

## CHAPTER 4

### 4. CASE STUDY FINDINGS, ANALYSIS AND DATA REPRESENTATION

A variety of data have been used to derive the findings presented in this paper, which include interviews, observations, illustrative materials (e.g., newsletters and other publications that form part of the case study organization's history) and past project management documentation. The authors have extensive industrial experience in the manufacturing industry and have used this experience, together with a pre-defined interview protocol, to determine the data needed for the research.

Numerous secondary data sources were also used, such as man-hour reports, stationery expenses reports, archived documentation and filed accounts that were later transcribed. The findings are subsequently presented using a narrative mode of analysis, which has over the years become popular within the field of IS (Orlikowski & Baroudi, 1991; Walsham, 1993). Hence, given this contextual background, the case detail is now presented.

#### 4.1 Findings from Interviews

Interviews were completed with several interviewees during formal interview and also informally during observation period. All important answer during interview were recorded and transcribed. The

transcribed were then organised according to 3 main Propositions as stated in previous topics.

## **4.2 Interview Findings**

According to the above proposition, (Irani & Love, 2001), has identified sub-item which can be sub classified as interview questions. The interviews started by introducing the interviewer. The interviewer will then explain the objective of the interview session. To ensure interviewee fully understand the objective of this case study, interviewee will be briefed on the current literature of EDMS both in the literature review and on EDMS implemented in RNZ.

The interview question is outlined as in following paragraphs.

## **4.3 Proposition 1: Strategic Benefit Questions**

There is a need to know whether the EDMS provides strategic benefits to the organisation. Please explain on your own view whether or not it meets the Proposition 1 benefits.

The interview session will be guided according to each of the following taxonomies:

1. Improved Growth and Success
2. Leader in New Technology
3. Improved Market Share
4. Market Leadership
5. Enhanced Competitive Advantage

Based on the above taxonomies, interviews were conducted against the above topics and interviewees will have to explain on how the EDMS can benefit the company based on the taxonomies.

#### 4.3.1 Improved Growth and Success

*Chief Executive (CEO):* The CEO shared his views on the EDMS potential; he mentioned that EDMS should become one of the vehicles to drive the company growth and success by minimising documentation discrepancies and ensuring project completion and meeting its deadline.

*Lead Engineer (LE):* The LE sees EDMS contributed into big potential to company growth and success as he explains that EDMS can provide more structured filings in-terms of softcopy material and speed up the process of developing new designs.

*Director of Project Services (DPS), Chief Information Officer (CIO), Chief Financial Officer (CFO) & Document Controller (DC):* view that Current EDMS in RNZ actually contributed to additional business process in RNZ operation and should create a big resistance to company growth.

*Analyses:* EDMS supports the company strategic benefits by eliminating document discrepancies and provide more structured softcopy filing for an organisation. EDMS should provide a simplified

business process rather than add additional work flow to the current business process. Strategic benefit towards company growth and success can be materialised when EDMS contributed to more project success and minimised operational errors.

#### 4.3.2 Leader in New Technology

*DPS:* DPS mentioned “EDMS are quite common in this industry, current EDMS we have is no different than our competitors. To become new technology leader we need to have something really efficient and very different from others”. DPS also mentioned that people will only recognised the system used after they managed to integrate with the client and influenced other competitor to use similar system to improve the backward integration introduce by the client. Current EDMS does not provide integration both in vertical and horizontal integration.

Whilst other interviewees did not give opinion on how EDMS can contribute towards becoming Leader in New Technology.

*Analyses:* EDMS in RNZ showed a very vague picture towards contributing benefit towards making RNZ a leader in technology. To ensure a company to become a technology leader, RNZ need to have a state-of-the-art of EDMS system at which, the EDMS must be efficiently manage documents towards achieving the company objectives. The EDMS must also provide an open concept where it can be easily integrated with other entities horizontally and vertically.

#### 4.3.3 Improved Market Share

**CEO:** RNZ manage to increase the degree of success in entering bidding activities after implemented EDMS. Since EDMS, RNZ revenues has substantially grow and put RNZ in the top 3 consultants in Malaysia, after Technip and Ranhill Worley.

**DPS:** In the recent years, more clients have put EDMS as compulsory requirements to participate during consultant selection and evaluations. At the same time it eliminates more competitors which have not implemented EDMS in their organisation.

*Analyses:* EDMS is important to support a company towards improving market shares. EDMS should provide more clear path towards improving market share.

#### 4.3.4 Market Leadership

**CEO & CFO:** The current EDMS does not contribute to RNZ to become a market leader, the systems need to have more sophisticated functions. EDMS can only benefit the company in becoming a market leader if EDMS can increases RNZ revenues or by decreasing the cost of goods through the means of EDMS functions.

*Analyses:* EDMS must be able to increase company revenue and reduces the operational costs in-order to maximised profit and capture more market shares.

#### 4.3.5 Enhanced Competitive Advantage

*CEO:* By having EDMS, it created a barrier to new entrant to compete in the same category as RNZ, thus it enhanced RNZ competitive advantage. The EDMS can also reduce client bargaining power once they integrate with RNZ.

*CFO:* CFO mentioned that he only agrees that the EDMS would enhance the company's competitive advantage if the EDMS managed to increase the production throughput and reduced the operating cost.

*LE:* According to the LE the EDMS can enhance to the competitive advantage of the company by enhancing product quality through the means of the system.

*DPS:* His view on competitive advantage only applicable if EDMS enable them to complete the project ahead of time, and simplify their reviewing process, which is not happening at the moment when the interview was conducted.

*CIO:* EDMS contributed to market leadership as it increases the chances for the company to capture the market opportunities as compared to most new players in the industry.

*Analyses:* EDMS can support company competitiveness by introducing EDMS as part of the barrier to the new entrants and enhance the bargaining power with clients through vertical integration. Project competitiveness can be further enhanced if EDMS can increase the throughput and minimise document approval lifecycle.

#### **4.4 Proposition 2: Tactical Benefit**

In Proposition 2, it states that there is a need to know whether the EDMS provides tactical benefits which is further sub-classified to tangible and intangible benefit.

The interview session will have to follow the following taxonomies as a guide for Proposition 2:

- i. Improved Flexibility
- ii. Improved Response to Changes
- iii. Improved Product Quality
- iv. Improved Teamwork
- v. Promotes Open Culture
- vi. Improved Integration with other business Functions
- vii. Increased Plant Efficiency
- viii. Reduced Delivery Lead-times
- ix. Reduced Lead-times
- x. Improved Capacity Planning
- xi. Improved Data Management
- xii. Improved Product Development Control
- xiii. Improved Accuracy of Decisions

The result of interview under Proposition 2: Tactical Related Findings are summarised as below.

#### 4.4.1 Improved from flexibility

*DPS:* Tactically, we strategized our project operation and execution according to our quality plan. Quality plan are derived from series of analysis from previous project. By referring to analyses, we improve our project execution. EDMS on the other hand does not provide such analysis. Online and real time analysis may helps project department to pre-plan or react towards reports generated by EDMS.

*C/O:* Current EDMS does not support flexibility. System work flow is so rigorous, and not flexible to process changes. EDMS must be able to adapt business process which may change from time to time.

*DC:* EDMS has changes the way we do things in RNZ. Our procedures were defined by ISO9001 which later after EDMS implementation, QA Department need to change the procedure to adapt EDMS business process. EDMS should be able to adapt the company process flow rather than the company following EDMS process.

*Analyses:* EDMS need to have modules that encourage flexibility to the company working environment or work culture. Series of analysis can assist business operation in planning for improvement and react on any



potential delay to the business process thus increase production efficiency.

#### 4.4.2 Improved Response to Changes

*DPS:* EDMS does not support company into becoming more flexible to changes. RNZ project services department work by adapting clients procedures to ensure compliance to client regulations. EDMS required having a module which encourages flexibility in adapting frequent changes in document approval cycles.

*C/O:* Response to change is the most important issue that would lead to data or document discrepancies among the working engineering disciplines in RNZ. Current EDMS system does not have an automated notification function which can highlight changes. Certain changes in one engineering disciplines may require another changes in other disciplines documents.

*Analyses:* It is important for EDMS to response to changes. EDMS needs to have a module to speedily adapt changes especially in workflow.

#### 4.4.3 Improved Product Quality

*CEO:* One of the Key success factors of RNZ is delivering quality product to their clients. A successful system implemented in RNZ shall

support the direction. EDMS shall provide means of analysis for Engineers and Designers to minimised product errors and improve product quality.

*DPS:* DPS did not agrees with the statement that EDMS improved product quality, as stated by DPS in an interview, “EDMS has actually created additional method in the process of developing our product, instead of simplify our work, we need to do redundant work just to ensure documents is available in EDMS at the same time we need to do conventionally, i.e.: on paper”.

*C/O:* CIO supported that one of EDMS objectives is to improve product quality. EDMS shall provide better process in document handling. Proper documentation leads to organised developed product. Hence, RNZ product shall have proper track records and it should help RNZ improve their product quality.

*LE:* LE agrees that EDMS implemented improved product quality. By having EDMS, it created historical data and which allows organisation to create lesson learnt from the archival documents. Additionally, most similar documents created simplified “go by” material for design as new design can be referred to available documents in EDMS.

*DC:* DC finds that EDMS help them to improve their way of work in Document Control Centre (DCC). Submitted document which arrived in

DCC, more organised and can be easily crossed check between hardcopy documents and softcopy inside EDMS.

*Analyses:* EDMS must be able to support product development and improvement analysis. EDMS should provide methods for users to simplify the product development process for example online reference on previous project and easy reference to updated engineering guidelines and codes and standard.

#### 4.4.4 Improved Teamwork

*CEO:* EDMS shall be able to provide channels for cross functional teams in RNZ to communicate, identify discrepancies, identify product errors and thus working together in developing quality products for RNZ's clients.

*DPS:* DPS does not agree on EDMS improve teamwork as EDMS does not allow cross functional teams to communicate online but they still have to call for meeting or using a procedure named, Inter Disciplinary Check (IDC) to communicate any document changes.

*C/O:* By having EDMS in RNZ, users communicate lesser as they are so focus in delivering products and conventional face to face communication are now channelled through EDMS communicating channel.

*LE*:EDMS must be able to create sense of urgency in delivering our product and documents within the specified deadlines.

*DC* : DC agrees that EDMS improves teamwork, since EDMS created centralised documentation system where each team in multi-discipline environment have to refer to a single document for the purpose of project development.

#### 4.4.5 Improved Integration with other business Functions

CEO: EDMS should be able to provide holistic reporting which can be tie with several business functions such as sales and marketing activities, Financing activities and quality control activities. These integration shall provide quick and easy access to information in order to provide business intelligence and decision support.

*DPS and DC*: agrees that EDMS implemented has improved integration with other business functions. By having EDMS, planning department, operation department and finance department has some idea on current progress of each project.

*LE and CIO*: did not agree as current implementation is not open for integration and not flexible enough to integrated with other systems. As a result, data and information are currently updated manually to other department.

#### 4.4.6 Increased Development Efficiency

In RNZ plant is referring to the Engineering Disciplines(ED) as ED are the main functional department that develop core products to RNZ. Even though it is not a mechanical built plant, the production efficiency is considered similar to the intention in the taxonomy developed by Irani & Love (2004).

From the interview, CEO and CIO believe that EDMS has lead to development efficiency, as EDMS creates central documentation easier for cross functional disciplines to refer and at the same time it creates sets of structured document archival for later reference.

While, DPS, LE and DC does not agree with the ideas as from their point of view, EDMS introduces more tedious method in filing documents which they believe as more3 time spent in feeding documents into EDMS it reduces quality of time spent in analysis the production outcome.

#### 4.4.7 Reduced Delivery Lead-times

From the interview, all candidates agrees that EDMS reduces the delivery lead times. As EDMS pre-prepare the documents in proper indexing and structure create ease of handling of document for product delivery to RNZ client. In compared to previously before using EDMS, DCC need to spent tough time to sort and prepare documentation for product delivery. DC stated, "*During previous years, we need to work*

*around the clock to ensure document sorted are complete and we need to cross check several time with the table of content to ensure all 1500 sets of documents are there for delivery. These does not take account on cross check the right revision are submitted which usually creates a lot of confusion for us here in DCC”*

#### 4.4.8 Reduced Lead-times

None of the interviewees agree that EDMS has reduce the lead time as proven by the s-curve analysis (see Figure 15: Project Progress Report After EDMS), in RNZ, DC need to pre-register all the deliverables and process to convert each documents into EDMS are very tedious. 3 different software needed before DC can upload it into EDMS which has cost unnecessary hours spent on the project which leads to huge amount of lead time needed for documentation.

#### 4.4.9 Improved Capacity Planning

In the interviews, DC and LE mentioned that they agree on EDMS has improved capacity planning as EDMS has creates an estimates and reduced their hard disk (HDD) storage capacity as converted document are actually incurred smaller space compared to original native files.

While, CEO, DPS and CIO did not agree with it as storage are redundant for more than 3 times in the overall server spacing. At the same time redundant filing are worst when IT Depart done their back

up which they need to backup all files whether or not they are redundant.

#### 4.4.10 Improved Data Management

All interview candidates, agree that EDMS has improve data management as EDMS introduces more structured document storage with proper indexing and metadata for references.

#### 4.4.11 Improved Product Development Control

CEO, DPS, CIO and DC agree that EDMS improved product development control as EDMS provides overall scheduling and progress report on the product development.

While LE did not agree with it as there are no sufficient alert or reminder whether through email or visual indicator inside EDMS. As LE are working with thousands of document it is hard for LE to notice that there document missing and they are delayed without having to spent time analysing data inside EDMS. As documents uploaded may not necessary updated up to the latest revisions. LE also need to identify whether or not all the comments indicated by clients and other disciplines are properly incorporated inside the documents especially AutoCAD drawings.

#### 4.4.12 Improved Accuracy of Decisions

CEO, DPS, CIO and CFO agrees that EDMS has improved accuracy of decisions as the system provides an overview on document completions and its progress against project schedule.

While LE did not agree as functions of LE is to ensure documents such as datasheets and drawings are accurate. Current EDMS does not have sufficient tools for LE to have an overview of document filed under EDMS. LE stated in an interview, *“There are cases where one disciplines make changes in one of the drawing, which affected two other disciplines documents as the design are interrelated. The 1<sup>st</sup> disciplines was informed but the second discipline focal person was not available at the moment. As a result the second disciplines did not incorporate the new changes in their drawings and resulted in major discrepancies in their drawings and datasheets”.*

#### 4.5 Proposition 3: Operational benefit

There is a need to know whether the EDMS contribute to the company operational benefit? The Interview follows the guides below for the detail taxonomies in the interview conversations.

1. Reduced Material / Paper Inventory
2. Reduced Levels of WIP
3. Reduced Labour Costs / Man-Hour Spent
4. Reduced Design Activity Costs
5. Increased Throughput



The interviewees are also asked if there are any other functions or benefit than the above that can further added to the current EDMS in RNZ. The summary of the interviews are as below:

#### 4.5.1 Reduced Material / Paper Inventory

In related to operational benefit, most people agree that EDMS contribute to reduced material inventory in this case paper.

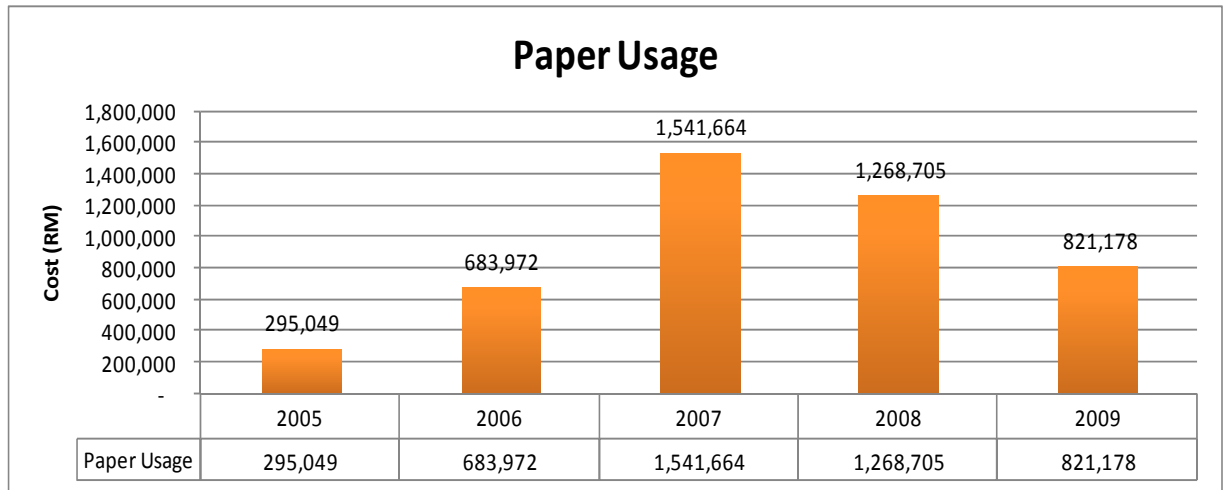
DPS and LE did not agree as Current EDMS setup does not affect project services and engineering disciplines in terms of reviewing the documents. Most document reviews are still done on paper instead of inside the system. The reason being, Engineers find it more convenience to do the mark-up conventionally. Furthermore all approved documents need to have a physical signature on the paper and currently RNZ clients still do not accept digital signature.

#### 4.5.2 Material Inventory: Evidence on Paper Usage and Expenses.

From the Interview sessions, DC mentioned that HR and Admin Department hold the information on paper expenses, and DC has assisted us to obtain the archival information on Paper expenses for the past 5 years.

The archival data obtained, are then plotted into a bar chart to show the growth of expenses spent on Paper before and after the implementation of RNZ EDMS.

Figure 11: Expenses record on Paper Usage



Source: RNZ Annual Management Review Meeting 2010

The bar chart described that from 2005, the usage of paper increases with a growth of more than 100 percentage (%) until it peaks in the year 2007. The CEO explained, that the increase usage of paper has become one of the justifications for RNZ to start procuring the AVEVA EDMS apart than the requirement stated in the clients invitation to bid (ITB)'s requirement.

The growth of paper usage are in line with the company revenues which depicted as the more company revenue, the more paper consumed by each department. In 2007, RNZ EDMS was set in operation. After the implementation of EDMS, paper consumption has

shown a slight decrease in 2008. In 2009, the chart shown a drastic decrease of paper, it is due to most of the project has been delivered in 2007 and 2008. Additionally, in 2009, number of project acquired by RNZ has been gradually decreased due to Oil price crisis in 2008 – 2009 which has caused decreased in RNZ revenue. The chart can clearly showed that by implementing the EDMS, overall number of paper consumed can be decreased. However, the chart does not show any relation to the other operational benefit as the data presented are not enough for the said analysis.

#### 4.5.3 Reduced Levels of WIP

Matters pertaining to work in progress (WIP) are referred to document such as datasheets, engineering codes and drawings under development and document that are sent in circulation for Inter Disciplinary Check (IDC). DC and DPS agreed that EDMS has reduced the WIP after the implementation since their functions are to distribute for IDC can be done in softcopy transmittal. Others do not agree as again documents are required to be printed for review and checking due to license limitation and the system does not provide a convenience way to check the documents online.

#### 4.5.4 Reduced Labour Costs / Man-Hour Spent

In the labour cost matters, the CEO himself has agreed that the EDMS managed to reduce the labour cost. This is supported by the DPS and CFO.

#### 4.5.5 Operational Benefit: Evidence on man-hour spent after EDMS implementation based extracted from planning department

RNZ calculate its cost according man-hour spent to complete each project. Each man-hour completed by each personnel in terms of timesheet which later submitted and analysed by the planning department for tactical and operational analysis.

The man-hour spent data are analysed and categorised according to total available man-hour, billable man hour, non billable man-hour and overtime spent for the project. The man-hour spent later analysed against the total maximum available man-hour and productive hour for each project. The category in the analysis taxonomy is explained in the following paragraphs.

#### 4.5.6 Total available man-hour

Total available man-hour is described as total number of personnel available during the specified period multiply by 40 hours a week. Operationally, each project are allocated with numbers of man hour by

the management. The man hour are then managed by the project manager to ensure they are spent wisely.

#### 4.5.7 Billable man-hour

Billable man-hour is described as total number of authorised personnel directly working for a project with a maximum of 40 hours a week. Billable man hour are usually pre-declared in the contract as cost to develop an engineering design.

#### 4.5.8 Non-billable man-hour

Non-billable man-hour is described as personnel who support or indirectly work for a project with a maximum of 40 hours a week. Non-billable man hours are for example other operational and support activity such as finance department, IT department and HR & Admin department activities.

#### 4.5.9 Overtime spent

Overtime spent is described as number of approved overtime hours spent for a project which later will be billed to the project cost. Operationally, overtime are pre applied and approved by the clients for later reimbursable items declared in project progress invoice.

#### 4.5.10 Total maximum available man-hour

Total maximum available man-hour is described as number of hours available for each project which can be spent as productive hour for the project. Maximum man hour for each project can not exceed 40 hours a week for each personnel.

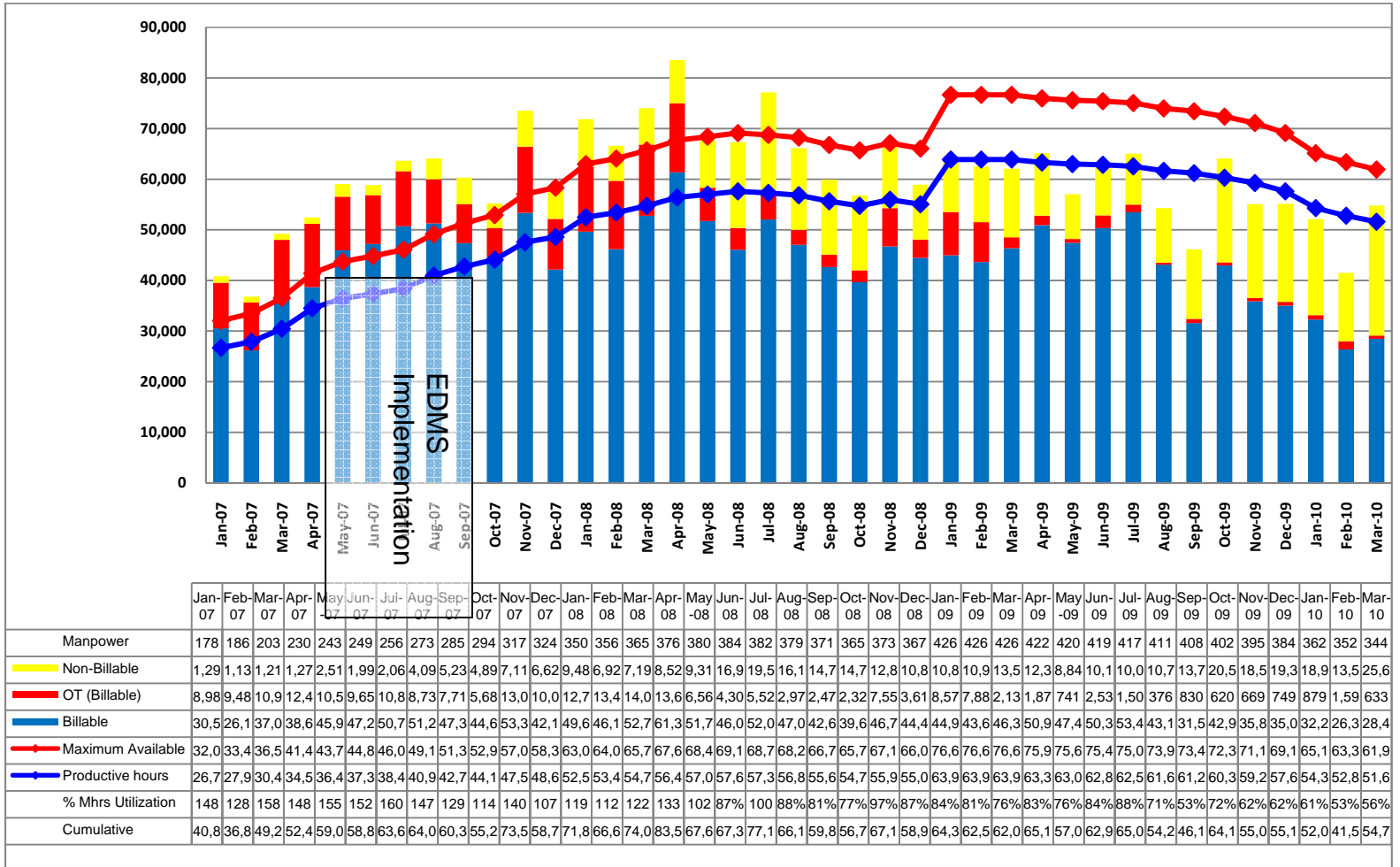
#### 4.5.11 Productive man-hour

Productive man-hour is described as man hour spent according to project execution plan approved by the client for each project. The productive man hour does not take account non-approved support staff man-hour spent who working in the corporate centre.

Data were collected from the electronic timesheet system starting from January 2007 until March 2010 for analysis. The data that were acquired are then plotted into a graph for further analysis as in Figure 12 - Man-Hour Utilization for Kuala Lumpur Head Office and in Figure 13 - Man-Hour Utilization for Miri Design Office.

The analysis outcome is explained in the following description.

Figure 12: Overall Man-Hour utilization for Kuala Lumpur Head Office (KLHO)



#### 4.5.12 Overall man-hour utilization in KLHO

Referring to the above chart in Figure 12, the chart shows trends in man-hour spent for each project. EDMS implementation was done during the period of August 2007 until October 2007. Trial runs were then conducted during October 2007 until December 2007 using current project data during that period. The graph shows productive man-hour growth aligned with the maximum available man-hour.

#### 4.5.13 Billable man-hour in KLHO

During EDMS implementation, numbers of billable man-hour were slightly decrease and caused the non-billable man-hour to grow. The growth is due to some of project resource were assigned to support the implementation of EDMS. They were assigned as Expert users and Implementation Tester during system development, validation and verification process according to RNZ Quality Management Procedure. *“Even though EDMS implementation were completed in December 2007, Users find it difficult to adapt the system. Additionally, there are a lot of additional customization needs to be done to suite different project format as different client imposed different standards”.* Quoted Capt.(R) Sarudin, Head of Planning, while he explained the data and charts. To create a better evaluation, the study will only focus on situation before the EDMS



implementation with comparison to situation after the EDMS has stabilised.

Before EDMS is implemented, most of available man-hour were utilised for the project up to its maximum availability. Even worst, personnel are required to take additional overtime to cover the workload. After the EDMS was implemented, less man power are required, this showed by the chart where billable bar has slightly decrease. It shows that EDMS has managed to reduce man-hour costing to complete a project.

#### 4.5.14 Non-billable man-hour

Before implementation of EDMS, there are minimal available non-billable man-hour as most of man power are allocated to concentrate for the project. After the implementation, numbers of non-billable man-hours has increase. The data were explained that only after March 2008; users start to adapt the system, while the system starts to stabilize on April 2008. Thus showing that after April 2008, there a significant increase to non-billable man-hour. DPS mentioned in an interview, "*EDMS in some way, has assisted us in reducing man-hour spent for a project as it actually decrease the delay in internal document circulation*". It is fair the justified that EDMS managed to reduced wasted man-hour through its means.

#### 4.5.15 Productive man-hour in KLHO

In view of a project, it is crucial to maximised the allocated man-hour for each project to ensure maximum returns. However, over productive may lead to many negative consequences. In this context, as RNZ project costing rely the most on man-hour charge, the decreased of productive man-hour shows that less man-hour required to complete a project. This shows through the chart where productive man-hour has slightly decrease in comparison to before EDMS implementation and after the implementation.

#### 4.5.16 Overtime taken in KLHO

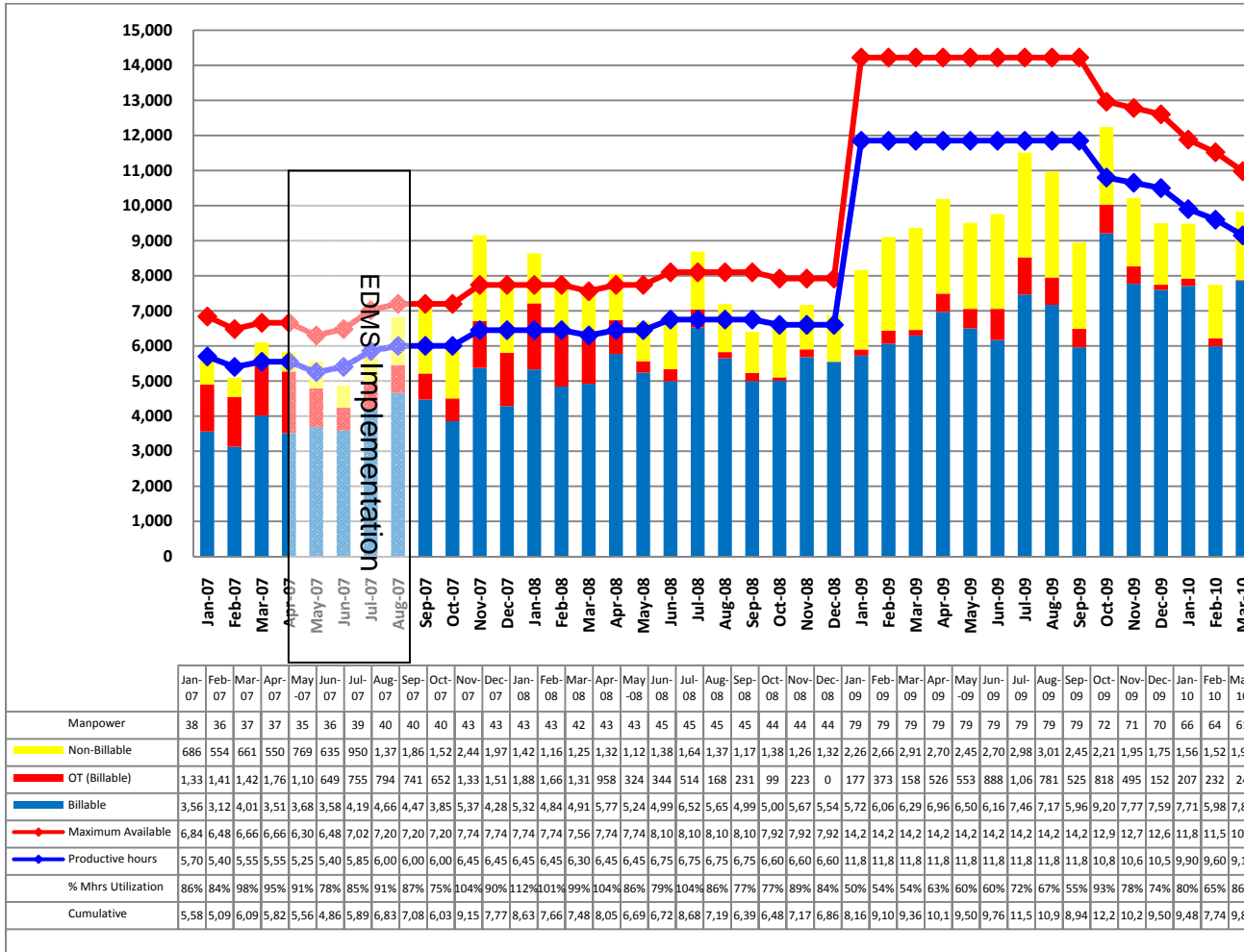
The chart also shows a significant decrease of man-hour taken through overtime after the implementation of EDMS. In RNZ, overtime are paid in full by the client, but overtime may also lead to more risks of delay to a project. Less overtime taken shows that the project managed to increase its reserved man-hour (i.e.: overtime taken) to ensure risks in delay are properly mitigated.

#### 4.5.17 Overall man-hour utilization in MDO

In Miri Design Office (MDO), East Malaysia, situation is a little bit different. MDO trends are represented by Figure 13, the overall man-hour utilization in Miri Design Office.

MDO took lesser time to implement EDMS in their office as degree of system complexity is lower compared to Kuala Lumpur Head Office (KLHO). Shaiful Mahmood, Head of MDO, explained, "*MDO only cater a single client, therefore it is easier to standardize the reporting format in MDO*". Due to some communication problems, MDO users adapted the EDMS system slower compared to KLHO. However, after MDO fully implemented EDMS in May 2008, the chart shows a significant growth in man-hour productivity, where there are minimum overtime taken and numbers of man-hour surplus has increased. The detail explanation is described below.

Figure 13: Overall Man-Hour utilization for Miri Design Office (MDO)



Source: Man-Hour analysis from RNZ Planning Department

#### 4.5.18 Billable man-hour in MDO

In MDO, situation in billable man-hour are slightly different compared to KLHO. Implementation of EDMS has caused the total billable man-hour to slightly increase. Head of MDO again explained, "*MDO only have 60 personnel, working environment here are more conducive, where everybody are like a family, we can easily communicate with each other as we just sitting closely to each other*". This shows that EDMS implementation does not have significant affect to MDO as the there are less delay in communication in MDO. However, the slightly increase to billable man-hour, is not explainable neither by the chart, nor by interview.

#### 4.5.19 Non-billable man-hour in MDO

Before EDMS non-billable man-hour are kept at very minimum availability. After EDMS, management acknowledged that there is a requirement to increase the non-billable man-hour, as a result an increase of non-billable man-hour to the chart. EDMS implementation has not shown any significant effect to the non-billable man-hour.

#### 4.5.20 Productive man-hour in MDO

Productive man-hour seems to have a direct relationship with billable man-hour as billable man-hour increase in MDO, productive man-hour also showed a slight increase.

#### 4.5.21 Overtime taken in MDO

There were significant decreases of overtime taken after implementation of EDMS in MDO. The chart shows that EDMS in MDO has a great influence in reducing the overtime thus increasing the reserved man-hour for MDO.

The graphs from May 2008 onwards proven that EDMS managed to decrease man-hour spent which fall under Proposition 3 which contribute to one of its operational benefit. The above analysis is summarised in Table as in the following paragraphs.

Table 3: Comparison of Man-Hour Utilization Before and After EDMS

Effect	Before EDMS	After EDMS
Billable man-hour (KLHO)	Utilised to maximum available.	Less man-hour required
Non-billable man-hour (KLHO)	Minimal – most of available man-hour were utilised for the project	More free man-hour and excess man-hour are utilised to other non-billable tasks.
Productive man-hour (KLHO)	Maximised sometime over utilized	Trends dropping for the project
Overtime Taken (KLHO)	Optimised to maximum available	Decreased – less personnel required to take

Effect	Before EDMS	After EDMS
	overtime hour	overtime.
Billable man-hour (MDO)	Maximised – are utilised to maximum available man-hour	No change
Non-billable man-hour (MDO)	Minimised – lower non-billable man-hour recorded	Increased – more billable man-hour allocated
Productive man-hour (MDO)	Optimised – most available man-hour are utilised for the project	More productive man-hour.
Overtime Taken (MDO)	Percentage of overtime taken are considered high	Less overtime are required.
Overall Man-Hour costing (KLHO & MDO)	High	Reduced

In general, EDMS has created a reduced to man-hour costing at the same time created better competitive advantage to the company.

#### 4.5.22 Reduced Design Activity Costs

None of the interview candidate agree that EDMS reduces design activity cost as they mentioned that EDMS does not have any

relationship to production or design stage. In addition, subsequent to the design stage they need to run through several additional software in order to convert documents into readable format for EDMS, these applied to AutoCAD documents.

#### 4.5.23 Increased Throughput

In the interview, CEO, DPS, CIO and LE did not agree with the statement that EDMS increase throughput of RNZ production. EDMS did not actually simplify the process of developing documents but in addition to that it has added additional processes which decrease the throughput of document production due to tedious conversion process introduced by EDMS.

While DC view EDMS at a different angle, where EDMS has enabled simplified process to DCC, as document submitted are better structured and EDMS has helped DCC to speed up the process of compiling document for delivery.

By analysing, archival documents provided by RNZ, the study manage to come out with a comparison on S-Curve analysis done by RNZ planning department which are shown in the following paragraphs. Similar sizes of project were taken to provide fair comparison to the study.

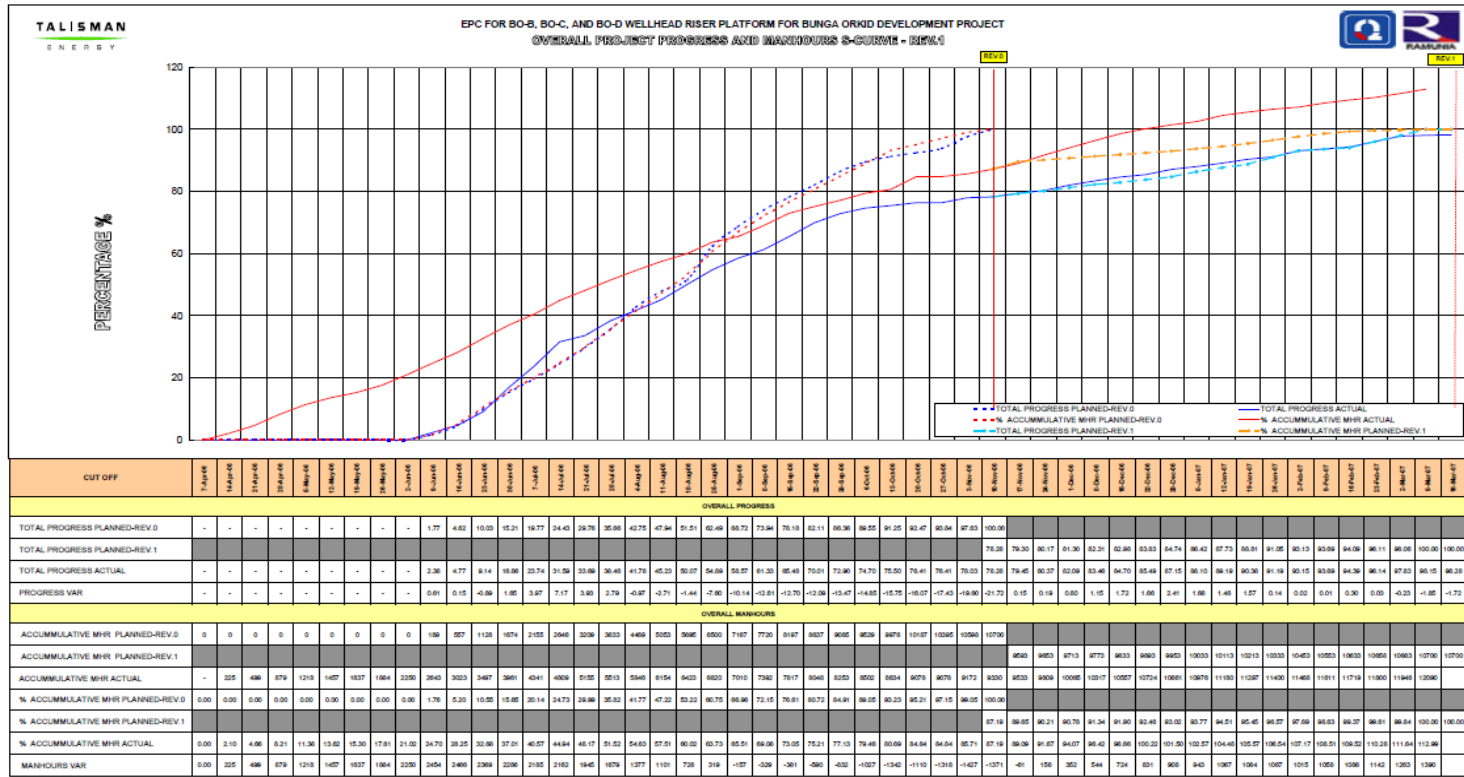


#### 4.5.24 EDMS effect on Project deliverable analysis and operational throughput.

Additional to man-hour utilization analysis, the study also collected data from actual schedule and project progress. Data collected from the planning department shown that analysis conducted against project deliverable milestones and Gantt-chart. The analysis is collected to further analyse on whether or not they meet the project deadline before and after implementing EDMS Presented in Progress report, S-curve analysis and Plan Vs Actual analysis. All data were compiled into a chart as in Figure 14 and Figure 15 as below:

Figure 14 below Provide an S-Curve analysis for project under Talisman Energy which was done before implementation of EDMS.

Figure 14: Project Progress Report Before EDMS



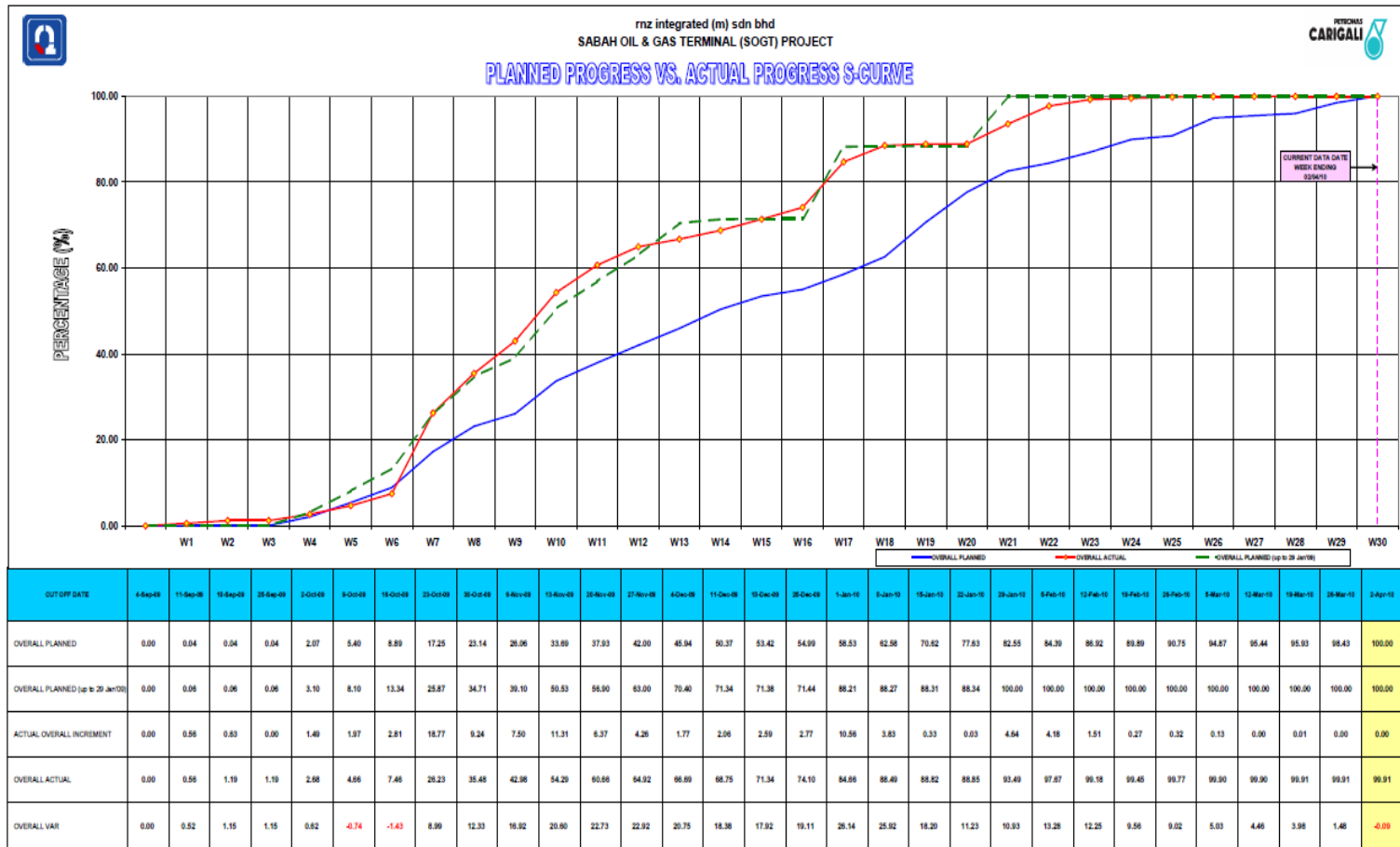
Source: RNZ Planning & Cost Control Department.

Figure 15 below provide an S-Curve analysis for project under Sabah Oil & Gas Terminal, which was done after implementation of EDMS

Detail analysis and data representation are describes as follows:

Figure 15 shows that EDMS has assisted to improve the development of project deliverables. With EDMS, not only EDMS improve the actual time to deliver the project deliverables, it also helps to develop a better project plan because the documents can be managed better. Before using EDMS, the project had shown significant delay after week 16. However, with EDMS the project progress catches up after week 8. As a result, the project ended earlier than before.

Figure 15: Project Progress Report After EDMS



Source: RNZ Planning & Cost Control Department.

Figure 14 illustrate the S-curve analysis on project progress before EDMS is implemented. The S-Curve will be used to make a comparison with Figure 15 to show effect of EDMS before and after it is implemented to the project progress. Table 4 below provide a summary of the above analysis and comparison between the 2 tables at which will be describe in detail in the following paragraph.

Table 4: Summary for S-Curve Analysis

Effect	Before EDMS	After EDMS
Total progress planned	Slow start. Start picking up after 9 weeks. Planned project completion is on week 32.	Slow start. Start picking up after week 3. Planned project completion is on week 30.
Total Progress Actual	Progress start showing on week 9. Actual crosses plan at week 12 and week 17. Project ends in weeks 48. Allocated man hour fully utilised on week 43.	Progress start on week 3. Actual start crossing planned at week 6. Actual progress better than planned. Project completed on week 23.

From the comparison, the study will focus more on “Total Progress Actual”. “Total Progress Actual” indicates the actual progress recorded against project period.

Before implementation of EDMS in RNZ, Project progress did not show any significant progress until week 9. The week is called mobilization period. In comparison, to after EDMS implementation, mobilization period were cut shorter as RNZ has adapted more technology which help them to shorter the mobilization period.

Before EDMS, overall progresses were delayed cost RNZ more than 16 weeks lost. After EDMS, better planning was done. Project actually completed ahead of schedule by 9 weeks.

The S-Curve analyses also illustrate the delayed caused by overall lead-time for the project which slow down the initial project progress.

Even though, the comparison showed significant improvement between before EDMS in compared to after EDMS, the improvement does not really proved that the improvement are caused by EDMS alone as there are other external influence which boost up the improvement of project deliveries.

#### 4.5.25 Data Compilation

Observation was made during the document set up which is the initial stage of the document management. In order for the users to create a document, users need to firstly create the document's template. The creation of each sub-document is as per the created template. Or else, documents need to be re-created. This system is not flexible enough since users need to create the template to suit different documents.

#### 4.5.26 Internal Circulation

Documents will be circulated to the users via the system. This process is important for users' information about the document and to enable users to review them. However, the system does not provide an alert or notification to the users informing that the documents are already circulated.

#### 4.5.27 Change Management

The documents in a project are created inter-link or inter-related by respective departments or users. Any changes made in one document, might caused other document to be changed. Hence, users should be notifying if any documents were circulated or amended. However, the system does not facilitate users with such facility. Users are not notified if

there are changes made to the documents. This might caused users to overlook the changes or documents that are circulated.

#### 4.5.28 Document Archiving

The EDMS does not support the function to archive documents. This creates difficulties to maintain historical documents. To overcome this problem, RNZ's IT team has to back up the whole server in the form of tape. This method is found not practical and not economical. In order to archive a particular document, the team need to archive the whole server. Furthermore, archiving in tapes would take up space to store the tapes.

#### 4.5.29 Team Communications

The EDMS does not support the alert function to notify the users about the document circulation or the updates of the documents. Hence, users are not aware and have to be pro-active themselves to check on the progress or updates of the documents. Since the documents are developed by different users or units, it is important for the users to know about the development of the documents because they are inter-related with each other.

Process observation is summarized as in Table 5 below:



Table 5: Summary for Process Observation

Observation	Description
Data Compilation	Complex, Tedious, Not User Friendly
Internal Circulation	Users were not alerted or notified when the document was circulated
Change Management	No notification on changes made
Document Archiving	The system does not have archiving facility. Back up for the entire server for archiving purpose.
Team Communications	No team communication since the system does not provide facility such as alert or notification

#### 4.6 Operational Observation

Operational observations are based on observations conducted during visit to DCC and Engineering Disciplines. These observations are based on operational of document handling between Engineering Disciplines, Project Management and Document Control Centre.

##### 4.6.1 Importing Documents

Uploading of documents and drawings into the VNET Dashboard involved complicated procedure. Current, VNET could not accept AutoCAD format. To make AutoCAD viewable in VNET EDMS, users need to use several steps and applications before it can be uploaded into EDMS. For example,

A drawing need to be converted into “svg” format using XMplant. Documents in PDF format have to be converted to “svg” format first by using bootstrap and import controller application before it can be integrated through the VNET Dashboard.

The uploaded can only be read by VNET after user extract XML information using another version of XMplant. The XML need to link together with the previously uploaded and need to ensure there is no error during conversion.

From the observation, conversion errors are quite common using XMplant.

#### 4.6.2 Metadata

Metadata are important information which users always forgot to enter for the uploaded documents. Missing metadata caused indexing less efficient. During observation, more than 70% of the document does not have any metadata. Missing metadata could significantly decrease the effectiveness of searching and retrieval process.

#### 4.6.3 Viewing Online Documents

From observation, there are some difficulties faced by users to view the online documents particularly the drawings. Drawings are not clear to be

viewed online since some of the drawings are using the AutoCAD. AutoCad drawings have a lot of layers and hatchings. In order to store the drawings, they have to be converted into svg format. By doing so the quality of the drawing are degraded and this technique also caused data loss from the drawing. Therefore online viewing does not create 100% document accuracy, Apart from that, the engineers in RNZ itself insist to view printed drawings.

#### 4.6.4 Long File name

Short-form or denote had been used to cater the character number limitation in the DDOC database. It affected the transmittal number, document title and appeared in the transmittal front page. The module accepts only 12 and 80 characters for transmittal number and document title respectively.

The character limitation has caused a lot of confusion and missing documents. Due to filename need to be reformatted before uploaded into EDMS and reformatted again before submitting to client for approvals.

The following table are to summarize the observation discussed in the above paragraphs.

Table 6: Summary of Operational Observation of EDMS

Observation	Description
Importing Documents	Several complex steps to imports.
Metadata	Usually missing due to ignorance
Viewing Online Documents	Drawings lost its accuracy due to conversion.
Long File Names	Systems have limitations on long file names.

#### 4.7 Issues in RNZ EDMS

The system was also commonly used among the oil and gas industry players. However, after the system was implemented, users convey their dissatisfaction on the system. Therefore, they have refused to utilise the system.

##### 4.7.1 Buy In

It is difficult to get users to be involved with the system implementation. This also includes the senior officers. They are not satisfied with the system since they claimed EDMS is not user friendly. Apart than the

comments, the study also found that trainings hours spent for EDMS implementation are low, which indicates that complex system such EDMS required proper training need analysis to ensure that the system implementation are successful.

#### 4.7.2 Integration with Customers and Suppliers

To ease the process of document submission, it is recommended that the customer and supplier using the same system to enable document to be submitted online. However, customer and supplier refused to do so since each supplier and customer has their own preferred EDMS. Furthermore, they are comfortable using the current method to deliver their document to RNZ hardcopy and in the form of CD.

During the observation period, none of the communication or transmittal with external parties is conducted through RNZ EDMS systems as claimed in the RNZ EDMS documentation. "*Client and vendor refuse to use our EDMS*" quoted by Khairul Ilyas Zaini, Document Controller, TOPAZ Project.

#### 4.7.3 Document Workflow

Workflow enables an organisation to capture information, processes and rules that are used to create documents and data with the aim of

eliminating and/or reducing redundancies and time, and determining which part of the process can be automated (Koulopoulos, 1994). Current EDMS in RNZ was found missing a proper workflow which aligned with current RNZ project execution plan business process.

#### 4.7.4 Technical support

Many outstanding issues not resolved because of lack of technical support provided by the AVEVA representative. Most of the technical problems such as transmittal reports hang, limitation on number of characters, transmittal format page setting have been resolved internally by the EDMS team.

Table 7: Summary from Operational Observation

Issues	Description
Buy In	It is difficult to get users to use the system especially the senior officers
Integration with Customer and Supplier	Customer and Supplier refuse to use the system.
Document workflow	Missing Built-in process flow
Technical Support	Lack of Technical support from vendor

All the above findings outlined a very important point on important function and characteristic of an EDMS. The findings show that there are more advantage of implementing EDMS compared to its disadvantages. However there are still a lot of room form improvements. The improvements will be explained in details in the recommendations and conclusion on the following chapter.