties of the teams
(3) Process in Finance Department takes more time
(4) Delay in buying some devices and equipment by procurement department which need for projects.
(5) Ineffective services introduce by Services and Facilities Department
(6) Different teams in different departments follow routine procedures in their work.

Consequently, a suggestion for the Critical to Quality (CTQ) characteristics for the improved PM model is endorsed and authenticated, and the proposal should be presented and approved by the senior management which will be responsible to determine date to lunch the recommended model.

At the end, the customer requirements that come from the CTQ will likely to be re-gained and integrated into the PM model. Critical to Quality for the predicted improved model are:

(1) Project lunch on objectives (start time and resources).
(2) Project deliverables in accordance with the requirements.
(3) Resource utilization on objective (price – time).
(4) Control over the work during all project stages.
(5) Accurate project accomplishment.
(6) Adequate support for PM function.
(7) Sufficient standardization of reporting and documentation.
(8) Effective communication schema.

The process diagram helps identify the workflow, lapses and other barriers that may contribute ineffectively in the performance of the project, which need much time to co-ordinate the various teams. So many factors have supposedly an effect on the time factor. Irrespective of this time and performance, the final aim for PM is to minimize the time to be taken for project completion and improve performance. Figure (12) below shows the sit rollout process in MTN-Yemen:

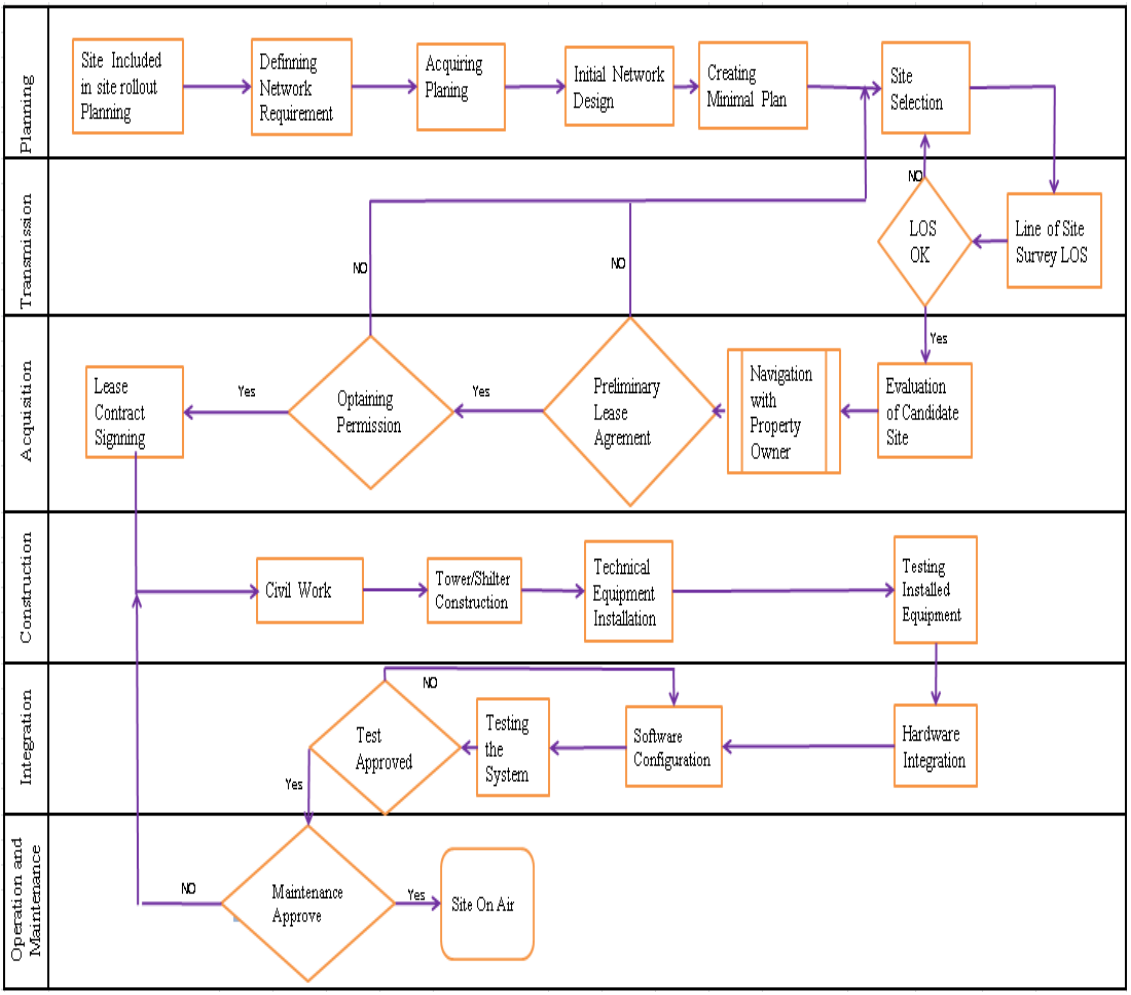

Figure (12): Site rollout process Flow chart in MTN Yemen

4.3.2 Measure stage:

Measure stage is the second stage in DMADV method and starts after examining and investigating of the current sites rollout management model and the characteristics of new project model is identified, appraised, and CTQ characteristics of the new model are well determined.

Project Managers responsibility to monitor the current process of the active projects which are implemented through new DMADV project model, the CTQ characteristics should be monitored and measured by comparing the data collection of process effectiveness from current DMADV model and the previous model. CTQs characteristics that used for measurement of site rollout PM are mentioned below:

(1) Percent of sites that completed according to schedule plan, set specifications and requirements.
(2) Percent of sites that required more resources for site acquisition.

(3) Amounts of extra resources needed.
(4) The extent to which the sites completed are matching specifications and user requirements.
(5) Communication efficiency between PM's team, different teams in one department and inter-department communication.
(6) Reporting System effectiveness either between project projects team and senior management or between projects team and other departments or with subcontractor.
(7) Processes that experience delays.
(8) Frequency of Cause of delays in each process.

Project manager assumes risk assessment, which is one of his fundamental tasks. Risks in the telecom project will have negative effect on the effectiveness of the PM model and the quality of its performance. When risks are recognized, it should analysis and measured according to the probability of occurrence and significances of the risk, and risk response plan is created.

4.3.3 Analysis Stage:

Analysis stage is the third stage in Six Sigma DMADV method, the main purpose of the analyze stage is to identify the problems that needs response depend on the CTQs variations. Six Sigma DMADV methods use Fishbone (Ishikawa) Diagram, as tools for identifying root cause analyses in telecom site rollout projects, a survey is made for investigating telecom projects team overview and evaluation on process performance at all stages in Site Rollout Projects in MTN-Yemen.

(a) Identifying the Root Cause of telecom site rollout Projects:

(1) First: Fishbone Diagram:

The research mentioned that Fishbone Diagram used for investigating Cause root analysis in order to identify most issues that affect process performance and lead to CTQ variation. As the Fishbone Diagram shows the most elements which cause variation in MTN-Yemen site rollout projects such as relation team issues, ware house issues, financing issues, procurement and facilities issues, transportation issues, risks issues…etc. Fishbone cause and affect diagram for MTN-Yemen site rollout projects can be found in Figure (13).

(2) Second: Questionnaire Analysis (see Appendix (B and C):

Inadequate workflow and process of some main elements of site rollout projects such as ware house, Training, Finance Dept., and Security Dept. and Services and Facilities Dept. as it was found in survey results have a negative effect on telecom projects process and project deployments performance. Other major problem was the effectiveness lacking of public relations and security departments and the weakness of the government performance in recent years (2011-2018) led to the exploitation of the company's resource by the owners of the company sites and add financial load on the company for its survival and continuity in the provision of service to customers. The

questionnaire included 43 questions depend on project process and it distributed to most telecom site rollout project team (20/26 Employees).

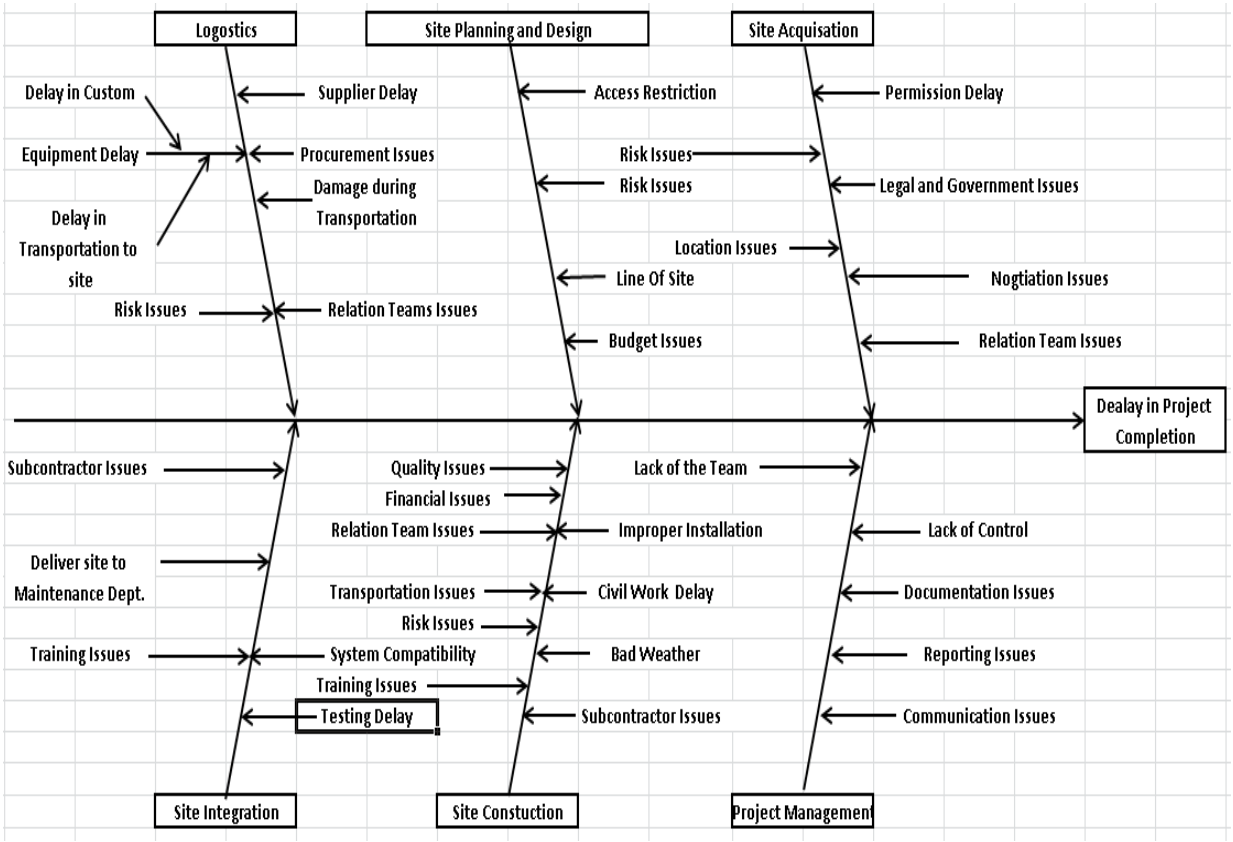

Figure (13): Fishbone diagram (root causes Analysis for Issues)

The project team overview on the performance of current process could be seen in Table (1) between 48.50 % (Warehouse performance as minimum) value to 69 % (project location selection as maximum value). Questioner result illustrated in Table (1):

Table (1): MTN Yemen Site Rollout Projects Survey Result - Descriptive Statistics

Rank	Project Items	Mean	Performance (%)
1	Project location	3.450	69%
2	Project improvement	3.317	66.33%
3	Quality of Material	3.250	65%
4	Project Closure	3.175	63.50%
5	Project Documentation	3.100	62%
6	Quality Job	3.083	61.67%
6	Planning Dept.	3.083	61.67%
7	Planning PM	3.075	61.50%
8	PM Performance	3.050	61%
9	Budget Average	3.000	60%

9	Project Implementation	3.000	60%
10	Services and Facilities Dept.	2.900	58%
11	Security Dept.	2.750	55%
12	Procurement Dept.	2.650	53%
13	Finance Dept.	2.500	50%
14	Training.	2.450	49%
15	Warehouse Performance	2.425	48.50%

Analysing MTN-Yemen as case study, the results and reactions were identified and explained through Fishbone Diagram and the results of questionnaire below:

Result: warehouse performance is not acceptable due to lack of system for managing telecom or generating equipment reports.

Reaction: use Telecom warehouse management system and Information Management System which designed to manage, control and reporting about telecom equipment status as well as the movement of equipment and materials within a warehouse, while processing associated transactions, such as; receiving, putting away and picking devices. In addition, this function can direct and optimize stock using real-time information, minimize time to improve warehouse performance.

Result: lack of projects team training

Reaction: Project teams play a main role in the company and working efficiently lead the change for the company's development, reputation and customer's satisfaction. Introducing projects with high quality outcomes assist companies to win competition and attracting customers for using their service's especially during intense competition. Projects staff training on applying quality standards during executing the telecom projects is very important.

Result: Projects financing performance issues.

Reaction: Improving financial procedures for projects aspects contributes effectively in improving performance of the telecom projects and meet company objectives.

Result: procurement and logistics issues:

Reaction: Projects team suffers from delay in delivering projects material, because of some reasons illustrated in Fishbone Diagram such as delays of equipment, customs, transportation and suppliers. Therefore, looking for causes separately and find solutions will improve the performance of the telecom site rollout projects.

Risk Issues: One of the most issues faced by MTN-Yemen during the last years (2011-2018), which affect negatively the Projects Management Performance.

Reaction: Security team should prepare normal and emergency plans for overcoming all expected problems either during stable or unstable environment. Securing company resources has critical role for the company survival.

Result: Services and Facilities Department performance issues: This department functions to provide services and facilities to project team in order to fulfill site rollout projects deployment and it include relations team.

Reaction: Enhancing services and facilities performance is very important to ensure smooth procedures running such as providing transportation for moving engineers and materials between company and telecom sites. They need to build a policy for covering all duties according to the schedules and quality standards. Relation's Team need to make an effective plan in order to assist telecom projects to complete projects successfully, such as:

(1) Awareness plan for clarify the wrong rumors which speak about telecommunications frequencies has negative effect on humans health and may lead to causing cancer.
(2) Explain the quality standards applied by MTN Company in order to protect their customers and provide ultimate services.
(3) Explain the rights, roles, functions and laws that control the relationship between the company, customers, stakeholders and partners.
(4) Arrange Action Plan with Marketing Department for promotional marketing and special deal on company's services in the new covered areas.

Result: Budget issues, top management make decision about the new sites that need installation during specific period either one year or couple of months and the priority in building new sites. Budget plan for planned new sites are estimated as fixed and equal budget for any site in the plan, project team make another plan for implementing sites with the same fixed budget.

Reaction: New planned sites are distributed in different areas and mountain terrain which mean in real environment the budget needed for deploy site is different from site to another. To avoid these issues, the budget must be adjusted according to the area of the site which mean different budget depend on the site location which add flexibility in using sites budget during the implementation of the sites and contribute positively on improving site roll out projects.

Result: Site construction performance issues such as delay in site construction because of some causes which are illustrated in Fishbone Diagram (e.g. issues of; bad weather, subcontractors, transportation, relation team, and risk…..etc.

Reaction: Preparing action plans for dealing with every factor that has negative affected on the site construction are very important to overcome the problems and simplify work process and procedures in order to improve site construction performance.

The PM liability of the project manager is to design the PM plan, which will define proactive measures needed to complete the project according to the schedule, within budget and specification required by the project charter. During analysis stage, the PM teams should investigate all causes of delays and considered that in the plan to solve the issues during the next design stage to reach the desired performance.

The communication issues in the cause-and-effect diagram indicates failing or missing to join to the necessary emails and meeting invitations which is an essential part of the planning information required to simplify the project. There must be a plan to enhance the goal of effective communication, and to be a good plan. It is only the way that guarantees the acceptable communication and coordination among team members.

Project management at MTN-Yemen as part of the cause-and-effect diagram has huge and critical roles over projects stages such as; understanding, guiding and PM during different stages and adequately maintained with project scheduled action plan, as well as designing effective assurance project such as; technical assurance coordinator, business assurance coordinator, user assurance coordinator in order to assist in controlling during specific project stage. The designing of project team would assist in enhancing project performance, standard reporting, and project documentation, avoid tasks conflict, regular communication between project team and reduce process variation.

4.3.4 Design Stage:

The Design stage is the most critical stage of Six Sigma (DMADV) method, as this determines the success of the project. During this stage the research involved in developing and enhancing current generic project model which has lack of control over the executed projects by different teams, need more incorporated reporting and documentation, as well as the need for adjusted communication plan. The new model has a mechanism that design for services which applied to determine and optimize future service tasks, increase customer satisfaction, reduce life cycle costs, and improve the life span that is environmentally compatible and sustainable. Therefore, the new model allows the project manager to have more control over the projects stages and enhance the communication between all project teams and stakeholders.

Quality assurance is a continuous effort is constructed to enhance the quality practices in the companies. Therefore, continuous improvements are predictable in quality functions in the company. Teams of project assurance should have high PM special skills in the field they are

responsible for. Furthermore, project assurance works must be implemented during the project processes in instant methods.

The main goal for presenting the project assurance team in the MTN-Yemen site rollout project is to assisting project managers in handling the challenges facing the PM such as reporting issues, control and documentations.

Confronting the communication issues in projects is not a simple duty particularly when projects require many people in various teams. A general phenomenon in the project is that not all people hold adequate levels of effective communication in projects. The project assurance team can assist also to standardize the reporting and documentation role through all units and teams during the project stages.

Deploying the function of proceed assurance across the project assurance team requires investing more resources in the initial phases of the project. However, it will be a valuable contribution about beginning and accomplishing the project on time through controlling the quality attributes of the project. Redesigning the PM model to contain a control stage associated with the implementation stage and incorporating the project assurance team into the PM model can adjust the efficiency in project execution and authorize the control over the project stages.

As proposed, the project assurance team should be included in all the processes in the project through all project stages; hence it should be appended to the process map as shown in Figure (14).

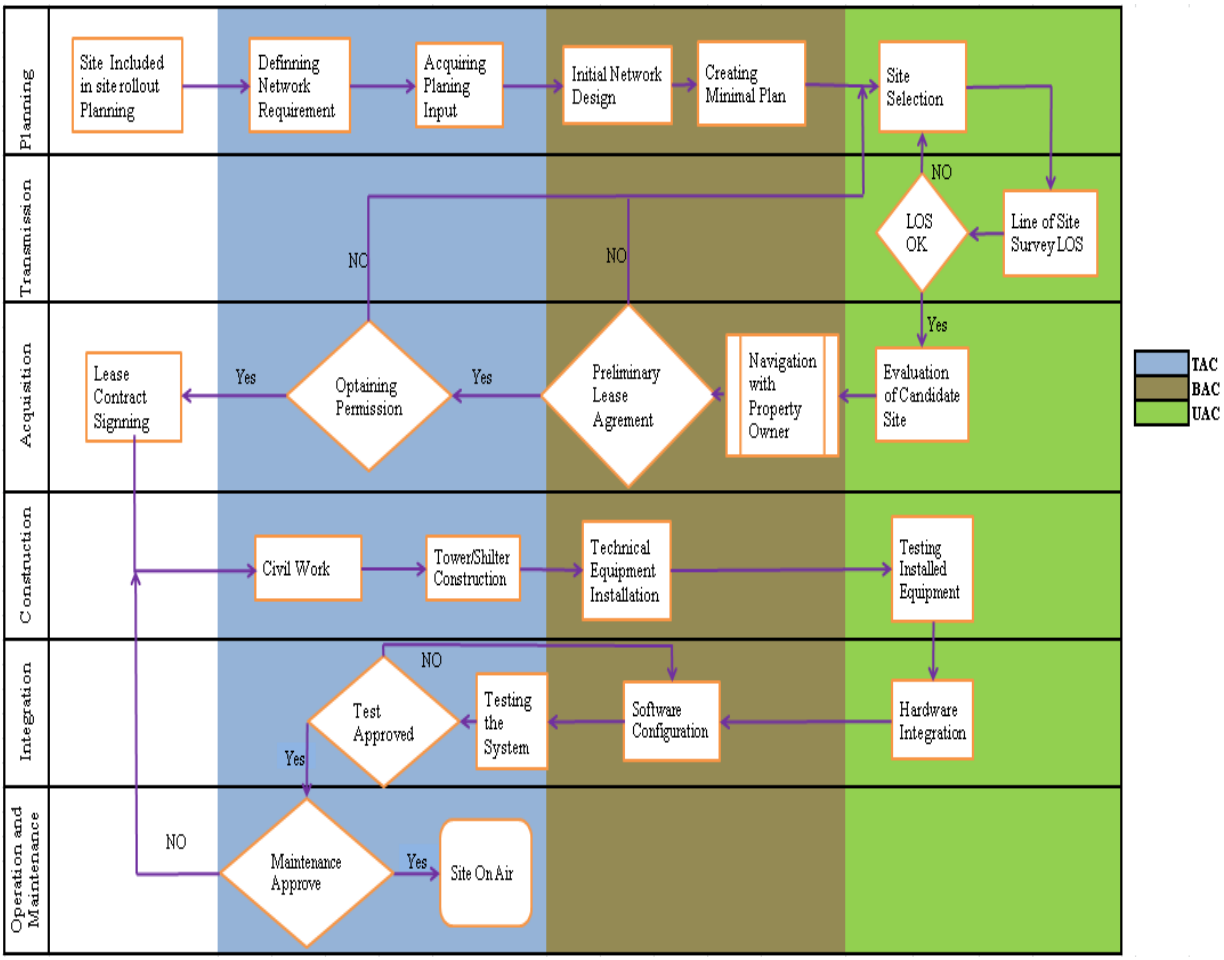

Figure (14): Site Rollout Process Map with the Project Assurance Team Involved in all Project Phases

Finally, in order to get the desired developments out of the suggested improved PM model, the responsibility of the senior management must be assured to support the application of this model and to confirm that all essential requirements and changes are accepted to ensure successful deployment.

4.3.5 Verify Stage

Verify stage is the fifth stage in DMADV method, successful implementation of six sigma improved PM model depends on the technique used, the projects team embrace and adapt to the used changes, the communication and cooperation with the presented project assurance team and the reliability in the PM function. Hence, the integrity, reliability, supports and obligation of the senior management is critical. It is definitely significant that all members who has a relation in the project to understand the causes behind performing the new changes. These changes are to cover the shortcomings of the PM model and not because poor performance by particular team or individuals.

5. DISCUSSIONS

The data analysis of MTN-Yemen Company shows that the delay in completing Telecom Projects according to schedule was the most effecting issue. Delay and process effectiveness can be noticed obviously in the questionnaire result according to the site rollout project team and consultants estimation. Table (1) shows the percentage of performance effectiveness of the different stages in site rollout projects. It is clear that most departments suffer from poor performance, it occurs in Table (1):

First: The Warehouse Department (48.5%), which led to the lack of well-reporting about the projects' materials, material availability, material positions in the warehouse area….etc., which need to use of Information Management System for solving the warehouse problems.

Second: The Training Department (49%), which means the lack of training of the Project's Team. Therefore, for increasing the Project Team Performance, MTN need to proper training for the project team which will lead to the team's satisfaction, increase the work quality, and gain knowledge about the best practices in implementing site rollout projects.

Third: The Finance Department (50%): The evaluation of finance is working by half efficiency, which affects the project's performance, so they need more effective processes in finalizing the telecom projects. The other department which has better performance of all was the process of choosing the site's location that shows (69%), and the lost performance was (31%), which contributes in the bad quality delay in PM.

For underperformance in MTN-Yemen Site Rollout Projects, the site rollout projects process, procedures and activities have been tracked and studied in detail, Flowchart for all activities in telecom projects has been structured based on projects documentation, engineers reports, unstructured interviews with projects team members and managers, survey to diagnose the effectiveness of projects process. Data collected have been analyzed. Causes of underperformance concluded from the analysis of fishbone and survey.

On what Project Management Model used by Site Rollout Projects in MTN-Yemen, the analysis of main activities of site rollout projects used by projects management department at MTN-Yemen showed that it consists of four stages, which are site defining, site planning, site execution and site closing. The stages participated in site rollout projects life cycle represent the generic project's model. MTN-Yemen is looking to improve telecom site rollout projects performance so, understanding the current projects model would contribute effectively to adapt more advanced

model which will assist the company to achieve the desired performance, goals and competitive objectives.

The issue of how are the causes of underperformance in Site Rollout Projects related to Project Management; it is found that Project management was part of main departments that has some issues, which is shown in the fish bone diagram analysis such as lack of the team, documentation issues, reporting issues and communication issues. Performance of project management is 61% according to questionnaire result. Projects manager's skills and capabilities play a main role in enhancing projects quality and performance outcomes. Process mapping could be used to systemically view the flow of work process and the reactions between the various teams and departments at a specific period of time.

The issue of how can the Six Sigma DMADV Method assist in the design, implementation. Six Sigma DMADV is one of the known methods that can be used for project management model improvement and it also be used to redesign an existing product or process.

Using the DMADV methods as quality tool were studied carefully and highly recommended to be used as development techniques for redesigning the process and improving the performance and could help MTN-Yemen in solving its underperformance in Site Rollout Projects. Projects manager's skills and capabilities play a main role in enhancing projects quality and performance outcomes. Process Mapping was used to systemically view the flow of work process and the reactions between the various teams and departments at a specific period of time.

Adding Project Assurance (APT) Team is to assist confirm that the objective of the project from the Business Perspective, Technical Completion and the User's Viewpoint is achieved. In addition, The "PAT" is divided into Three Departments that help to disruption the obstacle of information flow and to ensure that the planned curve is accomplished with respect to the project objectives.

6. CONCLUSION

MTN-Yemen was using a generic model for site rollout PM. This research was adopted to assist the development of a project model using Six Sigma (DMADV) as an improvement model for implementing MTN-Yemen site rollout projects. The new model would overcome most of the issues that appeared in the generic project model. Last studies on Six Sigma methods in improving projects performance concluded that implement of Six Sigma would assist companies to improve project performance and the study on MTN-Yemen projects management conclusion lead to the same result for improving site rollout projects performance and assist company management to achieve competitive advantages.

The results found that PM needs to focus on three main points which are PM, Projects manager roles and Six Sigma (DMADV) method as the main factors have a direct effect on improving MTN-Yemen site rollout projects. Project Management concepts and project manager role play a main part in leading successful implementation for new projects using the Six Sigma (DMADV). In last decades, many articles were published which included the big interest on Six Sigma research has grown substantially. But in this study, Six Sigma was defined differently. There are four types of definition for Six Sigma and their strength and weaknesses, which are: The defect metric, a set of improvement tools or an improvement method, an improvement approach or an improvement program, and an improvement philosophy.

Also, the study found that Six Sigma represents a new method of management for enhancing design and process. The main focus in Six Sigma is client orientation, accurate tracking of project advantages, and a common improvement method for variation reduction.

7. RECOMMENDATIONS

This study recommended that PM needs an effective method for developing current PM Model which would assist the company in delivering competitive service and meeting company objectives which required meet specifications, cost and time by the project team.

First: MTN-Yemen needs to make the following remedies as an initial step for applying the new PM model;

- Use Telecom warehouse management system and Information Management System which designed to manage, control and reporting about Telecom equipment status as well as the movement of telecom equipment and materials within a warehouse.
- Motivate MTN-Yemen employees and encourage them to attain the company objectives in improving performance.
- MTN-Yemen should increase maintenance team to solve the shortage in engineering resources and associated technical problems.
- Make sure that the spare parts are effectively available for the whole year through a well-planned procurement process.

Second: Project outcome recommendation during the application of the new (DMADV) Model;

- The project management together with the technical department should take the required actions to resolve all work delays at reasonable time to meet the projects deadline.
- Proactive planning should be used to assist in improving the efficiency of the overall site acquisition processes.

- The project manager and the team leaders should have regular meetings to discuss the progress of the plan, difficulties and performance variation with main scheduled plan.
- DMADV as a method for re-designing business processes required deep processes analysis and related information availability to project managers for successful implementation.
- The successful project manager should have enough knowledge, skills and experience to lead the new model change and participate effectively during projects execution.

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