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Managing Client and Contractor's Relationship in Multi-National Project Site to Forestall Delayed Project Abandonment. Case Study: OLKILUOTO 3

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TABLE OF CONTENTS page

FOREWORD

It cannot entirely be called a serendipity that I could write about a part of project management on the famous Olkiluoto 3 nuclear power plant construction project because I have delayed working on my theses as I want it to be on something substantial; a huge project. I feel highly privilege to work on the site and with utmost indebtedness I am gratefulness to my bosom friend like a brother, Tony Valkila who out of trust on my capabilities presented my resume and recommended me to the human resource rent company in order to work on the site.

Although I have worked on large projects previously, but the multi-national scale of Olkiluoto 3 construction project kind of dwarfed the previous experience and added to my wealth of experiences. The work colleagues both from the client and contractor/sub-contractors' sides are amazing and ready to support each other in whatever area help is needed. I am most grateful to Mr. Marco Goetzke, the Site Project Manager of Lausitzer Stahlbau Ruhland GmbH & Co. KG for allowing this privilege to write the thesis as a stakeholder, his amazing support and readiness to provide all that is needed to complete this thesis work.

Not to the least is my genuine appreciation to my Instructor, Professor Jussi Kantola for your patient and kind demeanor towards me as I have become rusty with my academic writing skill but you painstakingly guided me regardless of your busy schedule which I am aware of. I am grateful to course mates, friends, family and most importantly to Jehovah God for sparing my life and aiding me through my depression that I didn't jump into Vaasa University sea at some point of my struggle.

ABBREVIATIONS

NPP	Nuclear power plant
ERP	European water reactor plant
OL3	Olkiluoto 3 nuclear power plant project
OL1 &OL2	Olkiluoto 1 and 2 nuclear power plant
ISO	International organization for standardization
ISO 10006	International standard for benchmarking quality management
ISO 14001	International standard for environmental management
QMS	Quality management system
TQM	Total quality management
RFQ	Request for quotation
WBS	Work breakdown structure
EPC	Engineering, procurement and construction
EPC&IC	EPC, instrumentation and commissioning

ABSTRACT

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ABSTRACT:

The construction of Olkiluoto 3 Nuclear Power Plant is undoubtedly a mega project based on its magnitude and several players, different activities, profession , responsibility all coming together resulting in the ultimate goal of producing safely working nuclear power plant. This is a unique mega project taking a longer period to complete and multi-national that at one time has up to 4000 workers from 55 countries with over 1700 subcontractors from over 27 countries and managing such a project is not as easy as embarking on a journey from point A to point B, because there were challenges that by error of omission were over looked and hence resulted into decade of delays and near abandonment. Additionally, there were disputes between the client and the contractor and expectedly public debates about action and inaction of parties involved . Commendably, the project wheel was kept running , the disputes are being managed, project issues were are gradually resolved and new challenges are being managed as they evolved. The journey so far and how the client's and contractor's relationship have been managed enumerates lessons for effective project and quality management practices.

KEYWORDS: client, contractor, quality planning, Olkiluoto 3 nuclear power plant

LIST OF FIGURES

LIST OF TABLES AND GRAPHS

1. INTRODUCTION

Recent developments such as cold condition functional test to ascertain the leak tightness of the primary unit of the reactor during wintery weather and the hot functional test carried out during the summer this year which are among the major milestone in the schedule toward the eventual delivery of Olkiluto 3 nuclear power plant signifies the impending completion of more than a decade delayed project. The Project was agreed between the Owner, Tellisuuden Voima Oyj (TVO) and AREVA who took the total responsibility as the main contractor on a turnkey project with all the schedule and control handed over to the contractor. The challenges for the delays are reviewed and how the project was revived from near abandonment to completion in view.

1.1 Background

The research started from my firsthand experience from the site and observing how project activities are gradually being managed. I proceeded to search for information on any research that has been carried out on the Olkiluoto 3 nuclear power plant including researched published news. For example, Inkeri Ruuska with others in 2009 researched about Dimensions of distance in a project network: exploring Olkiluoto 3 nuclear power plant project under International Journal of Project Management. She and other set of researchers also under International Journal of Project Management researched a new governance approach for multi projects: Lessons from Olkiluoto 3 and Flamanville 3 nuclear power plant projects, in 2010.

In concluding their latest research, they suggested that ‘‘further research on project governance in the context of large and complex projects is needed especially in four specific areas. First, management of contractor and subcontractor networks through several tiers in the project's supply chain requires further research. Second, management in institutionally challenging environments with actors from several socio-cultural environments where the local and global players meet poses several interesting subjects

for further study. Third, further studies are also needed on the business performance implications of various governance schemes: for example, despite different governance approaches, Olkiluoto 3 and Flamanville 3 faced similar types of problems in project implementation. Fourth, especially nuclear power plant projects face a challenging interface with local safety authorities that have their particular approach to project management and nuclear safety''.

My research work is connected to First and Fourth part with expanded view of project management and quality management only on Olkiluoto 3 as the case study and the lessons involving the client is included.

1.2 Purpose

This Thesis examines how the relationship between the client and the main contractor has been managed so far through the delays and proffers suggestion on suitable project management practice. It also considers the effect of quality planning on construction project and meeting stakeholders expectation, because they are part of both quality management system (QMS) and total quality management (TQM) requirements on projects. It also examines project challenges and how these have affected the project. In addition to previous research papers and public information in the media about the project, it will reveal what has been observed on the site from project management point of view and recent challenges after what has been published that resulted into further delays. It also review foci's of project that impacted on Olkiluoto 3 nuclear power plant construction and how they can be balanced. Using the site Olkiluoto 3 as a case study, the Thesis work undertake two questions centering on quality, scope, time, resources and expectations as important foci when planning a project. The two research questions are as follows:

Question 1: What is the implication of not factoring performance criteria (quality) in the planning stage of the project while time (tight schedule), competitive budget (cost) and scope are considered?

Question 2: Can stakeholders' expectation be met while fulfilling quality performance criteria of a project?

1.3 The Project players

The client Teollisuuden Voima Oyj (TVO), a private limited company founded in 1969 whose largest owners are Fotum Power & Heat and Pohjolan Voima with combined 80% shares. Noteworthy about this client is that it is a non-profit organization that does not declare dividend to its shareholders at the end of the year because is main purpose was to just generate energy for its shareholders at a cost price (Ruuska et al., 2010)

The consultant is recognized as an expert whether an individual or organization who has expertise in the field of the construction and act as advisor or authority on behave of the client based on the terms of the contract. The consultant might be hired by the client or in position to act as one base on the field of construction and the law of the land where the project is being executed. With regards to this project, the Finnish nuclear safety regulator (STUK) under the Ministry of Social Affairs and Health acted as consultant in ensuring that the project is delivered in accordance to high quality standard that this type of project demands in consideration to hugely deadly damaging effect it might have on the populace if it fails during operation. As result, STUK undertake overseeing quality aspect by reviewing, approving designs relating to the power plant's construction on behave of the client and aid in the documentation and procedures towards getting government approval, permit and licenses.

There is usually the prime or main contractor that directly contracts with owner on either the whole or the designated part of the project; which means there can be more than one contractor but with a single contract agreement. The contractor(s) are fully responsible for the complete delivery of the project (Sears et al., 2015). The contractor on the project is a consortium formed by AREVA and Siemens. AREVA also called Framatone NP is a French state owned company with majority shareholding. AREVA, a

world leader in nuclear building, based on the contract is responsible as the main contractor and had agreed to deliver European water pressurizer reactor (ERP) as a turnkey project; by providing engineering, construction and delivery of the reactor. Siemens was to provide the turbine, generator and the respective buildings.

In a huge construction project such as the Olkiluoto 3 project, it is not expected that the main contractor undertake all the work activities to deliver the project because there are several and diverse specialties that will be required and he may have capability for few expertise. The prime contractor can as well subcontract many of the job task to specialty contractors but will coordinate all the multi-connected projects until it becomes a complete project. There were a whole lot of subcontractors that the prime contractor AREVA engaged in this Olkiluoto 3 project and the first one was Bouygues. Bouygues is a French construction company and main subcontractor for civil works on the industrial site (Ruuska et al., 2010)

1.4 Thesis stakeholder overview

This research project is compiled by an Engineer Consultant with more than 10 years project management experience in Oil and Gas field and presently more than one year on the Olkiluoto 3 site as one of the Engineer Supervisor for a German company called Lausitzer Stahlbau Ruhland GmbH & Co. KG formerly trading as SIAG Stahlbau Ruhland GmbH & Co. KG He is able to interchange his observation with the key project personnel on both the client's and contractor's side in order to ascertain what has already been research so far on the project and appraise the issues from project management point of view.

Lausitzer Stahlbau Ruhland GmbH & Co. KG is a steel construction company that undertake the construction of 470 steel platforms in 2007 at the value of 25,100kEuros and because of its performance, the manufacturing and installation of 1200 load lifting equipment in the Olikiluoto 3 nuclear power plant called monorails was added to its contract in 2008 at the order value of 8700kEuro. Yet in 2008 the company was

assigned to deliver 2 safety control rooms manufactured with steels structures at order value of 1900kEuro. The scope of work for all the contracts includes project management, engineering, manufacturing, corrosion protection, transport, installation and technical documentation. On the Olkiluoto3 project alone, the company employed up to 180 temporary workers in Finland. The company reflects the multi-national nature of the project site because it employs up to ten nationalities ranging from Nigerian, Finnish, German, Polish, Bulgarian, Romanian, Greek, Estonian, Latvians and Russian.

Recently, the company is also engaged to provide structure for Gamma irradiation protection and coordinate grating exchange activities on the site that are essential part of closing out on the field construction and non-conformances to quality and safety related open points.

2. THEORY ON PROJECT MANAGEMENT PRACTICE

The concept of project starts from recognizing a need for something such as energy, power, access road, heath care services, communication need, flight services and many other human need for amenities. The project originator which in most cases is the project owner or client might have a complete knowledge as to how to fulfil the recognized need or may consult an expert to suggest the concept in order to satisfy the need. The initial concept created might not be complete in understanding; requiring further detail but can be advertised for supposedly expert companies to tender offer on the project.

The offer submissions must include technical details containing more information about the project as well as commercial breakdown of executing the project. The technical detail which is normally called the technical tender will include sketch or drawing of the project, how parts of the project will be acquired, consulted experts of parts to either be fabricated, forged or constructed on site. The technical tender will not be complete without providing proving the estimated timeline for ordering materials, resources both human and capital, fabrication or manufacturing period, construction period, assemblage period of manufactured items and critical path for special items on the project. The issue of quality also commence at this stage whereby the technical bid tenderer will demonstrate to the project originator how performance criteria of the project will be monitored and assured.

Commercial tender is requested from technical bidders who satisfactorily convince the project initiator and the consultant that they have the capability and prowess to deliver the project beyond any reasonable doubt of expertise. The commercial tender will detail a breakdown of the bided lump sum price for the project. The lump sum price needed to be as precise as possible because it will serve as the bases for the successful candidate to form a budget for running the project after company overheads and profits are excluded. The secret towards getting the contract price right depend majorly on how much technical details were captured during technical bidding process. The stage is

critical and requires all hands on deck – both the project initiator and the prospective contractor – because it can determine the future delivery status of the project, whether in terms of quality, time, scope and expectation. When the contract price is not favourable, the contractor may result to engaging affordable but ineffective workforce, sub-contractors, materials and systems and in the long run will hurt the project initiator in the area of delivery time, quality of works or worse case project abandonment.

The technical and commercial tendering are more challenging in huge construction projects because it is impossible to get finite details of the project make up, otherwise there must be prototype of the project and everything has to be exactly similar. The fact is, the latter is an impossibility because every project is unique regardless of their exact similarity. The selection of the main contractor of the project follows after critical scrutiny of the commercial tender submission. Many project owners tend to select the contractor for the project based on lowest bidder but the ideal selection process considers other factors such as;

a) Project delivery pattern and success rate of the subcontractor
b) Contractor's project experience and specialty
c) Quality management system of the contractor but the project owner can demand for ISO standard certification and other quality assurance certification
d) Social responsibility policy of the contractor
e) Environmental management policy but ISO 14001:series certification is not mandatory.

The successful contractor must ideally check out on all the criteria or requested to measure up to the requirements especially with ISO standard certification if so demanded by the project owner. On meeting the criteria, the project is awarded to the selected contractor by contract signing.

2.1 Beyond project contract awandance

The successful contractor will then proceed to appoint a project director based on the magnitude of the project, who usually must have been among the contractor's contract negotiating team during tendering process. This will enhance first hand exposure and motivation about the contract for smooth running and moderation of the project budget. The project director will then appoint an experienced project manager and project manager will in turn gather the project team. The project team first of all must include the project planner, engineering manager and quality manager as these ones are important for planning right from engineering design to quality delivery of the project. Other members of the team can also include procurement engineer, project engineers, quality control engineers and inspectors, sub-contractor expediter, HSE officer, financial controller. (Adefolalu, 2013).

The work of the project team commences from making project financial budget and presentation to the project director and contractor's top management for approval. The budget is needed to be factual as the figures presented has be based on many RFQ asked from prospective subcontractors and specialty experts. They also need to develop a comprehensive work schedule with detail WBS and showing all the critical path of the project. The critical paths in the project is one of the factors that warrant development of risk management procedures. The risk management procedure is expected to enumerate all the expected risk on the project and how they will be mitigated. The document will have serve as a working document in developing other health and safety documents.

The teams also will commence engineering modelling and design of the project while quality experts scrutinizes the designs for adherences to established construction standards, codes and in accordance to project owner's requirement. Quality planning and assurance commences at the initial stage of the project. Regardless of the type of contract signed, the engineering packages are expected to be submitted to the project owners or the client for vetting and agreement with contractor. The client might not be an expert in the project but he will be expected to employ experts and consultants as a third party towards ensuring conformance to project requirements.

On partial approval of the engineering designs and details, the teams can kick-off on procurement process of non-critical items and based on earlier RFQ request from suppliers. Procurement of special and critical items can commence after all parties have agreed on the design detail and approval given. In this way procuring wrong items or rigorous change order process thereby leading to cost overrun or delays can be avoided. Standard materials and consumables that will have no effect when design is modified can also be purchased prior to design package submission.

Especially on a huge construction project, project team needs very good and experienced professionals on the engineering design process as this is start of real construction project and can determine whether the project can be delivered at required quality acceptable level. No wonder, the acronym EPC or EPCI&C normally used in construction project, placed engineering as process to be completed before procurement just as procurement must be completed before you can get materials to construct. instrumentation needs to be completed on a construction project before project team can carry out commissioning.

During procurement and even engineering design process, project team can begin qualification process of sub-contractors and suppliers of various aspects of the project which can include but not limited to human resources, logistics, cleaning, construction waste management, land preparation, security etc. The scope of the project determines different kinds of services that different sub-contractors needs to be engaged. And as the project proceeds, other scope of different sub-contractors starts unravelling. This means that the process of sub-contractor's qualification continues through the execution phase of the project and even until handover of the project. Normally, project engineers are expected to handle the qualification process since they will coordinate the activities of the sub-contractors during the execution phase of their assignment. While procurement officers in conjunction with project engineers handle qualification process of suppliers. The reason is that project engineers check for completeness of materials details specification and procurement officers follow up on the suppliers after orders are placed.

The qualification process of the sub-contractors is somewhat similar to the selection process of the main contractor by the project owners and project consultant. The slight difference surrenders the project site to the control of the main contractor as he is expected to take full responsibility on what goes on the project. As a result, check list bordering on social responsibilities and environment requirement are tempered on the sub-contractor's qualification. Whereas, quality management system, project delivery history and project experience are paramount in pre-qualification process of the sub-contractors.

Pre-qualification is the initial stage of the qualification process which undertakes the technical aspect of the interested sub-contractors after invitation for bidding. After the initial qualification, prices are requested from selected sub-contractors. The final phase of the qualification results into selection as the team project engineers makes their decision guided by the approved budget of the project. The project engineers may be thrifty in saving cost by selecting lowest bidders but experience has shown that cost saved by this endeavour will later be expended in covering cost of additional work omitted during itemization of work scope specified to the sub-contractor. And the situation might be an attempt by the sub-contractor to stay longer on site; thereby creating additional scope for themselves. The cost save during negotiation process with the sub-contractor can then come to the rescue of maintaining budgeted cost.

2.1.1 Construction phase of the project

The construction phase begins with clearing the site, soil testing. site organization and modification of site topography to suit the project set up requirement. Site organizational requires setting up porta cabins for project teams temporary offices members, changing rooms for workers and achieves for project documentations. The temporary set up can also be useful for project teams meetings, kick off meetings, follow up meetings, team building occasions, training, site inductions and even negotiations with subcontractors.

The concreting reinforcement of the construction project foundation must be done according to specification detail in the construction drawings and in connection with other sub-contractor's job scope such as steelwork, fire protection, electrical conducting and mechanical equipment installations. This is important to forestall breaking of concrete for omitted job scope and later rendering the finished solidified concrete work invalid because of afterthought modification thereby compromising the design integrity. That is why aside from approved drawings consultation for work, there must be all sub-contractors collaboration meetings chaired by the Project Manager which will ensure that responsible construction parties are carried along. The collaboration meeting is in addition to kick-off meeting that must have been held at the commencement of every sub-phase of the construction project. The collaboration meetings are a little different from follow up meeting in that collaboration meetings are filled with technical details; planning sequence of job scope of different sub-contractors while follow up meetings check and monitor progress of work of different subcontractors and aligning them with the general work schedule.

With well-coordinated but diverse activities of different subcontractors ranging from concreting, manufacturing, fabricating, forging, installations, erections, identifying and mitigating risk, days in, days out, construction project starts from a level ground until a gigantic edifice is developed.

2.1.2 Project documentation

Documentation is highly important in construction project; it is in fact the essence of quality assurance in quality management system. It entails ensuring that all specifications based on codes and standard of construction and client's requirements are incorporated into the engineering design documents and drawings. Inspection and controlling of construction process that the set specifications are applied. Testing at the set safety parameters and certification, inspection witness, hold point and signing off

point, commissioning and handover. While going through these quality assurance processes, project quality documentation are gradually being produced.

There are various type of testing and inspections usually carried out on construction project. Such tests as magnetic particle testing, die penetrant testing, x-ray testing, gamma ray testing, torque testing, hydro testing, air tightness testing, leak rate testing, cold function testing, hot function testing are carried out at values beyond normal operating values to check whether manufactured or constructed project items will fail under normal working condition and to strengthen confidence in the design and integrity of the project. The procedures of the test, values explored and the signing off documents by client, contractor and sub-contractors representatives are very essential part of project quality documentation.

Nonetheless, there are occasions where design parameters and drawings have to change through the project. This is not an anomaly because it takes great skill which is rare world over to design something and exactly what is design is translated into construction edifice without slight modifications . When there is need for such modification, project teams must discussed the issue at collaboration meetings, agreed on the way forward, the design can adjusted instantly but in order to forestall ripples in connection with other interconnecting designs, the modification can be carried out on site but the modifications must be reflected in as-built documentation.

As-built documentation is the documentation carried out towards the end of construction phase of a project reflecting all approved modifications on project site. It has to be signed off by the contractor and the client in as much as the deviation from design and drawing did not affect the functionality of the project but rather contribute to it success function. The documentation is essential part of the project quality documentation and has to be handed over to the client as part of the deliverables of the project.

The importance of these documents cannot be overly emphasized as they are part of the instruction manual towards operating the project or when the project is in function.

During the operation, there may be some faults or malfunction of the project, the client can then recall the contractor and retrieve the information from the project documentation in order to unravel the reason for the malfunction; whether due to modification performed on the project or there are deviation from design or that the design itself was faulty.

2.1.3 Relationship of client and contractors

The relationship of the client and contractor commences right from the project tendering stage and should be maintained cordial through the commencement phase, execution phase and the closing out phase of the project. While the technical bidding is going on, the project owner's team must have been developing affiliations for the prospective contractor based on the convincing submissions. And when the project contract is signed, the relationship kicks off officially with sole purpose of delivery the project at quality performance state. The fact is: no one whether in the client's team or the contractor's (including the all sub-contractors/suppliers) will be allowed to jeopardize the goal of the relationship which is basically about the project. This goal will aid all parties to the contract, to always come back to the 'drawing table' to resolve issues even when project relationship has gone sour to the point of legal arbitration.

There are many type of project contracts that can be agreed between client and contractors. It can be turnkey project contract where the contractor is expected to manage all the phases of the project from engineering design, quality planning/implementation, procurement, construction, closing out, commission/test running, training of client's delegated personnel to operate the project and handing over of fully functioning quality project to the client. And it can also be part of the turn key phases of project where the client's team manages other part of the phases towards delivery of quality project.

Regardless of the type of contract signed, it is important that the client employs a third party to oversee the quality processes incorporated in the construction of the project or

if he is an expert in the field of the project, he can delegate part of his team as third party. The assignment of the third party includes review of engineering packages and approval, witness or review of kick off of some certain phases of the project, review or sign off quality inspection of different sequence of manufacturing and construction of the project and ensuring quality assurance about the project to the client.

Moreover, the client will also make everything possible for the contractor to perform all the scope of activities specified in the contract. Supports such as allocating space where the project will be set up and making it ready for the contractor's project activities. The project also might put pressure on the communities in form of inconveniences exerted on the populace. It might also impact heavily on the environment. In this instances, permits and licenses will be required from the authority of the country of project in order to start the project through to its handover. The client will support and provide enabling environment in order to obtain the necessary permits or licenses needed by the contractor.

While maintaining relationship between client and contractor, there may be a situation where the project is lagging behind schedule and either the client or the contractor want the project to be expedited. The goal of the project relationship can make the project parties to introduce incentives which serve as motivation for project players to expedite their activities towards effective completion of the project.

2.2 Literature review on OL 3 construction project

A project can be exactly described by a work performed through series of sub-tasks and responsibilities by several organization through a planned period of time with a commencement date and closing date in order to produce an outcome. (Horine, 2009). A project consist of systematically managed processes and activities that will result to an outcome (Tuominen et al, 2003). The concept of management takes into consideration planning, coordinating and controlling in consideration of the client's expectation defined by project fitness for purpose, utility, quality, time and cost. While creating

connection between resources; integrating, checking progress and controlling the project stakeholders' activities; evaluating and exploring options towards achieving the project outcome with client's satisfaction (Walker, 2015) and a mega project (Flyvbjerg et al., 2003) takes a very much larger view.

Mega project is a project with a larger definition involving many players with temporary organizations interconnected by inter-organizational relationships (Winch, 2006). Many terms has been used to describe the magnitude, such as giant project (Grun, 2004), major project (Morris and Hough, 1987) complex project (Barlow, 2000) large project (Miller and Lessard, 2001a,b). Whatever it is referred, Ruuska et al (2010) suggestively described it as involving many organizational actors committed to producing a system or deliverables forming a complex system such as a power plant or an airport. The large project will be subjected to impacts due to a wide socio-political and socio-cultural influences as the multiple organization seeking successes with different objectives and their metarmorphobic priorities while undertaking their activities. (Ruuska et al. 2009) Floricel and Miller, 2001 implied that managing such mega project involves governance over all the parties.

The major parties in the governance in some form of trilateral arrangement are the client, consultant and the contractor (Reve and Levitt, 1984). By extension, the governance will include many sub-contractors and suppliers who are very essential to delivery of the project and these will conversely exhibits governance in their respective organizations. Management is a dynamic infusion that make temporary organizational set-up in a construction project site to function well (Walker, 2015). The setting up of performance task, around stakeholders expectation, monitoring, adjustment, proffering solution to project challenges are all part of management in construction project. Walker (2015) asserted that management on construction project is more challenging because team members of the project organizations are temporary workers or some are seconded from their main organization and can therefore be involved in other project simultaneosly.

The construction of Olkiluoto 3 nuclear power plant is undoubtedly a mega project based on its magnitude and several players, different activities, professions , responsibilities all coming together resulting in the ultimate goal of producing safely working power plant. This is a unique mega project taking a longer period to complete. It is as well multi-national that at one time employed up to 4000 workers from 55 countries(AREVA Suomi, 2012) and over 1700 subcontractors from over 27countries with activities ranging from civil works, steelworks, forgings, mechanical works and piping, electrical and instrumentation, installations, surface protection, commissioning to landscaping. Walker (2005) averred the complexity of construction project by the different professions having specialist subcontractors with a wide range of skills and tools. And when the project was executed outside the borders of the stakeholders, it will carry along issues relating culture, language and logistics. Important therefore, is the management of the complexities in that the different skills and the energies brought by the socio-cultural influences can be systematically structured so as to produce optimized outcome.

2.3 Examining the challenges of managing OL3 construction project

Project execution commencing from planning and being run through different phases must meet up with demands of external factors such as government regulatory agencies, financial organization, insurance and bond companies, special items manufacturers, suppliers, skilled construction workers, engineers, architects, labour unions and action groups. And these can surmount pressure on the project management team when not adequately planned, thereby making them a challenging and critical path in the project. Successful megaprojects are complex and many at times it is what went wrong that are documented (National Research Council, 1999) not challenges encountered toward the delivery of the project. Some of project challenges in the case of Olkiluoto 3 project discussed extensively in the following subtitles are unfamiliar territory, numerous expectations, communication debacle, cutting edge technology, collaboration problems, selecting sub-contractors based on claimed specialty, procurement of special items, and close to accurate estimation of project completion date

2.3.1 Unfamiliar territory

Every project is unique in the sense that two similar projects may not follow same path in it execution and many a times project field might be new to the groups that will execute them. According to Sears et al (2015) , in its specifics each project structure is fashioned to suit its environment, design and field of functionality. The project players might be experienced professionals but may have to execute the project in an uncharted territory or with new partners . Such is the case with Olkiluoto 3 project. The existing two plants OL1 and OL2 on same site of Olkiluoto 3 were ordered over 25 years ago; Olkiluoto 1 started production of electricity in 1979 and Olkiluoto 2 in 1982.

The TVO's client experience in the construction of the two nuclear power plants will need time to revive if there were retained project executives during the time the two previous power plants were delivered. The apparent outcome in the owner's management of Olkiluoto 3 project showed that there were no retentive experience in nuclear construction. Most importantly, the European water pressurized reactor system is a very different technology to the existing power plants; it was first of its kind. Although, AREVA is the world leader in building nuclear power plants but have not build the new technology nuclear plant anywhere else or in such an environment and climate as in Finland; where wintery condition can be severe and unpredictable. The weather condition has to be considered in the design and building plans, for effective implementation of nuclear safety culture.

AREVA had not worked with TVO before on major project such as Olkiluoto 3 and may have not undertaken such monumental project as turnkey project where all decisions such as engineering, quality, construction rest on it and with TVO's role as the owner defined in ambiguity. The enormity of the turn key responsibility accepted by AREVA must have created a sphere of hysteria as to demanding human resources that will be needed on the project and controls. This was demonstrated at the commencement stage of the project, when there were high turnover of construction site managers, supervisors and workers with unclear roles but negatively impacting on the project progress (Ruuska et al., 2010).

2.3.2 Numerous expectations

The existence of a project signifies the availability of stakeholders with their expectations. Complex project (Barlow, 2000) such as the building of Olkiluoto 3 nuclear power plant attracted many stakeholders and interest groups with their various expectations both expressively written and implied. The decisions to build the Olkiluoto 3 was spurred on by the expectation to meet the Kyoto target of keeping Finland's average greenhouse emissions to 1990 levels and to reduce increasing dependence on energy imports from Russian federation (Cabinet of Finland, 2005). The move was tagged as the easiest and the less expensive method to accomplish the Kyoto targets because it was expected to reduce CO2 emissions by 10 million tons per year (Cabinet of Finland, 2007). The plan would have impact greatly on the target if achievable. The inflated expectations centered on the production of the power must have blocked the owner's view in it its role to speculate probable risk factor and challenges relating to the tight schedule in building such a new technology of nuclear power plant and its quality issues (Greenpeace, 2007).

There were also the expectations about the period of time and the cost of the project. The Olkiluoto 3 project was promised to cost 2.5 euro and will take only 4 years to build. According to AREVA, the tendering phase was price-based competition and has underestimated the actual price of the European water pressurized reactor (Challenges, 2006). Regardless, the main contractor proceeded with the project in order to meet the expectation to deliver the project at 3.2 billion Euros with the dividend of establishing its position as the leader in the nuclear building market. Asides estarblishing itself as the world leading group of industries in nuclear building, the attempt to execute the project at minimal cost was to attracts similar contracts.

There were also interest groups such as Greenpeace who are in expectation to see how the promised efficiency about the nuclear power plant in meeting the Kyoto target will become a reality over other forms of renewable source of producing energy. Additionally, it is expected that the project will offer jobs to Finnish workers and that

half of the investment will be domiciled in Finland (Finnish cabinet, 2002) without transitory training to enhance expertise and motivation of the populace.

2.3.3 Communication debacle

There can be communication obstacle due to personal boundaries created in the organizations participating in a project as a result socio-cultural influenced style of relating to one another. Team development process and type of communication channels can also be impediment to smooth running of project if not proactively managed (Horinie, 2009). Delivering more and better information to the client as in agreement can significantly influence the client satisfaction (Tuominen et al., 2003) Similarly alerting the client about changes on the project or any hiccups in delivery of promised deliverables as at when appropriate or in due time can greatly create good impression on the client.

Conversely, it is especially challenging in project execution if there is no proactive and proper communication flow between the client and the contractor. In the case of Olkiluoto 3, communication was less than adequate and there were misconception about project player's focus and targets. This is evident in the way the owner at the inception of the project stayed aloft due to its interpretation of turnkey project system while expecting the contractor to just deliver the project (Ruuska et al., 2010) without plans to scrutinize the construction process from quality and nuclear safety culture point of view. This stance may have been approached politically as AREVA is majorly owned by French government and individual European union member state is autonomous with its decision. And when there were quality issues on the concreting of the reactor base, the contractor kept the information away from the client for more than five months with the intension to meet the tight project schedule.

The Olkiluoto 3 site involved more than 1700 subcontractors from over 27countries and employed altogether more than 4000 workers from 55 countries creating long chain of control due to major language problem (Härkönen, 2011) and communication style.

Socio-cultural order may have had effect on the communication pattern of the organizations who are players during the project execution. Regardless of different culture making up the project team, ground rules must be set that exchange of information can easily go through between project stakeholders. Any misconceptions on the information passed can easily be checked and corrected through follow ups on the information.

In order to address disrupting effect that the multi-cultural nature of construction project might cause, it is important to enlist on the project quality plan, responsibilities and authorities of different portfolios in the project management teams. Everyone should know what they are responsible for and what project issues they are expected to decide on. Also they need to be in awareness of their capability and other aspect of the project they will require additional training (Tuominen et al, 2003) in order to enhance better performance.

While on site, it was observed that the flow of project important information are delayed or kept among so called 'privilege ones' thereby leading to delayed action or inaction on expected task on the project and sometimes duplication of activities belonging to same project task. Tuominen et al. (2003) implied that it is imperative that everyone on the project team should be aware that small breakdowns in communication flow can unsuspectedly result into catastrophic situation. Like Pernile et al (2013) smartly remarked if communication is deficiently planned , it will limit information sharing between project teams and sensitive information will be revealed to non-effective project performer.

In order to communicate effectively in a multi-language project site, it is important to look out for commitment of the project players. While expanding on the Elaboration Likelihood Model, Petty et al. (1983) stated that when people are not committed to an issue, they are not ready to expend their time and ability to learn about the issue. To get the commitment through communication, one can use repetition of information passed with body language or hand demonstration such as 'thumbs up' which can leads to circumferential route to persuasion (Petty et al., 1983). The use of verbal and non-verbal

communication method concurrently can aid to emphasize the importance of the information passed. The use of picture to demonstrate on posters which is non-verbal in this instance can fix the information on the mind of project teams (Pernile et al., 2013). Therefore, an enriched communication style will earn the project team commitment to issues.

The enriched communication style can be impersonal using news media as it is not intended for a particular person or it can be interpersonal whereby it takes place between persons who may be representatives of different project organizations taking part in a huge construction project. The impact of the communication will depend on the extent the project team members applied the information passed. The impact can be exercised either by pull method whereby project team players can be persuaded to follow the instructed information or by push method in which the project team members are enforced to follow instruction (Pernile et al., 2013). Regardless of the fact that, the two communication styles and the two method of impacting communication are at opposite ends, their selective combination can enhanced effective communication on a multi-national construction project site.

In a huge construction project with multi-national community such as Olkiluoto 3 project site, it is possible to overcome communication barriers due to different language and different culture, just by avoiding certain communication errors applied from Worsley (2016). Communication errors such as;

(i) Too much communication as too detailed information will lead to waste of information. The reason is that few of the information is absorbed by the project team members. And there is likelihood that the information is not targeted to the right audience that needs the information for proper project application.

(ii) Poor quality communication or too little communication occasioned by poorly worded or inaccurate/ wrong information. Feeding information without getting feedback or checking whether the information gets to the

right audience for effective usage. Ambiguous information with no explanation or details. Same information circulated to every member of the project team and the stakeholders.

(iii) Another communication error to be avoided is bad timing of communication which is an incident when information is passed either too early or too late as there is no organized pattern set in giving information. Perhaps information are usually requiring emergency of reaction from project team members or stakeholders due to the anomaly that it was knee-jerking of last minute.

(iv) Too much dependence on specific channel of communication or use or wrong communication channel such as using site notices to pass an information when calling for meeting or training would have been more effective. Perhaps depending excessively on monthly progress meeting when issues arising from running the project could have been resolved when in contact with project team member or stakeholder concerned or via emails.

(v) Poor intelligence collation and arrangement may brought an idea of security issues as the planned information would be based on site observations, reports and intel as used by military intelligent agencies to compile information for the project stakeholders and team for improvement or commendation of their activities on the project. The information needs to be free from presumption as event are supposed to be investigated. When communication planning is properly arranged to reach the focus audience, then follow up on the information can be planned and implemented.

The five non-exclusive communication errors enumerated emphasized the importance of planning communication, dishing right amount of information, selective information, appropriate channel used and constant communication on construction project site. Word of caution is: there is also the danger of communication losing its effective usage when it is too regular. The project team member or stakeholders might lose the

importance of the information passed when it is unnecessarily a pattern of passing the information. Worsley (2016) cautioned that if regular communication result to routine, then it is likely that its usage will diminish over time unless constant reviewing and rechecking is done to enhance the effectiveness of the communication process and emphasize its importance.

2.3.4 Cutting Edge

The European pressurized water reactor was a new, leading edge technology in the field of nuclear power plant. AREVA is a world leader in the nuclear building but constructing the ERP technology in a severe wintery climate is a new field. The contractor had to learn to produce the outcome while making mistakes with regards to performance criteria of some parts of the project. This resulted to non-conformance and request for corrective actions.

The piping, electrical and instrumentation design and works are massive and the level of checking, test running, modification in case of failure of design parameters were not anticipated to take a longer period as a cutting edge technology. The management of design phase of construction project takes into consideration minimization of construction time with consistency on project quality, safety and cost. The delivery time of equipment and materials are checked and when long delivery is involved. The procurement can commence when the design phase has progressed enough to allow detailed buying of materials (Sears et al., 2015). It is therefore permissible in construction project to commence a part of the project such as concreting while design phase of another such as Instrumentation is ongoing.

In the case of Olkiluoto 3, nuclear power plant, the construction was allowed to commence before design of the reactor and the instrumentation was finalized, even though this fast tracking licensing would not be legal in Finland. The subcontractors therefore used outdated blueprints for their construction activities and as a result Finnish authorities could not at most time supervise work based on unapproved design

documents (Härkönen, 2011). It was just unfortunate that the design phase and approval of submitted designs of the equipment and instrumentations was unnecessarily delayed. As noted by a stakeholder planner on the project, the Instrumentation construction engineering was a critical path on the project and the non-approval at the time led to near abandonment of the project. The construction phase was demobilized in 2014 for almost a year because of the instrumentation design approval delays and was revitalized again in to a full blast in 2015 when all engineering solutions/completion has been carried-out.

2.3.5 Collaboration

In order to achieve project success, it is important that different stakeholders work together and strive to consider others' perspective with the ultimate goal of making best decision for the project (Horine, 2010). Unfortunately, at the outset there were less than expected collaboration between TVO and AREVA as both are related to European union member state. The less than expected collaboration materialized during the frictions and conflicts between the client and the main contractor and had resulted into litigations which has become public knowledge even in the media (Ruuska et. al, 2010). The collaboration issue was occasioned by functions and responsibilities between the major project players being in ambiguities and as result of the inadequate project definition of turnkey project contract system.

There was also collaboration difficulty between the contractor and the supposed consultant which is the Finnish nuclear safety regulator, STUK. The lack of collaboration was apparent when the contractor was running into trouble with quality issues but did not consult with the owner's quality assurance representative in order for the problem to be jointly addressed.

2.3.6 Selection of sub-contractors based on claimed specialty

In a huge construction project of the size of Olkiluoto 3 nuclear power plant, there will be arrays of sub-contractors that will be required to provide services. Some contractor will focus on providing specific parts of the project and therefore referred to as specialty contractors while others assumed a wider general scope for a complete system that is part of the huge project and are referred to as general contractors (Sears et al. 2015). It is an acceptable practice in the construction industry, that the general contractor can also subcontract part of its accepted scope to a sub-contractor that is specialized in that component thereby creating a complex system of interconnecting sub-contractors. For example in Olkiluoto 3, a German company was sub-contracted to supply steel container of the reactor and this company further sub-contracted the work to a Polish ship yard company to manufacture the vessel.

The sub-contractors are generally selected through technical and commercial bidding system whereby competence, capability, low cost, shortest period and smartest method of delivering the contracted deliverables are the watch word of the experts in charge of awarding the contracts. In the case of Olkiluoto 3 nuclear power plant, emphasizes was laid on optimizing technical solutions with consideration on cost and schedule impact in selection of contractors and sub-contractors. As the project progresses, there were occasions when the selected contractors fell short of delivering the deliverables in terms of quality. This unfortunate situation was caused by scanty information at the bidding stage or sometime inadequacy in the capability of a sub-contractor to fulfill its contractual agreement. The anomaly in the situation was then corrected by re-awarding the contract to another subcontractor. The series of corrective actions definitely resulted into the stretch in time schedule.

By qualitative research method, one question asked from the Olkiluoto 3 stakeholders was: Do sub-contractors fully comprehend the terms and delivery time of the deliverables at time of contract awardance? It can be inferred that it is not in most cases that sub-contractors fully understand the requirement of the expected deliverables.

There were technical difficulties and quality aspect during the bidding process . There were also long chain of interfaces with several entities which are beyond the compound of subcontractors' control.

2.3.7 Procurement of special items

Procurement is a process of obtaining goods and services (Albert, 2005) but it goes further than ordering to expediting, and delivering of materials especially special items requiring long delivery periods (Sears et al., 2015). Since services provided in construction projects are handled as sub-contracting process, then it is safe to say that getting all materials and installed equipment under construction projects are subjected to a procurement processes. The procurement process starts from proposal, submittal, approvals, purchase to logistic process to get what is ordered to site (Sears et al., 2015) . Procurement process is one rigorous exercise of reviews after reviews of specifications of the material following a complete engineering and approvals.

In such a huge construction project like Olkiluoto 3 nuclear power project, it is especially expected that repetitive reviews are done on special materials according to specifications and approvals done before finalizing the order. It is not unusual that after the rigorous reviews and the materials had arrived on site that the project teams will realized that the design specifications has to be changed. Then a change order process will need to be activated (Sears et al., 2005). The interview of stakeholders on the procurement so far on the project revealed that changing of ordered special items on the project is a common scenario leading to delays in achieving project milestones and the situation are managed by change order strategy and implementation of temporary solutions.

To ensure a hassle-free procurement of special items requires a good follow-up plan connected to important milestones or delivery date, or connected to scheduled phases of the construction project (Pernile et al., 2013) has to be implemented. With such project detail delivery schedules in relation to the order of special materials, it will be

convenient to assess plan and discover ahead of time whether any project milestone is lagging behind. At that point the project team can do an expediting by calling the defaulting stakeholder. The expediting can be done by telephone calls, emails and letter, or by calling for project meeting in order to address potential drawbacks on the promised deliverables date with the meeting. The challenges are jointly mitigated otherwise the project schedule has to be updated.

2.3.8 Estimation of project completion date

Estimation of project duration as presented by the project team at the time of tender submission is dependent on professional skill of the project players and their previous experiences. This is because the project duration is evaluated based on interdependence of activities and resources of the different experienced professionals. Some task might be performed concurrently while others are to be completed before another starts. That does not enforce on the project team that all the professionals and specialty subcontractors must submit their input regarding duration of their task as timings from earlier projects as per their task can be applied in the overall estimation of project duration (Tuominen et al., 2003). It is therefore expected that the main contractor will have a general knowledge of the different part of a huge construction project or have a traceable record of timing expended on manufacturing of special items base d on previous project executed.

Unfortunately, close to perfect estimation of project duration could not be ascertained on Olkiluoto 3 power plant project because it is the first of its kind. The construction of European pressurized water reactor nuclear power plant was estimated to be completed in four years without considering the finite details of the different part of the power plant and the long time duration of manufacturing special items such as the mechanical pressure vessels. Determining project special items can help the project team to identify the critical path in the project scheduling and come up with other project tasks that can be carried out concurrently during the period of the critical path. This strategy will compensate the reduction of project estimated duration.

While attempting to give rough estimated on project duration, it is important to speculate project risk that may come along during the execution phase. Equally important is to come up with ways to mitigate the risk in order to reduce their impact on the project duration. The glaring fact is that risk assessment procedure was not carried out initially during the estimation of the Olkiluoto 3 project duration. No wonder, after ten years of project construction, the outcome is precarious and the estimated delivery date is not yet certain.

In the estimation of project completion date, it is also important to intimate the project owner ahead of time about his responsibilities towards aiding the progress. Responsibilities such as review and approval of project design documents, obtaining licenses and permit. The project owner will therefore estimate how long it will take to review and approve submitted document or to obtain required license of permit on due request. The project owner's input on giving estimation of time period to fulfill his part in support of the project is important to forestall blame strategy when the project slightly suffers delay.

It is rare to find project management professionals that are able to accurately to estimate exact project duration, except that allowable project slippages are included in the estimated duration. Quoting directly from Tuominen et al. (2003); you only learn to calculate timings by estimating and measuring, and by using measurements from previous projects. The practice of including allowable slippages in the estimated project duration will earn project team members credit when they are able to complete all the project tasks before project completion date.

2.4 Managing project stakeholders

The existence of a project is directly proportional to the existence of stakeholders; there must be individuals or organization with interest on the project. Freeman (1984) was the first individual to introduce the concept stakeholder as part of project management

organization and defined it as any group of individual who can effect or be affected by objectives of an organization. Many other definitions followed and applied to project management such as individuals and/or organizations that are involved in or may be affected by project activities (PMI, 1996). Individual and organizations that are directly involved with the project and who have a vested interest in the resulting deliverables(PMI, 2001). Individual and organizations that are actively involved in the project or whose interest may be affected as a result of project execution or project completion (PMI, 2004). An individual, group, or organization who may affect, be affected by or perceive itself to be affected by a decision, activity or outcome of project (PMI, 2013). In summary, stakeholder can be a person(s) or entity(s) that will influence a project during start up, mobilization, execution, completion, demobilization and outcome either by its/their actions or the effect on it/them..

2.4.1 Identifying the project stakeholders

One challenge that the project team on such a huge construction project as Olkiluoto 3 might have is the all-encompassing identification of stakeholders asides the project owner, the experts, the suppliers and sub-contractors. Reed et al., (2009) aptly remarked that a key challenge lies in deciding whether the phenomenal event under investigation should show which stakeholders are included, or whether it should be the other way around. It can be a dilemma for the project team to even diagnose for analysis what stakeholder expectations to meet since some of the stakeholders are in the background. Grimble et al. (1995) suggested factors that can aid the project team to realize what extent they can expand their view on who to be counted as stakeholder on the project when he said in an enlarge terms, if the main concern of the stakeholder analysis is equal distribution of costs and benefits during project planning and execution, all stakeholders may need to be included. So when the construction project is huge in terms of cost and impact as Olkiluoto 3 construction project is, then all perceived stakeholders has to be included in the plan to meet their expectations.

While not pointedly created to identify stakeholders on a project, Worsley (2016) suggested using PESTLE analysis which is an acronyms for Political, Economic, Social, Technological, Legal and Environmental to confirm what persons or group to be included as stakeholders. In case of Olkiluoto 3 project, the project team can consider the possible extent global, national and local politics and authorities can impact on the construction of the nuclear power plant; groups and organizations that can impart on the economic performance of the project; community, social and cultural groups that will be affected either positively or negatively by the project; technological, construction or engineering aspects or specialty contractors that will influence the project process; Legal influencers, licenses and permit providers that will impact on timely and eventual delivery of the project and environmental groups, local environment and environmental policies makers that will impact the project during planning, execution and completion phase.

The stakeholders can either be those that have stakes invested in the project and are thereby referred to as primary stakeholders or can be secondary stakeholders with indirect responsibilities toward the project (Albert, 2005) . Primary stakeholders include both the external customers which are making payments toward the project and internal customers who are directly involved in the execution of the project through a collaborative supplier-customer network chain (Kenneth, 2005). Albert (2005) indicated that primary stakeholders is not limited to the client and project sponsor but also includes the contractor, project manager, other project team member, insurance and bank bonds provider, project consultants, subcontractors, material and equipment suppliers and users of the project when it will be delivered. As in the case of Olkiluoto 3 construction project, The eventual Olkiluoto 3 nuclear power plant electricity consumers in Finland are also part of primary stakeholders.

The secondary stakeholders are also not limited to pressure groups, labour unions but includes regulatory authorities, government agencies, licensing and inspection institutions, public utilities, technical institutions, professional bodies, support staffs and departments such as human resources, account department of the contractor’s main organization that is not directly involved in the project execution (Albert, 2005). There

are hidden stakeholders that do not directly take part in the project and most difficult to identify but their interest and concern for the project may directly influence the delivery of the project (Kenneth, 2005). Worsley (2016) called them the 'lurkers' 'sleepers' or 'spoilers' who might not be active during construction phase of the project but whose agendas in accordance to the project needs to be anticipated to forestall unwanted disruption to project outcome. TVO is both primary and external stakeholder for the eventual fully functioning Olkiluoto 3 nuclear power plant but is securing the outcome for the electricity consumers that are hidden stakeholders.

2.4.2 Exploring project stakeholders expectations

In order to meet up with stakeholders' expectation, project team must have stakeholder mind-set which will be applied to the content of the project goals. This stakeholder mind-set will also assist the project to react appropriately when stakeholders' expectation is changing. Their reaction will be similar to the way the project team will track, monitor and adjust to changes in project scope (Worsley, 2016). So stakeholder mind-set in construction project will dictate the objectives of the project and nurture the project process through changing expectation of the stakeholders toward stakeholders' influenced outcome. The project team will apply change order process during changes in project scope and deliver the project. Similarly, the project team can adjust their process to suit the metamorphic stakeholders' expectation .

In meeting up stakeholders' expectation, a project will go through a series of exchange processes that the project and the stakeholders engage in contributing and getting reward (Pernille et al., 2013). This exchange of contributing and getting reward is powered by free will as both the project and the stakeholders have what Bernard (1938) called 'power of choice'. This means that stakeholders can decide to submit, hold back or excuse themselves of their expected contributions (Slatter, 1980). Based on Smith's (1776) classical economic theory, to accomplish annexing relatively maximum contribution from project stakeholders, especially the ones that have direct influence on the project progress, it is then important to swing them to action.

In construction project, the stakeholders can be motivated to action if the project stakeholders knows that their contributing to the project will fulfil their self-interest or will benefit them. The anticipated benefits in the case of huge construction project can include salary payment, payments for ordered materials, profit and dividends on business investment, inclusion in challenging but rewarding task, enhancement of capability growth, added recognition of the stakeholder's establishment and not limited to opportunity to showcase their visible achievement (Pernille et al., 2013). Inferably, success in achieving meeting stakeholders' expectation will depend largely on how the project team had channeled their efforts in project activities to cover these benefits.

In order to achieve success in meeting stakeholders' expectation, project team need to gain insights into stakeholders' needs and prioritize them. Stakeholders' expectation are transformed into viable requirements specified in project quality plan (Tuominen, 2003). Pernille et al. (2013) further pointed out that gaining insight into stakeholders' expectation will involve a stakeholder analysis through stakeholder identification, stakeholder assessment and stakeholder prioritization. Stakeholder prioritization should lie on momentary project issue and stage of progress (Savage et al. 1991). Stakeholders' expectation need to be examined at every essential stages and usually through the period of the project and determining what stakeholder's expectation should be on target.

It may be impossible to unravel completely what constitutes stakeholders' requirements, concerns, and perception of what is acceptable because it is ambiguous or tacit knowledge (Pernille et al., 2013). The complicating aspect of stakeholders' requirement is that focus and opinions metamorphose over time through the life span of a project execution phase. In the case of conflicting stakeholders' requirement, Tuominen et al. (2003) implied prioritizing on customer's or paying stakeholder's requirement. And if the stakeholder's requirement change, then the project objectives are updated to suit the changes but not without consideration of time, cost and performance features.

2.4.3 Communication with project stakeholders

Meeting stakeholder's expectation requires constant communication and this communication can be achieved by various methods such as through meetings, emails, face to face, organized trainings, team building event and by post. There are great chances that the stakeholders can be satisfied and their expectation met when project processes, progress, challenges and planned mitigation are earlier communicated to the shareholders. As corroborated by Pernile et al, (2013), involvement of the stakeholders by constant communication will aid to enhance the alignment of expectations during project planning phase, project execution phase and project completion phase, albeit excessive involvement of stakeholder might hamper the commencement of the project.

The initial hindrance in commencement of requesting for tenders to kick start the construction of the Olkiluoto 3 nuclear power plant was because of Finnish populace whose memory about the impact of Chenobyl accident was still fresh. They somewhat protested against the building of another nuclear plant. And they are vital stakeholders to consider as they will be end users of the power plant as well as consequence receiving end of the project failures. Pernile et al. (2013) further emphasized that too much involvement of stakeholder might unwarrantedly inflate complexity, spring up expectations that are unachievable or difficult to meet and may be very stressful for other stakeholders that will be involved in the execution of the project.

Conversely, when there is very less communications with the stakeholders, the possibility that there will be challenges, misconceptions dissatisfied and grumbling stakeholders; not realizing any reward from the project will be high. The contrasting ends regarding the level of communication with stakeholders prior to commencement of project and resultant effect of each ends that project teams might choose to explore may kind of spell out confusion in meeting stakeholder's expectation. The insufficient communication with stakeholders will allow easy kick- off of project while resulting into misconceiving, cumbersome situation. On the other hand sufficient communication with stakeholders prior to starting the project will hinder a smooth but at the end of the

project, everyone will be in agreement with the focus of the project. The contrasting ends will importuned the project team to strike a balance in the level of communication with the stakeholders.

In the attempt to meet the stakeholder's expectation, there are two type of approaches which are forceful or power-based approach and co-operative or collaborative approach. The power-based is forceful in the sense that the stakeholders are manipulated to accept no-option choice presented to them and collaborative approach is co-operative in that it involves, communication with, imploration of and arriving at middle ground with stakeholder during negotiations but the outcome is no way destructive to the stakeholders (Pernile et al., 2013). From good project management point of view, the cooperative method of negotiating with stakeholders will earn the project team success in meeting stakeholders' expectation.

2.4.4 Stakeholders contribution toward project success

Stakeholders have different contributions and issues towards the project success and therefore have different level of interest, requirement and demands. As a result applicable communication methods will be different. Some stakeholders will require information about the progress of the project in form of reports daily, weekly, monthly or yearly. Another will require effective dialogue (Pernile et al., 2013) in order to clear any misconception about the project and strengthen their confidence in the project team. Yet another stakeholder will require repeated exchange of information and follow ups to enhance uninterrupted progress on the project.

While considering the delivery of a project according to certain acceptable quality performance, it is essential as well to consider satisfying the stakeholders. Kenneth (2005) suggested four areas where stakeholder's roles is important which includes ; (i) providing needs and requirements (ii) defining standards (iii) evaluating the outcome and (iv) providing feedback. In the case of Olkiluoto 3 nuclear power plant, it is the huge need for energy, light and electricity that made up the bases for planning the

construction of the power plant. Demand for efficient energy production defined choosing the option of nuclear energy while the environment defined the standards. The evaluation of the construction processes so far and the feedback on the eventual outcome of the project from the Finnish populace will determine whether the construction of another nuclear power plant like Olkiluto 4 will be initiated.

The decision as to who are project stakeholder and how to come by their expectation majorly rest on management of project organization but the decision should be based on sound stakeholder analysis. (Worsley, 2016). Bourne and Walker (2005) apprised that the preparedness to understand the frequently hidden strength and effect of diverse stakeholders is a crucial ability for accomplished project team. The stakeholder's interest can impact the drive to running the project to completion with their satisfaction as a focus. Comprehending their interest can propose technique for project team to leverage on their expectation.

2.5 Score card on construction project management

Score card is seen to be a graphical representation of assessment of progress made by an entity or organization over a period of time toward a achieving a particular goal. In other words it is a visual answer to the question a project organization might ask; 'how are we doing?' So the concept is about measuring activities against the targets, and when we are found wanting, how do we reach the target. There needs to be measuring sticks to indicate the level of project performance. With scorecards, one will find key performance indicators.

2.5.1 Literature download on score card

Performance scorecards are widely used in many industries throughout both the public and private sectors. Performance scorecards are also used to monitor the progress of any

organizational goal. The integral concepts of scorecards are targets and key performance indicators (KPIs). KPIs are metrics used to evaluate factors that are crucial to the success of an organization; targets are specific goals for those indicators (Margaret Rouse, 2010). Performance measurement is considered a part of a performance management system.

2.5.2 Application of score card on construction project site

Applicably, it is important to understudy score cards in project management practice, since score card is about reaching targets and measuring the performance level of reaching such goals. And project purpose is about achieving its goal of delivering the project and the project delivery performance can be measured by certain project indicators. Aside from the deliverables of a project which will be checked at project handover, there are project factors that can be used to score a project as achieving its objective because project delivery is not enough.

These indicators include time, scope, cost, quality and stakeholders expectation. Time is essential as project performance indicators in the sense that it assess whether the project is delivered according to contractual delivery date. It is not just about a timeline with a starting point and an end point but about how the WBS with critical path is being managed because situation whereby project delivery date is underestimated can arise. The scope as project performance indicator is all encompassing of deliverables of the project which emphasized the fact that project score card can not only be based on deliverables of the project being delivered. The scope as part of performance indicators measures what was delivered according to contractual agreement.

In order to commence, keep it running until completion, cost is important indicator in the execution of project. As a performance indicator, it will measure weather the project is delivered within budget or there is cost overrun. Cost overrun for example is a bad indication of how the project is poorly managed in terms of schedule, scope and the quality planning and implementation. Planning for quality and how it is implemented is

very paramount performance indicators as it underscores the performance of a delivered project during operation. When quality is not planned to be infused in a project, then it is certain that it will fail even during project usage making all activities on the project resulting to waste. So project team members can ask themselves, 'how are we doing with regards to quality planning' and 'how much quality control and assurance did we incorporate into the project.

Stakeholders' expectation is equally as important as time, scope, cost and quality in score card's performance indicators because if a project is delivered according to schedule, all the deliverables delivered within budget and according to required quality performance but the stakeholders are disgruntled, then the score card is not balanced. This indicates that the project score card performance indicators are not measured singly but in connection with other performance indicators. Balanced score card requires satisfying the requirements of all the project indicators. In order to ensure a project balanced score card by satisfying all the performance indicators at the end of a project, project teams will consider indicators as focus or foci when planning the project. Foci in the sense that they will become the center of their concentration in achieving the project objectives.

2.5.3 Balancing project score card

Project focus include scope, time, cost, quality and expectations because there cannot be a project without an outcome or deliverables (scope), a planned period of the outcome delivery (time), resources or budget to run it (cost) while meeting an acceptable level of performance (quality) and stakeholder expectations (Horine, 2007). National Research Council (1999) inferred that scope, cost, schedule and quality are closely connected to each other and that a deviation in one will most possibly result into a change in one or more of the others. Balancing the focus can be likened to balancing foci surrounding managing the project toward delivery as illustrated in the Figure 1 that follows;

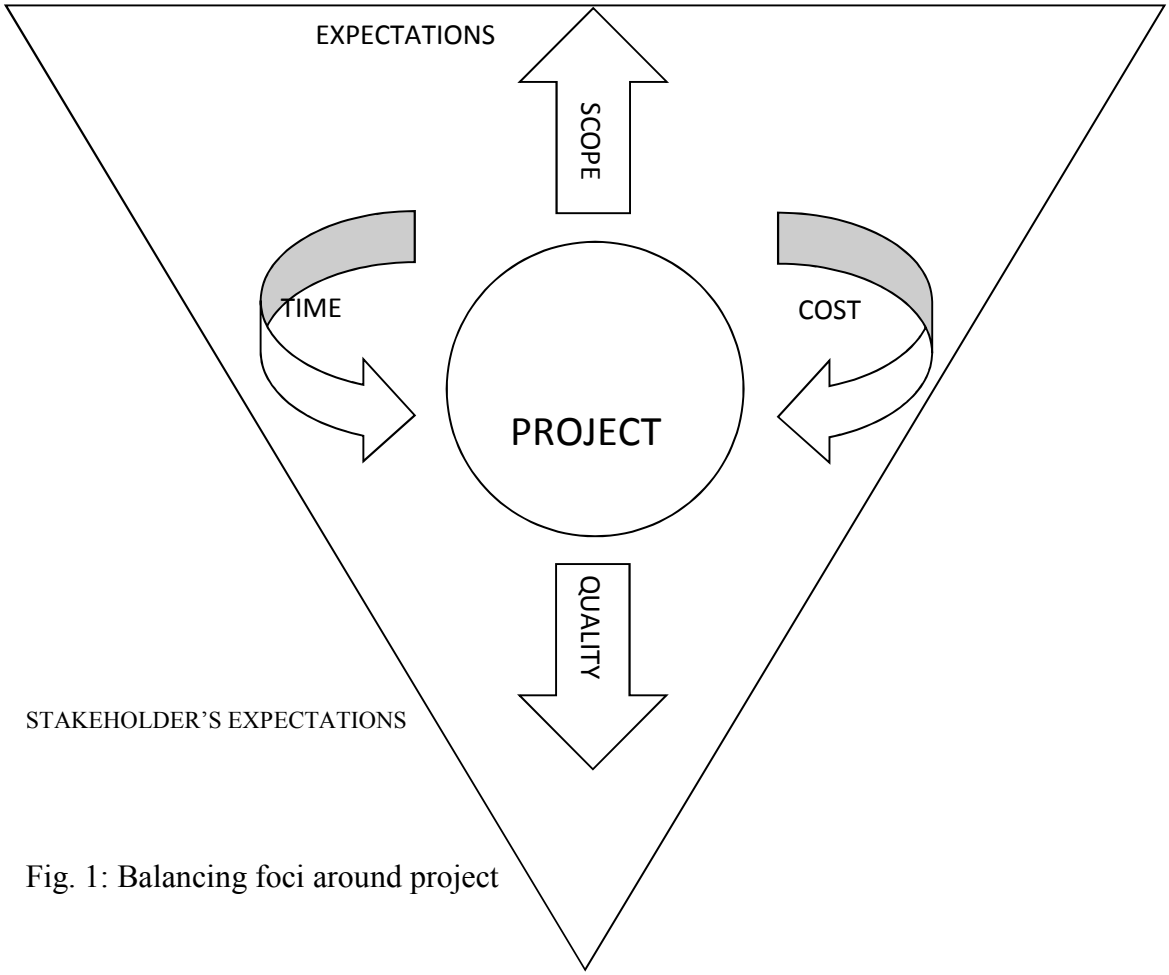


Fig. 1: Balancing foci around project

The foregoing discussion on balancing the forces around the execution of a project resulted into the two research questions.

3. METHODS AND DATA

The PMBOK Guide (2004) described quality planning as establishing what quality standards are relevant to the project and creating a road map toward achieving them. Kenneth (2005) called the process the bases on which quality is being planned and not an afterthought whereby it is inspected in the project. In other words, Instead of expending time on inspection and corrective action in the case of deviation, quality planning embraces using conformance to standard to prevent non-conformance and ensuring project delivery according to set quality standards. Whether quality planning is carried out before commencing or not on Olkiluoto 3 nuclear power plant project can be clearly discerned from the events on the project. The research methodologies employed on the this research work was targeted towards answering the two research questions.

3.1 Data Collection

The overall research method for this paper is majorly qualitative method whereby six major key personnel on the project are interviewed physically and interviewed questions sent to them from 1st to 14th October to answer at their convenience. The response came back within a span of two weeks. By key personnel, I mean project managers, project site coordinators, project planners/schedulers, subcontractors' supervisors, client's site managers and sub-contractor's site manager. In addition to the interview questions, I enclosed brief questionnaires with survey questions ranging from, communication, change order process, project task follow up process, progress reporting, material supply and expediting and improvement process. The intent of the survey was to confirm if there was quality planning included initially in the project as a case study and performance in meeting the expectations of stakeholders internal and external, direct and indirect, obvious and hidden.

A unique five point scale measuring frequency of occurrence of a hypothetical event was used to measure the level of quality planning, instead of Likert seven point scale, for the purpose of simplicity. The five point scale goes from very often (+2), sometimes (+1), coincidentally once (0), rarely (-1) and not at all (-2). The respondent's qualitative attributes with the questionnaires was reflected in the manner in which they added small notes in the italics like an explanation for the response given for each of the questionnaire's enquiry.

3.1.2 Historical qualitative data collected

Interestingly, there have been many well researched and written articles in the Finnish news media such as Helsingin Sanomat, Kauppalehti, Global nuclear news available on the internet such as Reuters, World Nuclear news, investigative reports from STUK and previously research work concerning the Olkiluoto 3 nuclear power plant project. These public information are the backbone of the empirical data for this research project. The substantial public information are validated by interviews conducted with key personnel on the project. Additional information gleaned from the interviews are reflected in form of derivatives of originally published information.

TVO made an application in November 2000 to construct Finland's fifth Nuclear Power plant. Finland's parliament approved the constructing of the Nuclear power plant in May 2002 to go into operation in 2009 by a vote of 107-92, and that is after about a decade of rejection of similar proposal in consideration of Chernobyl incident. The project, construction of the Nuclear Power plant is very crucial in relation to Finland's plans to achieve Kyoto target of reducing green house emissions and dependence on energy imports from Russian federation (Cabinet of Finland, 2005). The option to go by Nuclear plant was put forward by Finnish National Climate Strategy in 2001 with the high hopes in cheap energy and competitive energy production.

The location to situate the new Nuclear power was concluded in October 2003 to be in TVO's Olkiluoto island where there were already Nuclear plants OL1 and OL2

functioning there. Interestingly, Technical and Commercial tenders were submitted by viable contractors with various options of the nuclear power plant presented. The lowest bid which was AREVA's tender to construct 16MWe European Pressurized Water Reactor was accepted due to low cost of running this type of plant. The other tender bidders were General Electric in conjunction with ABB and Atomstroyexport a Russian Federation nuclear power construction company to be a key subcontractor (Ruuska et al., 2010).

The agreement for the construction of the European pressurized reactor was signed in 2003 with the consortium formed by AREVA and Siemens as the main contractor to be delivered as a turnkey project in the first half of 2009 at the cost of 3.2 billion Euro. Siemens's responsibility was to build turbines and generators and their respective buildings while AREVA NP will provide the reactor. The construction work did not start until 2005 after the owner TVO had cleared the site in order to make the site location ready for the main contractor. The goal post toward the starting commercial operation was shifted to 2010 (Ruuska et al., 2010)

There were quality and safety issues in the civil construction work resulting in further delays. The concrete base slab is one of the crucial parts of the project that should demand utmost quality attention with regards to its composition. Unfortunately, the subcontractor chosen to supply the mixture of the concrete was not instructed about the quality and nuclear safety culture of the plant nor possessed adequate quality management system to meet the requirements of the concrete slab. There was too high water content making the concrete too weak and porous. The problem was noticed during the poring of the concrete and the main contractor later changed the composition without informing the Finnish Radiation Nuclear safety Regulator (Greenpeace 2007).

The eventual cubes formed in the concrete base exposed the cover ups and as a result the concrete slab was declared invalid due to the fact that it was not fit for purpose. The reason was that it lacks strength, durability and resistance and its steel reinforcements susceptible to corrosive effect of the seawater. Due to the notion that the concrete

problem cover up took 5 months period before it was exposed, the main milestone was shifted till summer 2011, then till 2012 and further to 2013 (Vehmas, 2010).

Further, there was problem with the steel compartment structure which was to serve as a protective shield from radioactive materials leaking out to the environment in the case of unforeseen accident occurring in the reactor. The manufacturing of the steel compartment was sub-contracted to a German company but further sub-contracted to a Poland fishing ship yard that has no prior experience and information about the quality expected of the compartment. The quality requirement was later enforced on the sub-contractor. The resulting effect was poor welding of the seams, occasioned by obsolete hand welding method with a lot of non-conformance to quality standards due nuclear safety culture. The main contractor presented a non-conformance repair procedure to correct the defects (Greenpeace 2007).

Another quality issue resulting from the subcontractor not been briefed about quality criteria of nuclear culture and the site peculiar condition such as the wintery condition was also reflected in the re-work done by an Indian contractor on the generator concrete base after thermal expansion was included in the design of the base. (Helsigin sanomat, 2007) There were also quality issues with primary circuit and cooling that AREVA had to re-fabricate part of the reactor's pressure vessels. The supply of steam generators was also delayed because of quality deviations. Due to further non-conformances, Pressurizer parts of the reactor was without option of repair than to be re-fabricated and forged pipes with defects were as well re-casted (Greenpeace 2007).

Additional 700 quality and safety non-conformances were issued by Finnish Radiation and Nuclear Safety regulatory agency, STUK; some detected way past the time the quality offences were committed because they were usually kept away from the watchful eye of the client's representatives (Greenpeace 2007). The trend in the execution of this project is apparently familiar with delays. After the civil works have been completed and main reactor pressure vessel and steam generator installed with welding of piping for the primary coolant done, the main contractor tendered complain that the owner TVO was not forthcoming with regards to the approval of

instrumentation and control design package submitted. The complaint resulted into controversies thereby moving the plan to start operation of the plant till August 2014 (World nuclear news, 2012).

AREVA claimed that getting approval on the design of Instrumentation and control from STUK took a period of four years of exchanges between the contractor and the owner thereby resulting in further delays. The expected date for the commercial production was shifted till end of 2018. This particular delay was critical because it almost resulted into abandonment of the project site as the main contractor had to demobilize workforce from the site for a period lasting up to a year. The site construction activities resumed after the instrumentation and control design packaged was signaled to go further into construction.

3.2 Data Analysis

The data gathered on this research paper are basically qualitative; by way of interview and well reached papers but for the purpose of empirical analysis, the questionnaires enclosed to the interview question sent to the focus group was being analyzed mathematically using statistical tools such as mean value which will be expected value and standard deviation. The hypothesis to be certified by means of the expected value and its standard deviation is to mathematically verify whether indeed quality planning was not incorporated in the OL3 project as a case study.

The set of questions on survey questionnaires are designed to reflect whether or not quality has been planned at the inception of the project. Issues such as communication, change order process, project task follow up process, progress reporting, material supply and expediting and improvement process are essentials of quality planning in project management practice. Mirroring the research work of Dvir et al (2003) that dealt with measuring project success, the empirical values gathered is statistically calculated and the mean value is evaluated against the formulated range as follows ;

No quality planning	=	-1 to -0.5
Poor quality planning	=	-0.49 to -0.01
Moderate quality planning	=	-0.009 to +0.009
Good quality planning	=	+0.01 to +0.49
Total quality planning	=	+0.5 to +1

As can be observed in the ranges above, there is rather infinite range for the moderate quality planning because a slight thought of how quality can be managed at the inception of the project can make a huge difference in meeting up with other focal points such as cost, time, expectations of the project.

4. RESULTS AND DISCUSSIONS

The empirical data gathered from five point scale that goes from very often (+2), sometimes (+1), coincidentally once (0), rarely (-1) and not at all (-2) with a ten questions survey enclosed to interview questions sent to six major personnel who were the focus group on this research. In order to mathematically determine the level of quality planning at the inception and during the project, the range of survey questions goes from issues around communication, change order process, project task follow up process, progress reporting, material supply and expediting and improvement process which are essentials of quality planning in project management practice.

4.1 Presentation of quantitative results

The mathematical value obtained puts the mean or the expected value at -0.067. Recalling the formulated data analysis;

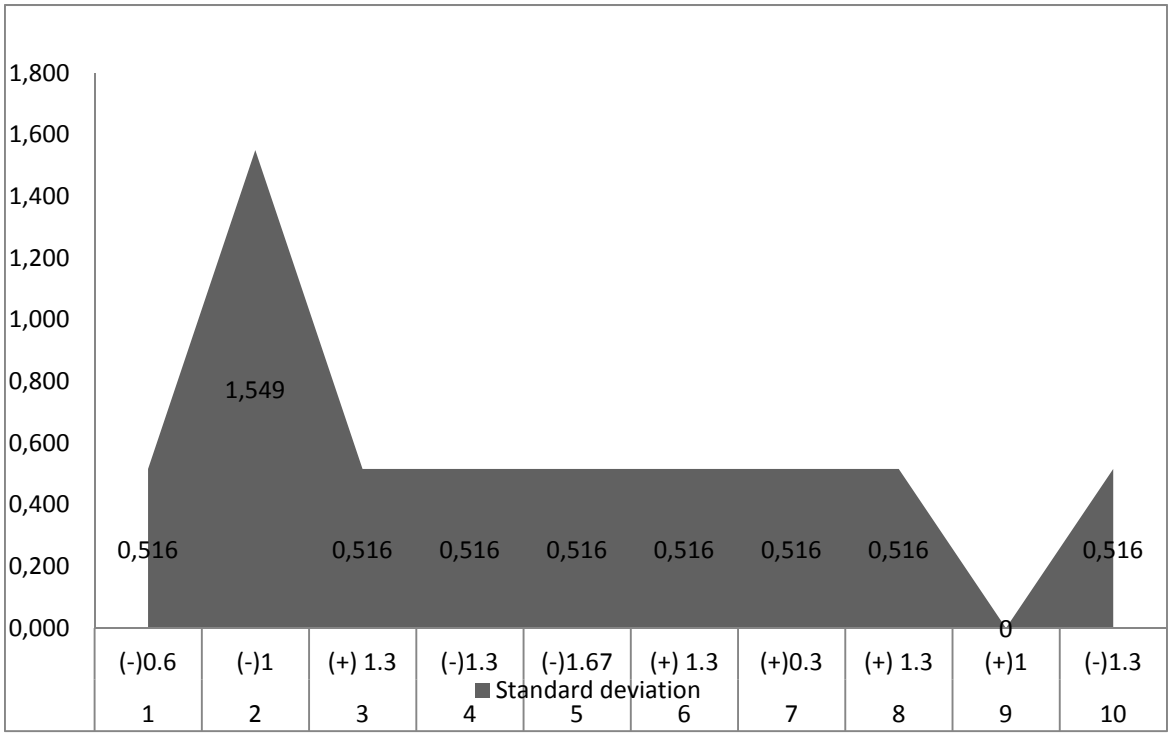
No quality planning	=	-1 to -0.5
Poor quality planning	=	-0.49 to -0.01
Moderate quality planning	=	-0.009 to +0.009
Good quality planning	=	+0.01 to +0.49
Total quality planning	=	+0.5 to +1

The mean value of -0.067 shows that there is obviously poor quality planning at the inception and during the execution of the case under study; the Olkiluoto 3 project. There is a slight silver lining in the result obtained because if there is no quality planning at the inception or during the execution of the project especially in the nuclear industry, everyone should be more worried about the eventual outcome of the project regardless of its more than a decade delay. The major concern would be the mishap that may come along during commissioning and running of the plant if it lacks any quality planning even later on during the construction.

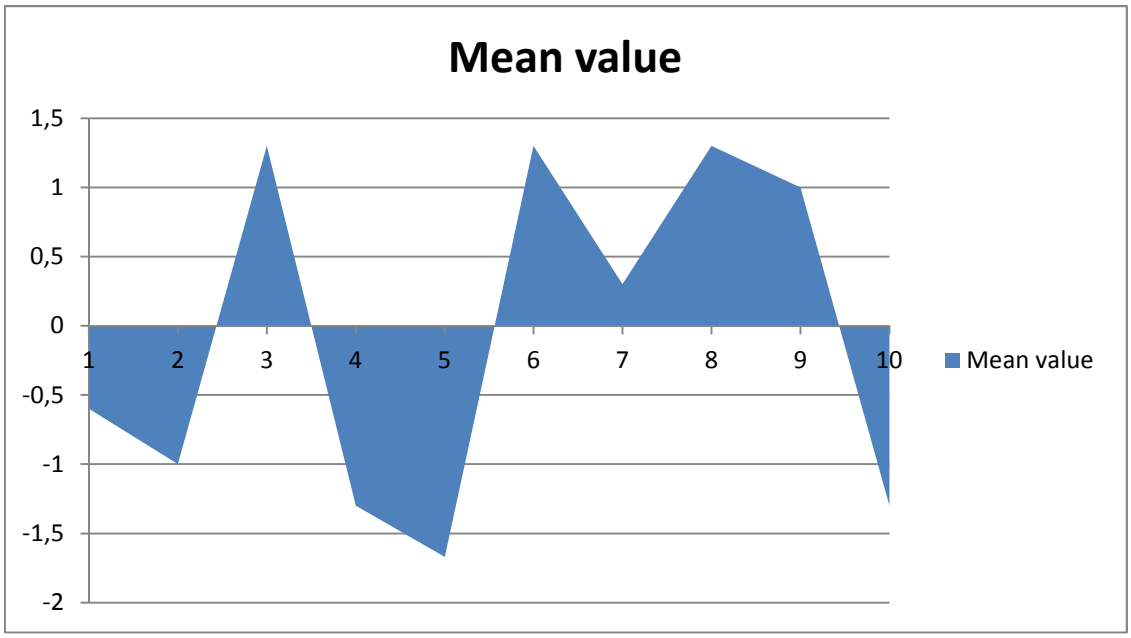
Table 1: presentation of data set

	Question	Respondent (N)	Mean value	Standard deviation
1	How often is information about project task communicated?	6	(-)0,6	0,516
2	How often are you notified when there is a slight change maybe in timing or approach in the information earlier passed	6	(-)1,0	1,549
3	Are you caught unawares about change in information?	6	(+) 1,3	0,516
4	As to intensity how can you evaluate positive change in the information flow?	6	(-)1,3	0,516
5	Are follows up usually carried out on the task assigned on site?	6	(-)1,67	0,516
6	As to intensity how can you evaluate the improvement in situations regarding follow ups?	6	(+) 1,3	0,516
7	How often do methods of follow ups used, achieved the purpose?	6	(+)0,3	0,516
8	Has there been situation where arrival of expected delayed thereby delaying some other aspect of the project dealing to milestone date changing?	6	(+) 1,3	0,516
9	Has there also been situation where materials received are not suitable for task at hand leading to waiting time for change of supplied materials?	6	(+)1,0	0
10	What is the intensity of occurrence of wrong materials received or delay at this time?	6	(-)1,3	0,516

The following is the area presentation Graph 1 of the standard deviation of the stakeholders' responses to the project management questions bordering on issues around communication, change order process, project task follow up process, progress reporting, material supply and expediting and improvement process. It can be observed that question on change order process is positive but largely deviated from ideal situation and the responses to question on material supply are negatively deviated toward zero. Indicating that delays experienced on the supply of materials largely impacted on the progress of the project.

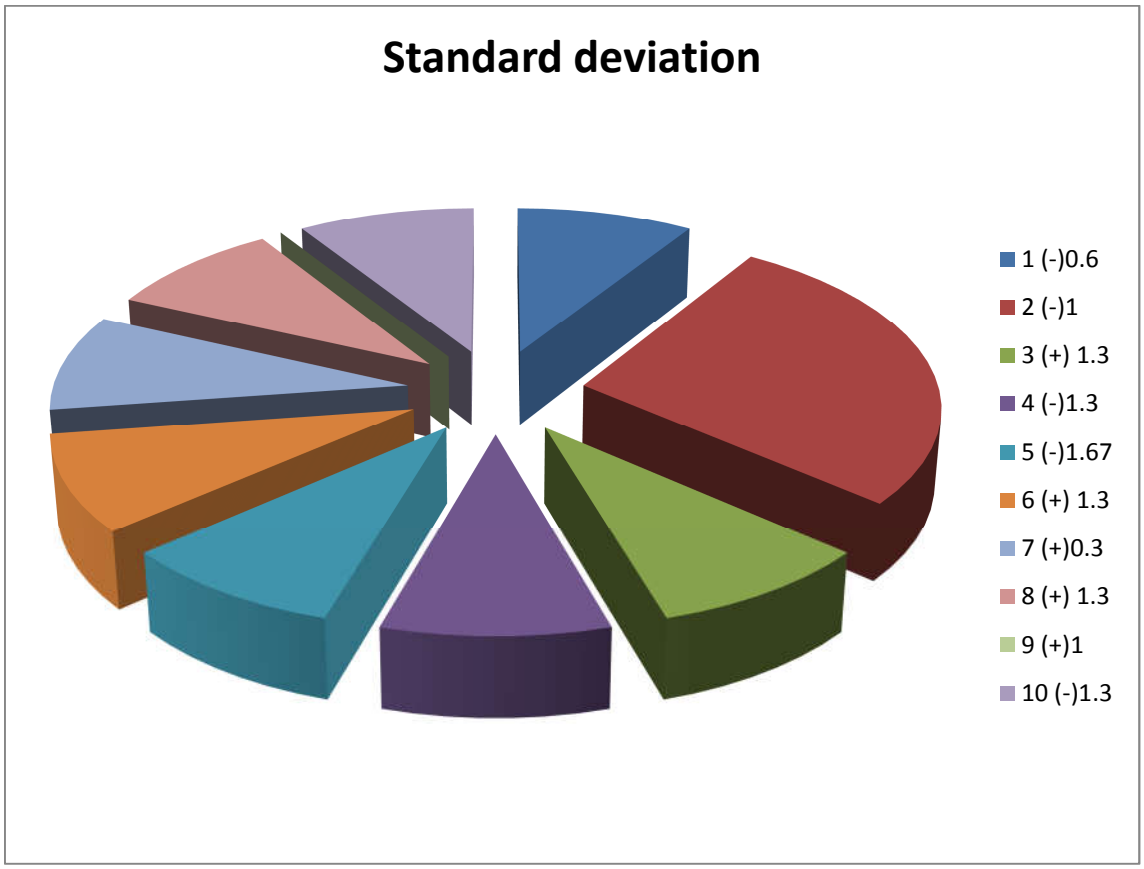


Graph 1. Area presentation of standard deviation



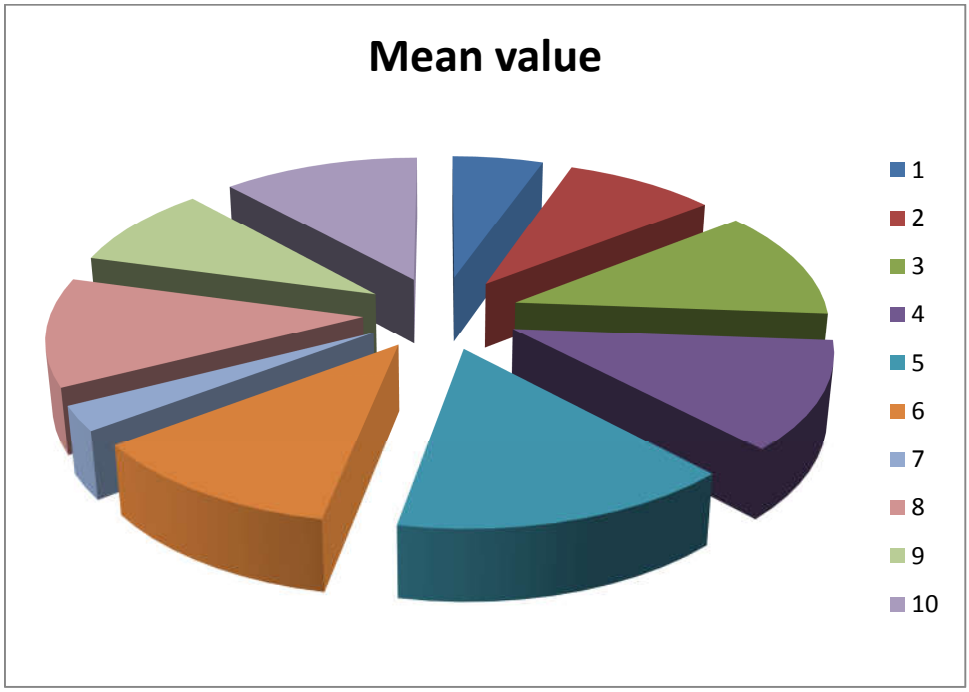
Graph 2. Area presentation of mean value

Due to the negative values of the mean on the responses of the focus group it cannot be area graphically presented together with standard deviation on area graph. The mean value on area graph is presented in Graph 2. The mean representation presents different aspect of the project such as communication which is at negative value of 0,6. It is an indication that there was communication problem on the project. It is apparent the project task was not often communicated or when communicated, proper style was not being implemented. Another problem of communication is gleaned from the area representation of the mean on question number 2 which is asking how often is notification circulated about change in the project task direction. No wonder, at some point the project lacked coordination as cultural impulses influenced project team member to work in a parallelism pattern leading to duplication of actions.



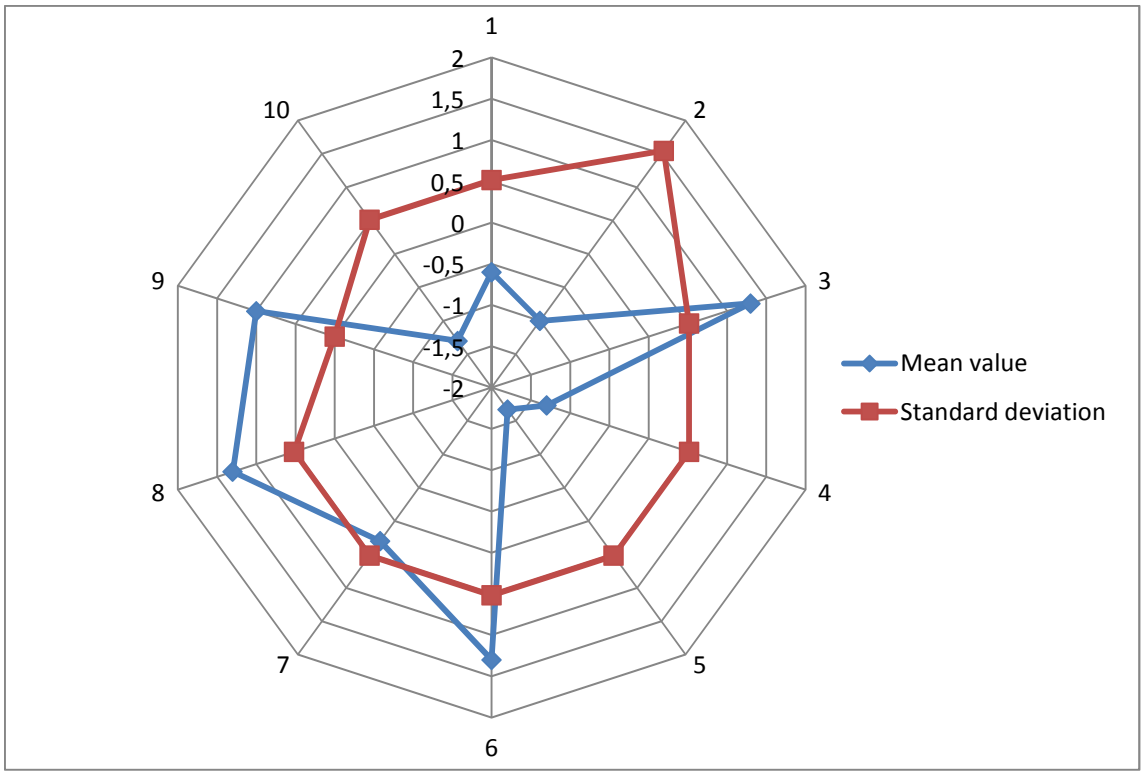
Graph 3. Pie chart presentation of standard deviation

The results can also be presented using pie chart in Graph 3. It also shows that the response to material supply which is number 9 and light lime green coloured is almost not found on the pie chart indicating that wrong supply of materials occasioned by basic problem of the project has resulted into extension of time to complete the project. Amazingly also is the largeness of the pie coloured brown on question number 2 bordering on change order process. The largeness of the pie does not indicate that change order process of the project is fantastic but how often does the change order has to be initiated on the project. The bountiful frequency of the change order process being initiated is a bad symptoms of inadequacy or no quality planning at all prior to commencement of the project. The 'nay' saying on the quality planning of the project does not spell out that change order process is not acceptable on huge construction projects, as it is part of project management processes. Rather, the existence of quality planning on construction project reduces to the barest minimal occurrence of change order process.



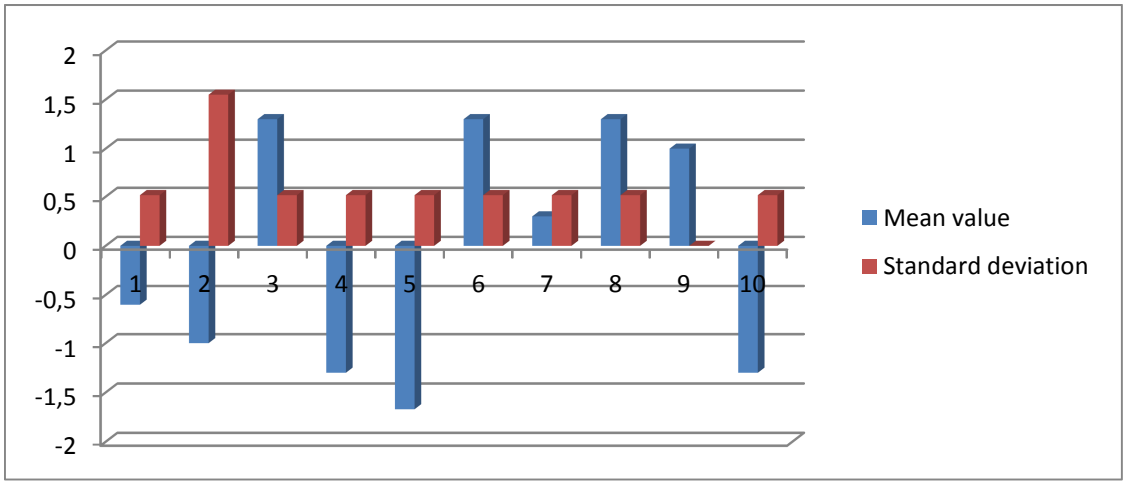
Graph 4. Pie chart presentation of Mean value

The result of the mean value of respondent responses can also presented using pie chart Graph 4 but it is not a true presentation of results because average negative responses are treated the same way as average positive responses thereby making glaring analysis of the results impossible. One excellent statistical research tool that I have found that is able to combine both the Mean value and the Standard deviation of this research on the same chart without interruption from one or the other is the Radial chart Graph 5 as below;



Graph 5. Radial chart presentation of Mean value and standard deviation

Also excellent and more preferable to Area presentation of the results of Mean value and Standard deviation together on this research work is the use of Histogram but in 3-D format Graph 6 as following;



Graph 6. Histogram presentation of Mean value and Standard deviation

As shown by Graph 6, the project team claimed to always be caught unware about project change in information as shown by question 3 with positive rise of response to the question. Also noteworthy is the average negative value of response to follow up carried out on site. Project expediting and follow up is an essential part of project management practice, especially when the project is meandering towards delays. The follow up frequency of the project is less than sufficient thereby leading to further delays on the project. As shown by the standard deviation about materials in question 9 , question 10 reflects the negative mean value of intensity of occurrence of ordering and supplying wrong materials on the project thereby resulting to delays occasioned by waiting to correct the anomaly and receiving new materials.

The positive aspect of the project as shown by the mean value is that there are improvement in the follow up pattern and intensity indicated by question 6. There are also visible results of the follow up intensity and pattern as shown by positive value of 0,3 for question 7. The mean value or average positive response to question 8 about delayed in material supply leading to change of milestone date is a clear indication that delays in supply of materials is one of the rudiment of the OL 3 construction project delays.

4.2 Presentation of qualitative result sets

As previous mentioned the focused group comprised of project managers, project site coordinators, project planners/schedulers, subcontractors' supervisors, client's site managers and sub-contractor's site manager. In order to avoid putting them on a spot light or pointing accusing fingers as to who is responsible for delays, I made the project stakeholders to understand that I am on their side of the issues because it has taken me one year to observe and understudy the reasons for the delays. During my pre-meeting with them, I assured them that regardless of my research questions, the purpose of the thesis is to emphasize challenges of delivering huge construction project such as Olkiluoto 3 against the back drop of negative stories that has been written so far on the project. The challenges of the construction project are inclusively discussed in the Theory section of the research work. In addition to the assurance at the pre-meeting, preface to the interview questions goes like this: "I am carrying out a research on project management practices in OL 3 and the purpose of the research is to promote improvement in methods of operation on the site from what it used to be to what it is now thereby leading to completion in sight. The research is only for educational purpose."

The responses of all the correspondent are somewhat similar and are therefore summarized under each question;

Question 1: Was there any Technical bidding and selection process carried out on the contractor and sub-contractors at the inception of the project or what method was used to select contractors?

Summarized responses:
Yes, by technical bidding and strategic selection, especially for complex topics with several possibilities and opportunities that can optimize the technical solutions (in terms of impact) with consideration also of cost and schedule impact.

Question 2: Do sub-contractors fully comprehend the terms and delivery time of the deliverables at time of contract awardance?

Summarized responses:

Few amazingly responded yes, just because of their area of specialization, while majority acknowledge that not all cases that subcontractors understand what is expected of them at the time of contract signing, as some of them do not have specific experience of working on Nuclear Power Plant Construction. Another responded this way: In most cases NOT due to different reasons (few items to mention):
7.1 Technical difficulties during the process including quality aspects.
7.2 Interface with different entities which not at the control of the sub-contractors

Question 3: On this type of project, it is important to carry out follow ups on the assigned task of the project, what kind of follow ups and expediting of milestone's action was done by the contractor?

Summarized responses:

Yes, it is important to carry out follow-up. Contractually, the (sub)-contractors are meant to fulfill milestones.

a. Progress follow-up, 4 weeks look ahead, working hours follow-up
b. Regular progress reporting
c. Regular meetings/ monitoring are being organize to follow the status, If there are any difficulties
d. Time schedule is one of the key tools to assess the status.

The main client representatives categorically stated that the project owner excluded itself from expediting follow up of the project progress as the project terms is turn key project delivery. The implication of the action is that the client remain dormant until the contractor is ready to handover the completed project even if it takes additional 5 years.

Question 4: Does Socio cultural method have any impact on the follow up style of the contractor ?

Summarized responses:

The response to this varies in that some acknowledged that it impacted negatively to some extent but leaving behind learning grounds for parties involved. While some are of the opinion that the impact is positive as there is set template which is part of the contract on the project; various parties had to align their various cultural methods accordance to the template.

Question 5: How is the initial milestone compensated while dealing with quality issues that sprung up during execution of the project?

Summarized responses:

Safety and Quality are the "main" priorities of the project over cost and time schedule. Indeed the initial milestone has been re-forecasted but "intermediate" milestones has been set to compensate and record significant progress that supports the global view of the project. The initial milestone compensated by increasing number of manpower or increasing working hours but unfortunately this action did not impact considerably on the schedule of the project and as a result the whole time-schedule is extended accordingly.

Question 6: Did the eventual project issues leads to temporary abandonment of the site and how was the site resuscitated?

Summarized responses:

In 2014, there has been a demobilization of Construction phase. This is to focus on I&C Engineering completion which is the Critical path of the project during that time.In 2015, The construction has been set to full-blast again in response to all engineering

solutions/completion that has been carried-out. And sometimes Contractor's activities can be suspended due to major interfaces in particular working area.

Question 7: Suitable materials and tools are the life blood of project execution. Has there been situation where arrival of expected materials delayed thereby delaying some other aspect of the project dealing to milestone date changing?

Summarized responses:

Yes, it is very common for major projects but in order to reduce the impact the following are being considered:

a. Implementation of temporary solutions/installations
b. Change of strategy (scenarios/ sequences)

Question 8: What are the project challenges that resulted in to further project delays and changing of milestones' date from 2013 till date?

Summarized responses:

Quality issues, Safety accidents or events, need to carry out various Nuclear Culture and Safety related trainings, outage related delays causing schedule slippage. Communication on site not sufficient, which results in uncoordinated works, which delays or blocks the companies and the progress.

As the project is moving forward to different phase, the stage of challenges is adapting as well. The project is today not in an "IDEAL" stage but it is in a more "COMPLEX" stage (Co-Phase Activity) that manifested difficult and new challenges.

Question 9: Achieving quality requirements of a project takes into account satisfying the customers both contractual and perceived as follows; (A) TVO (B) Finnish Nuclear safety regulator (C) Future electricity consumers(D) The media/press (E) The

environment. In the order of most important customer to the least important, kindly list the letters of customers to satisfy in the delivery Olkiluoto 3 NPP:

Summarized responses:

B A D C E

4.3 Derivatives

After presentation of the quantitative and qualitative data set gathered, at this point I address the two research questions and consider the derivatives. The first question that borders around the essentials of construction project delivery such as performance criteria (quality) time (tight schedule), competitive budget (cost) and scope goes as follows;

Question 1: What is the implication of not factoring performance criteria (quality) in the planning stage of the project while time (tight schedule), competitive budget (cost) and scope are considered?

Undeniably, quality planning which is a part of quality management system under study in this research work was not undertaken at the start of the project but was being inspected in. The evidence was seen in the sub-contracting system whereby information regarding nuclear building quality standards and nuclear safety culture were not transferred to the sub-contractor nor do the sub-contractors demonstrated abilities to abide by the standards. In addition to these quality standards, Olkiluoto 3 project site has special condition in relation to the wintery weather and the bed rock that must be put into consideration while determining its quality specification. The nuclear quality standards and the site's special weather condition occasioned specification requirements which were later enforced on the sub-contractor at no compensating cost.

Further evidence to prove inadequacy of quality planning at commencement can be gleaned from the interviews conducted with the stakeholders. One question asked during the interview was: what are the project challenges that resulted into further delays beyond year 2013 till date. Quality issues were paramount in the responses. The quality planning was inspected in as an afterthought not planned. Nuclear culture and safety related trainings were organized half way through the project. The resultant effect of sparseness in quality planning occasioned inclusively a decade long delays on the project and cost over runs . As aforementioned a deviation in one of the foci of the project will result into a deviation in one or more foci of the project.

Inferably, the deviation in the quality planning on the Olkiluoto 3 nuclear power plant construction project has resulted into a deviation in timing (schedule) that a project planned to be completed in 2009 is to be completed in 2019 and a deviation in cost in that the project value at 3.2 billion Euro is more than 50% overrun (Les Echos, 2009) and still counting. Sears et al (2015) rightly stated that uncertainties which are much familiar with especially construction projects does not rule out the necessities of quality planning but the level of quality planning will rather serve as the basis for either project success of its failure.

In application of ISO 10006, Tuominen et al. (2003) categorically stated that the originating organization which in this case is the main contractor is responsible for development and maintenance of quality management system and its continual improvement. Conversely, the absence of quality planning apparent in the way sub-contractors executed their project task is occasioned by the main contractor's culture toward quality planning. For example, Lausitzer Stahlbau Ruhland GmbH & Co. KG is modifying many of the structural steel structures and loading bearing structures just because they were not manufactured according to detail design. Adequate project management practice demands proper change management process that if there were reasons for deviation from approved detailed design it has to be reviewed for approval before they could be accepted as-built situation. From experience, there should have been, quality control inspectors on site that will issue non-conformance ticket and will put the progress of the job task on-hold until corrective actions are proposed and applied

accordingly (Adefolalu, 2013). It is never an ideal project engineering practice to accept non-conformance as as-built without proper corrective action procedure before accepting the deviation.

Regardless of the fact that the project has been delayed for a decade, the main contractor needs to be credited for its resilience to complete the project regardless of the challenges. As project issues evolve, management of AREVA work out details to overcome the issues. It takes into consideration time management whereby intermediate milestone are planned to be executed parallel thereby bringing critical path of the project to progress. The efforts in reducing the period of time for some sub-contractor project tasks has resulted into frequent revisions of task schedules on the overall project plan. Sears et al. (2015) rightly noted that when project execution is falling behind schedule there will be attempt to haphazardly expedite all ongoing project tasks in the attempt to cover up lost time to the point that there will be no means to differentiate what project activities requires control. This anomaly will only result into additional cost being expended on the project with no significant effect on shortening the delivery time of the project.

Unfortunately, there was similar situation on Olkiluoto 3 project site where all project activities were expedited by workers working more than 8 hours each day and sometime weekends. In addition, there are double shifts being run on the site in other for the project time delivery to be shortened. The sub-contractors were also mandated to work overtime, employ additional workers and more equipment in order to expedite their project activities. The expediting style on site as implied by one of the stakeholders had been like solders on the battled field that will hurry to move to another location only to wait for another emergency. The inadequacy in the control of expediting actions on project activities will only result into project overrun.

Consequentially, based on the terms of construction contracts, the client can impose an agreed project completion date on the prime contractor and failure to meet the contractual time requirement will put the main contractor in breach of contract and make it liable for any damages resulting from delays in the delivery of the project (Sears

et al., 2015). For every year of the delays at a price of 30 Euros/MWh of electricity, the Olkiluoto 3 nuclear power is losing 400 million Euros that it is supposed to be producing (Greenpeace, 2007). During arbitration proceedings with the International Chamber of Commerce the client TVO has therefore made a claim for damages due to the delays caused by the prime contractor in the sum of 1.4 billion Euros while the contractor made a counter claim of 1.9 billion Euros because the client was not forthcoming in the approval of instrumentation details and agreed cooperation during the final phase of the project (World Energy News, 2013).

4.3 Derivatives on meeting stakeholders expectation

Question 2: Can stakeholders' expectation be met while fulfilling quality performance criteria of a project?

Derivatively, meeting stakeholders expectation is a quality function as it is part of both quality management system (QMS) and total quality management (TQM) requirements on projects. Therefore, when a project fulfilled it quality performance criteria, it will on a large scale meet its stakeholders expectation. Regardless of how numerous and changing project stakeholders expectation might be, their baseline is the quality performance of the project and that it satisfactorily serve it purpose.

Since meeting up project stakeholders expectation is a quality performance criteria and the case study project fair badly in the quality planning of the project, the stakeholders expectations were not met. The arbitration proceedings between the client and the main contractor further indicated that the expectation of the primary external stakeholder; who is the main financier to the project has not been met even as the main contractor struggles to close out most of the open points of the project due quality performance requirement. The present internal stakeholders now on site may not be bordered about meeting expectations because the eventual cost of the project delays will be bored by the main contractor and the client. Similar conclusion cannot be said about sub-contractors whose contracts were short-lived or struggled to deliver due to expected

nuclear safety quality requirement not being communicated at inception of their project activities.

Commendably, as reveal by one of the stakeholders, the contractor at moment has kept an open budget in order to encourage various internal stakeholders and remove any constraint towards closing out their various project activities before the year will end. The idea of open budget is regulated by the contractor's supervising managers in order to forestall inflated resourcing and further project overrun. The hidden stakeholders such as Finnish nuclear safety and radiation regulatory agencies undertook 'fast track' licensing of design and safety document (Greenpeace, 2007) towards the construction of the nuclear power plant but other hidden stakeholders such as the pressure groups are unrelenting complaining about the errors in the decision to go ahead in the commencement of Olkiluoto 3 project. Other hidden stakeholder also includes the consumers of electricity who have to bear the cost of the delays in the finalization of the project; in the form of increasing cost of electricity.

While the Olkiluoto 3 nuclear power plant struggles to meet the quality criteria expected of nuclear safety culture as the project is gradually winding up, it is also important for the project players to assess the level of meeting stakeholder's expectation. At this point of the project, I will suggest that the project players employ public relation strategy as the project usage concerns the general public and their level of satisfaction will go a long way in either adding and further reduction of the main contractor's and the client's reputation. The public information available in the media demonstrating what is on the mind of the populace did not present the project relation and even the eventual project outcome in a good light.

The public relation strategy might encompass what Pernille et al. (2013) called impersonal push communication whereby posters, electrical display media, broadcast, newspapers and offer for excursion on the project come handy. A well confounding but honest story about the project describing how it all started, challenges along the way, how they were managed. What has been put in place to make the construction project outcome safer that will defray any fears regarding nuclear disaster when the project

starts the commercial production of electricity. Pernille et al. (2013) also suggested using merchandise such as T-shirts or other valuables with the project signs but supported with appealing and motivating stories to sensitize the acceptance of public stakeholders on the project. The merchandise should possess attractive usage for particular interest group and in tune with the project theme. For the stories to catch the interest of the public stakeholders, it needs media professionals to edit the stories towards convincing and enhancing their acceptance of the project.

The use of carefully edited media can be impersonal push communication method with no particular stakeholder in mind but can be useful in creating awareness, preparing possibility for acceptance of the project deliverables and outcomes (Schiffman and Kanuk 2009). Even if the promised outcome of the construction project is not accepted by the general populace, the awareness created in their minds can eventually leads to acceptance of project outcome. Such dramatic change can result due to repetitive persuasion through the media and gradual but unnoticeable change of stakeholder's attitude. The strategy is usually employed by the world of advertisement whereby constant exposure of consumers mind to product or service can influence and change the interest of the consumers that something originally disliked by the consumers later becomes something appealing in the long run.

Also effective and more influential method of communication is interpersonal or face to face communication (Daft and Lengel 1984). This method of person to person communication can take place in the same room or through use of media such as telephone, audio and video conferencing to the point that common understanding on information can easily be obtained (Pernile et al., 2013) For example in a meeting whether physically or by media, concerns and question can be raised about outcome of a construction project but those can easily be cleared in the same meeting with the use of an effective moderator of the meeting. Inferably, the result can be impressive both when carried out physically such as in meetings, training and pep-talk sessions and virtually such as using email, direct letters, and video meetings.

Regardless of the fact that interpersonal communication can be useful for maximizing understanding and obtaining feedback on information passed, it possesses its drawbacks. The drawback is the relatively heavy resources involving people and time expended to set up and schedule meeting with the stakeholders and engaging them in a quality interaction with the aim of answering their question. Even if the social media forum such as Twitter, Facebook (Pernille et al., 2013) or Instagram is used to dispel stakeholder's fear about outcome of a project, the downside involves the demand for mental and physical preparations, efforts and time expended to ensure that the project stakeholders are convinced beyond any doubt regarding their concern on the outcome of the project. Such is needed in the case of Olkiluoto3 where the stakeholders consider the outcome to be precarious with regards to nuclear safety.

Communication is highly important and can make a difference in determining whether a project is a success or failure and makes a difference in achieving stakeholders' expectation. All communication need to be followed through; that a project has progress to advanced stage and about to be completed does not imply that stakeholders expectation has been met (Worsley, 2006). Effective communication is one of the top key factors for successful project management (PMI, 2016). So on Olkiluoto 3 nuclear power plant construction project, communication can aid meeting stakeholders' expectation and same time signify success on the project.

The hidden stakeholder that is the electricity consumers are losing because the Finnish state has to continue importing energy from Russian Federation generated from coal during the period of delays and buying carbon emission credit in order to fulfill Finland's Kyoto target (Greenpeace 2007). The delays in the delivery of Olkiluoto 3 nuclear power plant cost electricity consumers three billion Euros at shared population ratio of 600 Euros per person (Kauppalehti, 2007). At early stage of the delays, the Finnish government increased the allocation of free CO_2 emission credit to Finnish power plants and industry by 13Mt at a price of 20euros/tCO_2 and amounting to 260 million Euros (Finnish Trade Ministry, 2006).

It is apparent that meeting stakeholders expectation on technological or construction project are usually ignored or very limited compared to socially inclined project as the project will be more concerned about delivering the deliverables and completing the construction according to contractual terms agreed with the client. Socially inclined project such as deforestation, immunization against suspected diseases, building roads or trams etc have requirements interpreted by stakeholders' expectation. While technological and construction project have requirements interpreted by quality performance and expectations of solely the client. Worsley, (2016) remarked that it is hardly astonishing that the two type of project settings (socially inclined and construction) are on the same playing field; they both executing project and striving to meet stakeholders expectation. The added advantage of Olkiluoto 3 nuclear power project is that it will perform social function and is at the same time a technological construction project; emphasizing the importance of meeting stakeholders expectation while achieving its performance criteria.

Noteworthy is the way the client's and contractor's relationship is being managed regardless of long-running dispute over cost over runs, setbacks, site demobilizations and delays. The methods used in their dispute resolution is not part of this research but the two major parties on the project decided to put problems aside and agreed on settlement of 450 million Euros to be paid by the contractor; consortium of AREVA and Siemens as compensation for damages due to delays. The client on the other hand promised up to 150 million Euros as incentive payment to the supplier consortium companies (World Nuclear News, 2018)

4.5 Reflections

Managing a project is not as easy as embarking on a journey from point A to point B in as much as one has a very good car and there is enough gas, otherwise everyone can be a project manager if there were no challenges; especially a mega project like Olkiluoto 3 in Finland. Projects involving construction can be complicating, time-demanding due to influences of unforeseen variables and uncertainties. Inherent complications of

construction project according to Sears et al (2015) included weather, site topography, soil test parameters, supply of materials, material and human logistics, site utilities and services, labour demands, specialty of sub-contractors and level of availability of technical know-how. If these complexities are not properly researched and managed, they might result into project over run and delays.

Construction projects are complex and time consuming undertakings.(Richard et al., 2015) It is fair to say that no one can easily forecast accurately issues that will come up when a planning a project and will be able to allow enough contingency to compensate the issues. No planner can anticipate adverse weather conditions, material delivery delays, labor disputes, equipment breakdown, work incident/accident and change order situations (Sears et al., 2015). No wonder, promised project delivery dates are speculated using assumed ideal conditions. Sears et al. (2015) further noted that at the time of project bid, the contractor will not have accurate forecast of project duration nor will be able to single out critical activities. This is the case with Olkiluoto 3 project which was forecasted to be completed in four years under a tight schedule.

Construction project especially in industrial field of power plant and in multi-cultural sphere is a complex endeavor whereby even two similar projects cannot be run in the same way. The fact is; each project is unique with different challenges. Lessons learnt from previous similar project can only be applied to be better prepared when running subsequent projects. Olkiluoto 3 nuclear power plant project executed during the time when there had been stagnation in nuclear construction experience resulting into lack of expertise and competent companies; went through many project challenges peculiar to construction project. Multi-national nature of construction projects can be managed as stated by Tuominen et al. (2003) when project teams takes into account different cultures of the customer, partners and other stakeholders working on the project.

Basically, stakeholder's expectations are enlisted in the contract and transformed into requirements (Tuominen et al., 2003) Inferably, when a project is executed according to scope, delivered as scheduled, run within budget in relation to contract price and according to quality; performance criteria, it is certain that stakeholders' expectation

will be met. Indeed, meeting stakeholders' expectation is a possibility, regardless of circumstances such as weather or nuclear industry, Even negative stakeholders whose interest on the project was that it should not succeed (Albert, 2005) will be silenced when there is positive dividend of the project and their expectation will be defeated. There are downside in trying to persuade these type of stakeholders. While using modern technology and heavy resources involving people and time, the disinterested stakeholders may not pay attention to the efforts to convince them. The stakeholders' unwillingness to pay attention will make the project team to be resourceful in expending their effort to persuade them. Structured knowledge about the stakeholder will put the project team in better position of being equipped to meet their expectations (Pernile et al., 2013)

A comprehensive project quality planning takes into consideration the identification of stakeholders and their expectations and maneuvering pathways to meet these expectations. Rightly stated by Kenneth (2005), stakeholders are sources of requirements that must be met for project success. Management of project organization ensures that stakeholders' needs and expectations are taken into consideration when making plans for the project (Tuominen et al, 2003). Otherwise, the project plan will lead to undesirable direction (Kenneth, 2005). It is therefore important that steps toward identifying stakeholders' expectation and prioritization be completed early in the project, prior to project plan or design completion.

5. CONCLUSIONS

An effective construction project management start from inception in that the factors that will make it a success in achieving score card performance level are planned at the project initiating phase. Right from the project tendering process, issues about quality criteria of the project and how to achieve stakeholders expectation should be paramount in the action of the project players. These should be apparent in method of contractor's selection, information and training given to sub-contractors, communication style with the stakeholders, project site organization and type of human capital invested in the project.

The Olkiluoto 3 construction project has many challenges ranging from unfamiliar territory, numerous expectations, communication debacle, cutting edge technology, collaboration problems, selecting sub-contractors based on claimed specialty, procurement of special items, and close to accurate estimation of project completion date. Regardless of these challenges discussed in this theses work, project delivery success is still possible with prior strategic quality planning. The quality planning can go a long way to mitigate any unplanned surprises that is peculiar to huge construction project.

The multi-national nature of the project site undoubtedly impacted on the site but the management of the risk posed by multi-cultural and multi-language clashes is worthy of applause. Regardless of the more than a decade delays, the credible organization of workers group based on their language and their interfaces is one lesson that can be drawn out from the project site and transferred to similar international construction site. The effect of multi-cultural clashes is also apparent in the relationship of the client and main contractor but their resolution of the project issues is a reflection of the cooperation between the European union member states.

5.1 The effect of quality planning on the construction project

While planning for a project is essential to strategize on how project performance criteria will be met. Time, scope, cost and quality are foci to project delivery and are so interconnected that changes in one will result into change in one or more than one. The lack of plan for quality on Olkiluoto 3 project under a tight schedule and attempt to cut down on cost because the contract price was minimally under estimated , has been an excuse for the main contractor to select less expensive and less competent subcontractor to carry out project activities. When selecting the subcontractors, requirement on quality and safety deemed nuclear safety culture was not included in the selection criteria and neither was training on nuclear safety culture given to workers until towards the end of the project These had resulted to many quality problems. While correcting the quality non-conformances required additional cost, the project cost went into cost overrun. Ultimately, it took time to carry out various rework on the project which has cumulatively resulted in to more than a decade long delays.

The unpreparedness for quality is also evident in the non-finalization of design before commencement of construction phase of some part of the project which resulted into near abandonment or demobilization from site. These resultant effects of commencing construction before approval of designs of critical part of especially nuclear power plant project should discourage repetition of the practice on subsequent project such as Olkiluoto 4 project, if it will be approved.

5.2 Stakeholders' expectation

This thesis work considered meeting stakeholders expectation because it is part both QMS and TQM requirement on projects. A successful management of stakeholders expectation starts from identifying who are the stakeholders on the intending construction project . The identification of project stakeholders should take off before the commencement of the project in order to ensure that there is no disgruntled stakeholder at the completion of the project. Project stakeholders is not only the client

or financier of the project but also includes others who in one way or the other the influences the delivery of the project. Project stakeholders can be primary or secondary stakeholders, can be hidden or visible stakeholders and can bolster great impact on the successful completion of a project. Derivatively, sub-contractors, suppliers or government agencies are part of project stakeholders but project team members are not part of project stakeholders. The frequency and style of communication are very important in meeting stakeholders expectation .

Since meeting up project stakeholders expectation is a quality performance criteria and the case study project fair badly in the quality planning of the project, the stakeholders expectations were not met. No wonder there were several disputes and dispute in court of arbitration between the primary stakeholder and the main contractor. Even the identifiable secondary stakeholders like the customers who are paying higher price on electricity and energy needs due to the delays, are disgruntled.

5.3 Further research

This research work has only examine quality management planning as a function of project management practice on Olkiluoto 3 nuclear power plant and has under study meeting stakeholders' expectation while managing client's and contractor's relationship when the project was delayed and near abandonment. Using the Olkiluoto 3 project as case, the Thesis work is leaving opportunity for further research on : (a) what typical total quality management system applicable to nuclear safety culture and peculiar to Finland weather should be applied to the project and similar construction projects and (b) methodology in conflict resolution on international construction project contract especially when contract's relationship involve European union member state while not disrupting European integration. Another research work can carry out survey on the level of meeting stakeholder's expectation on Olkiluoto 3 as this can be ascertained after the project is delivered

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7. APPENDIX

Questionnaires for focus group on Project Management Practices in OL 3

I am carrying out a research on project management practices in OL 3 and the purpose of the research is to promote improvement in methods of operation on the site from what it used to be to what it is now thereby leading to completion in sight. The research is only for Educational purpose.

1) Communication is a very important part of project delivery. How often is information about project task communicated?

very often [ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

2) How often are you notified when there is a slight change maybe in timing or approach in the information earlier passed?

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

3) Are you caught unawares about change in information?

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

4) As to intensity how can you evaluate positive change in the information flow?

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

5) When project specific tasks are itemized and agreed, it is important to do follow ups to ascertain completion and compliance to expected time, quality and safety. Are follows up usually carried out on the task assigned on site?

very often[ ] sometimes [ ]coincidentally once[ ] rarely [ ] not at all[ ]

6) As to intensity how can you evaluate the improvement in situations regarding follow ups

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

7) How often do methods of follow ups used, achieved the purpose?

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

8) Suitable materials and tools are the life blood of project execution. Has there been situation where arrival of expected delayed thereby delaying some other aspect of the project dealing to milestone date changing?

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

9) Has there also been situation where materials received are not suitable for task at hand leading to waiting time for change of supplied materials?

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]

10) What is the intensity of occurrence of wrong materials received or delay at this time?

very often[ ] sometimes [ ] coincidentally once[ ] rarely [ ] not at all[ ]