Accelerated use of Microsoft Dynamics NAV within The Antenna Company Nederland B.V.

JUNE 11, 2018 | PROCESS ANALYSIS

Presented by
Tariq Hussain

Fontys University of Applied Sciences
Rachelsmolen 1,
5612 MA, Eindhoven

Fontys
University of Applied Sciences

GRADUATION REPORT

FONTYS UNIVERSITY OF APPLIED SCIENCES

HBO-ICT: English Stream

Data student:	
Family name, initials:	Hussain, M.T.A.
Student number:	2222716
assignment period: (from – till)	February 5th,2018 - July 5th, 2018
Data company:	
Name company/institution:	The Antenna Company Nederland B.V.
Department:	Operations
Address:	High Tech Campus 41, 5656 Eindhoven
Company tutor:	
Family name, initials:	van Hees, Andre A.J.M.
Position:	Operations SVP
University tutor:	
Family name, initials:	Zijlmans, Jack J.H.A
Final report:	
Title:	Accelerated use of Microsoft Dynamics NAV within The Antenna Company Nederland B.V.
Date:	June 11th 2018

Approved and signed by the company tutor:

Date:

Signature:

Preface

The graduation internship style project initiated by The Antenna Company Nederland B.V. provided a platform for further professional experience within a period of February 5th till July 5th this year as a part of my study at Fontys University of Applied Sciences. With this report I present the process involved and learning goals achieved to accomplish a successful commission.

With that being said, I would like to thank Mr. Frank Henning (Internship Co-Ordinator) for his recommendation of the project and Mr. Jack Zijlmans, my University Tutor, for his input and guidance.

I would also like to thank my Company Coach- Mr. Andre van Hees and all the other Stakeholders involved for their timely guidance and concern towards the success of this project.

Finally, I would like to thank all the people of The Antenna Company I had the priviledge to interact with given their busy schedules within work hours to understand the company culture, motivations and their dedication towards their goals.

Contents

Terminology

ERP- It stands for Enterprise Resource Planning and used within organizations to facilitate its business processes.[1]

NAV- Short for Microsoft Dynamics NAV and is an ERP system by Microsoft.[2]

BI- Short for Business Intelligence. [3]

SQL- Short for Structured Query Language for managing relational databases.[4]

ODM- Short for Original Design Manufacturer. [5]

OEM- Short for Original Equipment Manufacturer. [6]

GPS- Short for Global Positioning System.[7]

B2B- Short for business-to-business. [8]

CM- Contract Manufacturers. [9]

R&D- Short for Research & Development.[10]

Purchase Order- *"A **purchase order** (**PO**) is a commercial document and first official offer issued by a buyer to a seller, indicating types, quantities, and agreed prices for products or services."* [11]

Sales Order- *"The **sales order**, sometimes abbreviated as **SO**, is an order issued by a business or sole trader to a customer."* [12]

KPI- Short for Key Performance Indicator. [13]

DOT Framework- A research methodology introduced and enforced by Fontys University of Applied Sciences by using strategies of finding, using and analyzing information based on fieldwork, archival research, comparative studies over equivalent material, and findings presentation according to dynamic requirement.

POWER BI- Business Intelligence tool by Microsoft.[14]

Dataset- Collection of data in tabular form, where variable entities arranged by columns and its corresponding members over rows.[15]

Workflow- A systematic arrangement of business activity and resources to transform materials, provide services, or process information.[16]

URL- Short for Uniform Resource Locator also known as web-address.[17]

ERD- Short for Entity Relationship Diagram for providing insight into the structure of databases and data models.[18]

G4-NAV- Short for Gear Fourth- Navision. A standard operating procedure devised to accelerate engagement of NAV with users of The Antenna Company.

MoSCow Method: "*A prioritization technique used in management, business analysis, project management, and software development to reach a common understanding with stakeholders on the importance they place on the delivery of each requirement;"* [19]

SOP- Short for Standard Operating Procedure. [20]

Summary

This report represents the key research elements involved with implementing an accelerated usage of Microsoft Dynamics NAV 2016 in The Antenna Company. The company initiated this project to understand their ERP (Enterprise Resource Planning) and further its engagement among key users involved in Sales, Operations, Supply Chain Management, and Finance.

Initial stages of project require acclimatizing to the work environment including gaining experience with an ERP system like Microsoft Dynamics NAV. Free roam capability using copies of Microsoft Dynamics NAV production environments and other online material supports the building of a foundation, which was critical to its understanding.

The lack of a dedicated BI (Business Intelligence) visualization software and rigidity of the data streams were initial problems analysis. Custom tailoring system limited on user front as database authentication and handle reserved by supplier for risk management. Coming from a background with experience in data visualization tools like Power BI to produce dashboards, it seemed viable to apply here. However, overlooking user defined track lead to a dead end, hence was the realization for a change in strategy. In other words, to change usability of the system rather than the system itself. Further, to approach user requirements with an understanding of where it stems from to recommend an alternative solution which accommodates acquaintance to system for certain users new to Microsoft NAV.

Chapter 1: Introduction

"There once was a chef, he had to feed a few people.

They said, 'Feed us how and when we want, but know the kitchen is special…'"- ANONYMOUS.

As a student at Fontys University of Applied Sciences within the stream of Information and Communication Technology, one must undergo an internship style project in a company for graduation. Upon recommendation from Fontys coordinator of internships, this project opportunity presented and taken from The Antenna Company to address their business intelligence requirements on the 7th of February 2018 in Eindhoven, The Netherlands.

Scaling within the company required an ERP system to implement business and operations activity, however to monitor these processes within the user group values certain changes, hence the scope of this project. The ERP used is Microsoft Dynamics NAV 2016, in short referred hereafter as NAV and the user group requirements came from their perspective of visualizing ERP data from NAV and other functions within NAV.

First impression of NAV from its daily users within company include its critical operation in all business areas and the validity of its data sources. However, a lack of dedicated BI tooling observed, along with rigidity of data streams. Initial observations also include general understanding of company structure and distinction between user groups over experience with NAV. Some of the stakeholders do not use the system on a regular basis. Although the stakeholders knew exactly what they wanted, a strategy to extract their requirements first devised and then initiated.

Chapter 2: About the company

Company Description

The Antenna Company formed in 2013 to commercialize a new 'geometry based' antenna technology which used over a wide range of wireless applications ranging from sub-GHz to mm wave frequencies. The heart of the technology is a combination of patented innovations that integrate advanced materials, RF (Radio Frequency) systems know-how and Super-Formula (patented) design principles to realize high performance 2D and 3D antennas.

The requirement of this technology is to address antenna system issues for existing and next generation wireless standards targeted primarily at leading OEMs (Original Equipment Manufacturers) and ODMs (Original Design Manufacturers) for Wi-Fi, GPS (Global Positioning System), Cellular and other wireless technologies in the lookout for a tailored solution. Antenna Company has a design center in the Netherlands with sales offices in the US and Asia. The company, headquartered in Willemstad, Curacao shifted to Eindhoven, The Netherlands.

Company Structure

There are three fiscal entities namely The Antenna Company International N.V., The Anten na Company Nederland B.V. and TAC IP B.V. The workforce structured under The Antenna Company Nederland B.V. with Finance, Human Resource, Research & Development, Operations and Sales department. There are two other entities namely The Antenna Company International N.V. and TAC US based in Curacao and The United States of America respectively. The Antenna Company International N.V. based in Eindhoven purposed for revenue (Sales) with other operations conducted by The Antenna Company Nederland B.V. Further, TAC US purposed for engaging with American businesses.

Company Business

Being a B2B company, the core business involves meeting customer requirements through CMs (Contract Manufacturers) in Asia, specifically China. Further, certain customer requirements do entail integration of The Antenna Company product with their own systems. For this the R&D (Research and Development) team of engineers work to build the required technology. To commercialize the products developed the sales department is responsible for pulling in customers. After receiving a PO (Purchase Order) from the customer by The Antenna Company International N.V. the TAC NL entity (The Antenna Company Nederland B.V.) sends PO for manufacture and storage to associated CM(s) also contracted for shipping. This setup utilizes ERP functionality to internally book POs and SOs (Sales Orders) between the entities 'The Antenna Company International N.V.' and 'The Antenna Company Nederland B.V.' named as TACI Production and TAC NL Production respectively in NAV. The CMs produce antenna based on blueprints and instructions provided by The Antenna Company B.V. Further, all intellectual property of TAC IP B.V. strategically valued as an asset within company.

Chapter 3: Assignment overview

Stakeholders within company operate on different sectors of the business. The assignment at a macro level is to let stakeholders engage with their ERP data and efficiently channel cross validation of business processes. At micro level, KPIs setup (Key Performance Indicators) by all stakeholder involvement, access and recognition of customized reporting over requested business processes within company NAV.

A global approach proposed to this assignment from an initial unfamiliar standpoint first involves one-on-one user-requirements gathering sessions where stakeholders share their demands from the system, in terms of functionality and key essence of structural and aesthetic specifications without compromising ease, to accelerate their usage of the system. Further down the project time-line, phase wise functional implementation of user requirements as planned.

“Pre-alpha” phase (February 9-March 21) depicted by the initial project-plan (see Appendix 1) constituted holding these one-on-one user requirements gathering sessions, system constraints research and attempted trouble-shooting from a limited user perspective and concept work arounds. Former which constituted development of a simplified web-based ERP-BI tool being detrimental in meeting user requirements within project time-frame, hence disqualified.

“Alpha-phase” (March 21 - May 10) involve inductive research format with action sequences like trial and error presentation runs with user group and archival research within NAV triggered an optimistic de duction of the system to further uncover its capability.

“Beta-phase” (May 10 – July 5) initiated after surface of database authentication constraint, by accommodating hands-on delivery of business reports for custom changes. Parallel initiation of beta ph ase with goals to systematically accelerate users to arrive at version release via user-guide documentation and hands-on training along with a survey to generate closure of promised deliverables on user opinion via checklist. Thus, a strategic hybrid research format to conclusively execute the assignment.

Further, research methodology to accommodate project elements is by combination of DOT framework strategies presented in more detail as the discussion continues to the next chapter.

Chapter 4: Method and Process of Research

The assignment at large entails certain areas of research and analysis. To uphold clarity as set within guidelines this research methodology uses DOT framework of the five strategies namely FIELD, LIBRARY, WORKSHOP, LAB and SHOWROOM.

- FIELD: Interactions with individuals in practice of the concerned field. It also involves the use of the Internet to find relevant information.
- LIBRARY: Gather information from books, internet blogs, websites, forums etc. to direct research.
- WORKSHOP: Hands on control of outcome. However, a project generally requires the rapid switching between multiple strategies.
- LAB: Tests the solution to provide a measurable account of end goal realization and user experience.
- SHOWROOM: Actions include, comparing project with similar work, analyzing possible patterns in results, apply feedback and validate outcome. This strategy will answer the question of why initiate a certain approach instead of using an existing solution.

Further, DOT based combination patterns observed as defined to produce a topic wise breakdown of the research.

PATTERN NAME	INVOLVES DOT
A	FIELD and/or LIBRARY on WORKSHOP • Used for building deliverables, open or fix issues within this research either by finding the right information via one-on-one or group interactions with concerned individuals or from books, internet blogs, websites, forums etc.
B	WORKSHOP and/or LIBRARY on FIELD • Used for opening discussions on topics of and related to this research with concerned individuals via one-on-one or group interactions based on observations made and/or findings over books, internet blogs, websites, forums etc.
C1	SHOWROOM on A • Applies validation to approach pattern A from analyzing results produced and feedback acquired.
C2	SHOWROOM on B • Applies validation to approach pattern B from analyzing results produced and feedback acquired.
D1	LAB on C1 • Finalize approach pattern C1 by review and continue to the next objective.
D2	LAB on C2 • Finalize approach pattern C2 by review and continue to the next objective.

Accelerate the use of Microsoft Dynamics NAV within The Antenna Company stakeholders

- **1. Project Foundation Building and Microsoft NAV.**
  Approach Pattern Used: B

  Description: First focus on the solution research over problem research, for understanding of system compatibilities in accordance with user requirements. Criteria set for using online information from dedicated help tool within the NAV application installed by supplier ABC E Business. [21]

Justification: Initial assignment request to automate report emailing from NAV, lead to trial and error tweaking of the NAV scheduling functionality. For the purpose, requirement of training on NAV Job Scheduling from the book *Implementation of Microsoft Dynamics NAV by Alex Chow* and dedicated online help. [22]

Result(s):

- 1. Inconsistency with report scheduling in NAV using Job Queues.
- 9. Initial Solutions Breakdown Overview
- 11. SQL access enquiry and NAV – Standard Operating Procedure for accelerated NAV use.

- **2. External role and influence on project.**
  Approach Pattern Used: A & B

  Description: NAV is a service provided by Microsoft partner ABC E Business for The Antenna Company. Further, the NAV database is cloud hosted by another company which prohibits access through means other than NAV where all datasets are discrete. They provide a proposal for migration of database to on-premise servers or Power BI upon a certain quote to circumvent the SQL (Structured Query Language) authentication, training on creating custom report layouts using NAV and assistance with project management.

  Justification: External influence i.e. NAV supplier involved plays a key role within the system at place. They hold access to all NAV information which records critical operational and financial data. To understand how they function also meant understanding the system in place and recommend a workable solution.

  Result(s):

  - 3. Conclusive Report of March 15th meeting discussion with NAV supplier - ABC E Business.
  - 12. Conclusive Report of May 28th meeting discussion with NAV supplier- ABC E Business.

- **3. Assignment setup from project-holder perspective.**
  Approach Pattern Used: C2

  Description: The assignment set to train and expose the use of an ERP in real business practice, along with the research element of devising methods to produce KPIs and apply experience with requirements gathering and key skills acquired during the study. Further, criteria set to train on result based entrepreneurial approach rather than a pre-defined process to counter problems.

  Justification: Observation from analyzing user defined end goal to initial assignment setup from project-initiator perspective, made a clearer overview of a workable solution. Further, a requirement to uphold transparency and accelerate usage of the system among stakeholders with short experience.

  Result(s):

  - 2. URL Injection in NAV Web client.
  - 3. Conclusive report of March 15th meeting discussion with NAV supplier ABC-E Business.

- **4. Justification of key decisions made.**
  Approach Pattern Used: D1 & D2

  Description: Key decisions made include providing long-term and short-term recommendation along with a workaround solution considering project constraints to uphold end user goal.

Justification: Constraints of the system, time and NAV supplier- ABC E Business company policies justify the decision for a workaround solution.

Result(s):

- 6. Market research to form a long-term and short-term recommendation.
- 12. Conclusive Report of May 28th Meeting discussion with NAV supplier- ABC-E Business.

- **5. Initial Planning: How it differed from its actual run.**
  Approach Pattern Used: D1

  Description: Start off by prior experience recall with project planning and learning core company business policies. Built expected Project Initiation Document with Gantt style project plan and scope analysis attached based off estimation. The actual run also accommodates system acquaintance and training on NAV usage.

  Justification: Request of stakeholders to not publish or manipulate any production environment data within NAV.

  Result(s):

  - 7. Initial planning and availability.

- **6. Change in methodology – its necessity.**
  Approach Pattern Used: C2

  Description: Change in focus from solution research to problem research. Depth analysis of available NAV reports and how to build expected user requirements including multi-stakeholder involvement.

  Justification: To shorten research cycle by targeting frequently used reports by users from the total pre-installed set.

- **7. KPIs as a basis of user requirements with supporting functionality.**
  Approach Pattern Used: A

  Description: Consolidated list of requested KPI builds include:

  1. *Delivery performance of shipments and order confirmation intervals,*
  2. *book to bill ratio,*
  3. *gross margin % by products sold, business segment and region*
  4. *record of open or unfulfilled orders,*
  5. *margin by product, business segment, and business region*
  6. *inventory valuation*
  7. *cash conversion cycle and*
  8. *forecasting coverage along with a revenue outlook.*

  These user requirements gathered by holding one-on-one, group discussions, Skype meetings with stakeholders that work from other locations.

  Justification: To approach stakeholders and define specific reporting requests, constitutes part of assignment.

  Result(s):

  - 5. Consolidated format of user requirements.

- **8. Recording of user requirements and feedback.**
  Approach Pattern Used: B

  Description: Categorized list of KPIs based on priority, business area and availability followed by planned availability.

  Justification: Deliverables produced require the approval of end user expectation, a process defined within scope of this project. Hence maintenance of feedback from user facilitate end-product realization.

  Result(s):
  - 5. Consolidated format of user requirements.

- **9. KPI Analysis and overview.**
  Approach Pattern Used: A

  Description: Book borrowed from company coach – *Key Performance Indicators by Bernard Marr* provide definition to all KPIs requested, relevant to industry. And clarification on all company defined KPIs from stakeholders via email. Collecting and combining frequently used reports by key stakeholders into sets then create a subset of reports after eliminating duplicates; locate necessary fields from these reports to assemble the KPIs from definition and validate by stakeholder approval. Thus, finding the right information within these NAV reports for KPI building, an analysis surfaced. Further, certain KPIs include using forecasting capabilities of NAV. An arranged meeting with stakeholders to demonstrate the NAV forecasting functionality with key stakeholders. [23]

  Justification: All KPI functions requested serve to provide BI over company performance, to identify areas of improvement and monitor company health. Requirement of having a quick reference overview to accommodate each KPI function from NAV reports, creates ease with project fulfillment.

  Result(s):
  - 4. Demonstration of Forecasting Capabilities of NAV.
  - 9. Initial Solutions Breakdown overview.

- **10. Presentations to stakeholders on project update and availability.**
  Approach Pattern Used: D2

  Description: Project Overview presented upon an arranged meeting on April 23rd with majority of stakeholders present, to brief on consolidated user requirements collected and their availability with a recommendation of short and long term applications for NAV. To ascertain quality five presentation runs held, each critically assessed by primary stakeholders.
  Further, to update users on project with a short 20 to 30-minute presentation. A criterion set to use only one or two slides, hence provide all information in a concise format.

  Justification: Certain stakeholders within the company do not operate from Eindhoven at times, including CEO. This presentation catered to provide an update to all stakeholders present in Eindhoven on April 23rd. Further, each presentation run gave a clearer perspective on the assignment.
  On a research style project, requirement to meet end goal expectation over a defined track comes with setting up time constraints to prevent wasting time over dead ends and device a different approach. To share progress based on results, users request an arrangement involving a short presentation to have a discussion on deliverables and advice on issues if necessary.

Result(s):

- 6. Market research to form a long-term and short-term recommendation.
- 8. Project update format of May 14th.

- **11. Uncertainties and bottlenecks - Factors unaccounted during planning.**
  Approach Pattern Used: C1 & C2

  Description: Surface of uncertainties with project progress on deliverables dignified and not delivered directly impact initial success-based planning and scope. Major bottlenecks involve accommodating user requirements on initial planning. Bulk of the research went on customizing the system reports based on specific user expectation and declare a conclusive possibility or impossibility with user expectation firmly set on a declaration of possibility**.** This process indeed lead to discovery of key constraints, declared late in the project cycle as beyond the capabilities of current setup to serve user requirements, in pursuit of any exploitable loophole.

  Justification:
  Defining constraints seen critical to this research as it acquaints the user base to the limitations of the system at place, based on which a workable solution proposed and delivered.

- **12. Hypotheses defined, and the state of confirmation applied.**
  Approach Pattern Used: C2

  Description: Certain hypotheses built as research elements include, implementation of POWER BI based on experience, validity of a KPI formula from the chosen source and assignment setup. Their confirmation states either prove or disprove over time based on the turn of events during project cycle.

  Justification: The track between end goal realization and initial start-off remained an undefined state besides the user requirements gathering phase by navigating on educated estimation of the next steps. Formulating such milestones along a general direction requires to have hypotheses to confirm based off which other later goals realized, to not leave no stone unturned as advised by coach.

  Result(s):

  - 9. Initial Solutions Breakdown overview.
  - 10. Margin as a difference between Customer/Item Sales and Vendor/Item Purchases.

- **13. Essential Resources gathering and key milestone indications.**
  Approach Pattern Used: C1 & C2

  Description: Forms of essential resources include sync up meetings with users on project progress for advice and validation, tangible forms of information like excel spreadsheets, feedback on deliverables and lists of frequently used reports in NAV. Key milestone indications include conclusive declaration of system SQL capabilities and counter proposal for a workable solution.

  Justification: The user requirements gathering phase set parallel to other research elements play a key role with task orientation and provide the necessary results to proceed. Without these inputs, project success cannot be determined.

  Result(s):

  - 4. Demonstration of Forecasting capabilities of NAV.
  - 11. SQL access enquiry and NAV-Standard Operating Procedure for accelerated NAV use.
  - 12. Conclusive Report of May 28th meeting discussion with NAV supplier- ABC-E Business.

- **14. Solution breakdown and deadline management.**
  Approach Pattern Used: C1 & C2

  Description: The collection of reports in NAV oriented around each KPI formulate the breakdown of the solution. Estimation of the time to form each KPI, giving a scheme to manage deadlines.

  Justification: Breakdown of the solution reveals components to focus on and clear out uncertainties.

  Result(s):
  - 9. Initial Solutions Breakdown Overview.

- **15. Change in implementation process and availability.**
  Approach Pattern Used: B, C2 & D2

  Description: Initial implementation scheduled on rough estimation of availability to end user prior to solution breakdown cycle. Final implementation process formulated based on time estimation for each task oriented to the solution breakdown.

  Justification: Stakeholder request to confirm delivery on proposed time meant update in the implementation process.

- **16. Output and validation processes.**
  Approach Pattern Used: C1 & C2

  Description: KPI reports sent for feedback and validation via email to concerned stakeholders after redesign and evaluation from previous feedback.

  Justification:
  To supply user base with reports that meet exact user requirements and allow them notice over upcoming deliverables produced.

- **17. Comparative study of assignment setup to actual turn of events from stakeholder perspective.**
  Approach Pattern Used: D1 & D2

  Description: Project from stakeholder's perspective as befitting of an internship at HBO level to research and visualize company operations, sales and financial performance, with consideration of self-directing research methodology and requirements gathering. Thus, establishment of project track is also a research element. Assignment setup coincide actual turn of events during project, however not at a desirable rate. Hence, means for motivation by declaring confirms on delivery scheme of project elements. This confronts the issue of linear waterfall like process-oriented sequence and switch to a cyclic result-oriented solution breakdown with progressive completion over each cycle.

  Justification: Analyzing the assignment setup from stakeholder's perspective hints at how to device the solution breakdown with the confirmation bias that the assignment track is not setup open ended by stakeholder.

- **18. Forms of stakeholder support and influence on project.**
  Approach Pattern Used: D1 & D2

  Description: Over critical advice, requirement of information and resources, stakeholder support depends on specificity. In other words, support over issues that require engagement over 15 to 20 minutes reached upon prior meetings arrangement. However, issues that do not require too much time approached in person and discussed. In general, most use case scenarios involve validation of data and aesthetic requirements to reports produced, such as landscape orientation, yearly overview by month and number formatting. Further, involvement with company operation's meetings expose certain practices in professional environments.

  Justification: This influence on the project seen on the outcome of presentations, reports and documents produced, self-directive solution breakdown and critical project scope analysis.

- **19. Alternate track analysis.**
  Approach Pattern Used: C1

  Description: Proposal of on-location consultancy over NAV functions via demonstration and Q&A runs include implementation of graphs in NAV Role center, process of adding fields into NAV reports, advice on Sales and Purchase Order Approval Workflows setup and general advice on inventory wishes of reports by NAV supplier early in the project cycle.

  Justification: On meeting with NAV supplier – ABC E Business a discussion on issues of NAV system collected over initial experience without immediate resolve.

  Result(s):
  - 3. Conclusive report of March 15th meeting discussion with NAV supplier- ABC E Business.

- **20. Applied Track Justification.**
  Approach Pattern Used: D1

  Description: Applied track over self-initiated research over engagement with consultancy assistance from ABC E Business on technical and project management.

  Justification: To dignify the learning process associated with self-training and validation over right and wrong decisions rather than explore the validity of actions based on laid out track upon consultancy advice.

- **21. Review of Scope- MoSCoW method**
  Approach Pattern Used: D1

  Description: Review of project scope analysis over established constraints by all-parties-involved discussion in MoSCow method described below:

  † **Must Haves:**
  G4-NAV to include procedures to create KPI reports- *Open orders*, *Backorders*, *Book-to-bill ratio*, *Shipments*, *Delivery performance by CRD and TAC Confirm*, *Order Confirmation Interval*, *Inventory Turns*, *Inventory by value*, *Gross margin% by Product- Customer-Sales*, *Purchase $ spent*, *Margin by Product-Segment-Region*, *Sales by Product-Segment-Region*.

- † **Should Haves:**
  - † Reports embedded within **G4-NAV** as functional representation or otherwise.
- † **Could Haves:**
  - † POWER BI potential by data visualization.
  - † Forecasting module based on revenue outlook.
  - † All reports running on stakeholder scheduling with all custom requirements met along with a dedicated dashboard within NAV.
  - † Cash Conversion Cycle in a yearly overview by month format.
- † **Will Not Haves:**
  - † POWER BI Pro Setup to visualize, style and schedule reports of the users, by the users, for the users.

Justification: To confirm project scope and accommodate end user reporting requirements by workaround solution system via **G4-NAV** a Standard Operating Procedure for NAV use.

Result(s):

- 8. Project Update format of May 14th.

- **22. Key Competences of new deliverable proposal.**
  Approach Pattern Used: D2

  Description: A workaround solution as a Standard Operating Procedure doc to accelerate the usage of NAV. It applies to all stakeholders from minimal to high level experience with NAV.

  Justification: As a tool to accelerate usage of NAV among stakeholders by formulating company KPIs, provides user an overall experience with NAV as a tool independent of system constraints set from supplier business policies.

  Result(s):

  - 11. SQL access enquiry and NAV-Standard Operating Procedure for accelerated NAV use.

- **23. New skills acquired upon company influence.**
  Approach Pattern Used: D1 & D2

  Description: Besides experience with project planning, NAV, and user requirements gathering, new skills acquired include, how to change project methodology, consolidate data, and think from end user-perspective to provide workaround solutions by in-depth analysis.

  Justification: These skills acquired make the solution breakdown and the implementation process time-effective and reduce any redundancies from double work.

  Result(s):

  - 2. URL Injection in NAV web client.
  - 4. Demonstration of Forecasting capabilities of NAV.
  - 5. Consolidated format of user requirements.
  - 6. Market research to form a long-term and short-term recommendation.
  - 7. Initial planning and availability.
  - 9. Initial Solutions Breakdown overview.
  - 10. Margin as a difference between Customer/Item Sales and Vendor/Item Purchases.
  - 11. SQL access enquiry and NAV-Standard Operating Procedure for accelerated NAV use.
  - 12. Conclusive Report of May 28th Meeting discussion with NAV supplier- ABC-E Business.

Chapter 5: Process and Results

All results factual by nature, derived either from a combination of research topics or individually from the set shared in the previous chapter, found below. The reason to elaborate on factual results being its characteristic quality of adding "evidence" to the "investigation" and a movement to its validation. Additionally, other insights produced within research by the what-how-and-why syntax, reflect over the justification of the research done.

Result 1: Inconsistency with report scheduling in NAV using Job Queues

Research Involved:

- 1. Project Foundation Building and Microsoft NAV.

Description:

NAV provides the capability to schedule a report sent out over recurrence on fixed intervals. Upon request, the Open Orders report tested for this functionality. However, multiple times the report would not arrive in the Report Inbox in NAV.

Result 2: URL Injection in NAV Web Client

Research Involved:

- 3. Assignment setup from project-holder perspective.
  23. New Skills acquired upon company influence.

Description:

Certain stakeholders operate on MAC computers however MAC computers do not support the Windows based Desktop client for NAV. Further, the requirement arose after errors encountered from changing NAV Companies via Web Client. None of the attempts by method of using the NAV Web Client worked, hence a possible proposal by URL (Uniform Resource Locator) Injection to a workable method of changing companies as described below, taken the "**G4-NAV**" project deliverable (Fig.1).

Inject URL with **TACI%20Production** to switch to TACI Production and **TAC%20NL%20Production** to switch to TAC NL Production, where it goes "company=" as shown (Fig.2).

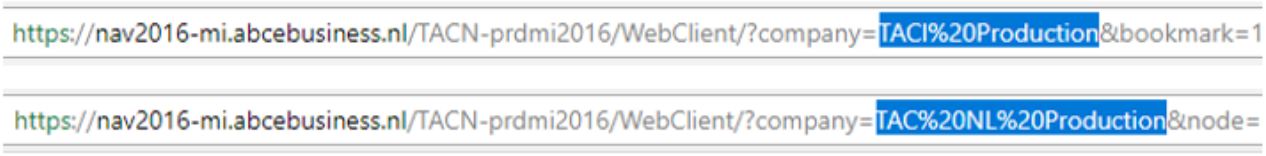


Fig.1

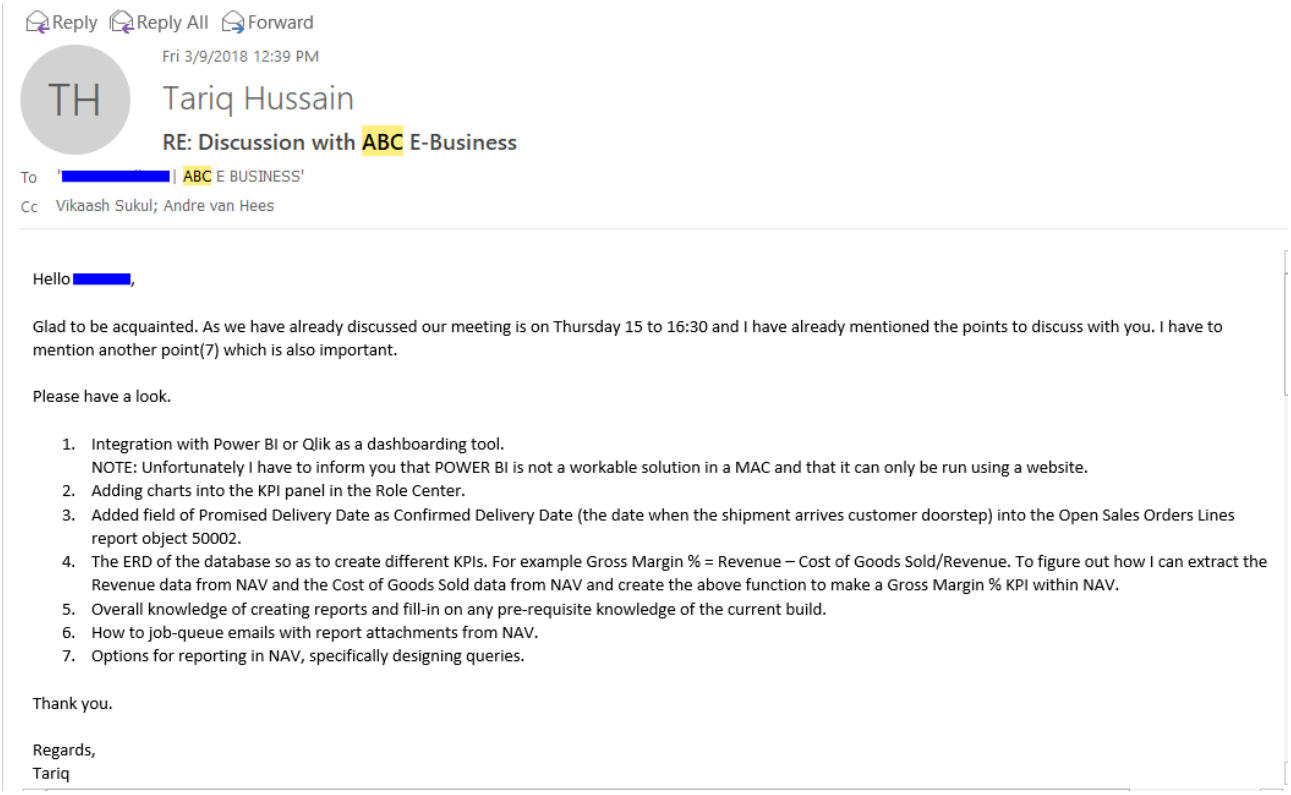
Result 3: Conclusive report of March 15th meeting discussion with NAV supplier- ABC E Business

Research Involved:

- 2. External role and influence on project.
- 3. Assignment setup from project-holder perspective.
- 19. Alternate track analysis.

Description:

The screenshot below of the email correspondence with ABC E Business representative, preparation for discussion on key topics followed by minutes shared with stakeholder (Fig.2 & Table-1).



Reply Reply All Forward

Fri 3/9/2018 12:39 PM

TH

Tariq Hussain

RE: Discussion with ABC E-Business

To '[redacted] | ABC E BUSINESS'

Cc Vikaash Sukul; Andre van Hees

Hello [redacted],

Glad to be acquainted. As we have already discussed our meeting is on Thursday 15 to 16:30 and I have already mentioned the points to discuss with you. I have to mention another point(7) which is also important.

Please have a look.

1. Integration with Power BI or Qlik as a dashboarding tool.
   NOTE: Unfortunately I have to inform you that POWER BI is not a workable solution in a MAC and that it can only be run using a website.
2. Adding charts into the KPI panel in the Role Center.
3. Added field of Promised Delivery Date as Confirmed Delivery Date (the date when the shipment arrives customer doorstep) into the Open Sales Orders Lines report object 50002.
4. The ERD of the database so as to create different KPIs. For example Gross Margin % = Revenue – Cost of Goods Sold/Revenue. To figure out how I can extract the Revenue data from NAV and the Cost of Goods Sold data from NAV and create the above function to make a Gross Margin % KPI within NAV.
5. Overall knowledge of creating reports and fill-in on any pre-requisite knowledge of the current build.
6. How to job-queue emails with report attachments from NAV.
7. Options for reporting in NAV, specifically designing queries.

Thank you.

Regards,
Tariq

Fig. 2

Table-1

Phase 1: Introduction and Communication Development.
Arrival Time & Date at the ABC E Business: 14:55 March 15th, 2018
Attendees: Wouter Pullens, Vikaash Sukul, Tariq Hussain
Process:

- Pleasantries and Introductions
- Office tour
- Personal Background Information

Phase 2: Problems Discussion
Problem 1.1: Issue with connecting Power BI Integration with NAV Desktop Client.
Response: Send screen-shot showing error.
Problem 1.2: Add support for POWER BI Report Server multiple instance in on a single server.
Response: Point Noted
Problem 2: Adding charts to KPI Panel in Role Centre
Response: Point Noted
Problem 3: Adding more report objects and customization of additional fields in certain report objects.
Response: Point Noted
Problem 4: Access to ERD (Entity Relationship Diagram) of the Microsoft NAV database.
Question: What is an ERD and how is it necessary?
Response: Power BI could also be a possibility to visualize the ERD.
Problem 5: Overall knowledge of creating reports and any other information.
Response: Arrangement of meetings for consultation.
Problem 6: Job-queue emails with report attachments from NAV.
Response:

- Proposal to walkthrough creating job-queues and applying them in NAV.
- Clarification of scope.

- Point Noted.

Problem 7: Options for reporting in NAV, specifically designing queries.
Response: Point Noted.
Problem 8: Remote Access of NAV Server for MAC User.
Response: It is not possible for to use remote server besides using a virtual machine with MAC. However, it is possible if it is an on-premise.
Problem 9: Workflow templates not allocated to the correct company and PO and SO workflow events are missing.
Response:

- Brief background explanation.
- Point noted.

Problem 10: Integration with SharePoint.
Response: Possibility to use POWER BI.
Other Issues Discussed:

- No response to calls.
- Database backup by SAASPLAZA.
- Server connection lost from 16:30 to 17:30, frequently.
- Order processing of a very large quantity of orders takes too long.

Proposal Declared:

- First to separate all requirements based on easy-fixes and development fixes.
- Second appoint a consultant to review all the issues and implement fixes for those that are easy to fix.
- For issues that require development help, design a SDD and then fix the issue.

Requirements:

- Screenshot of POWER BI integration error.
- Excel file about the figures.

Conclusion:

The March 15th meeting with ABC E Business was an introduction meeting where discussion of topics approved by key stakeholder. However, meeting not seen to provide solution, rather as an opportunity to gather these issues for further discussion amongst own. The recommendation provided on March 20th after this meeting goes as follows (Table-2):

Table-2

Activity's remote consult:

- To make use of PowerBL a new servicetier has to build. This costs one time € 300 and € 100 per month.
- Research documentation entity-relationship diagram (To be planned after location/training) 2 hours

Activity's consultant on location: 8 hours

- Describe graphs in role centers and review settings. (Tariq would send examples)
- Submit and describe addition field in "open sales orders"
- Go through workflow templates and advise on setup.
- Set up a job queue process.
- Inventory wishes for reports and advice

Follow-up consult: 8 hours

Count on 3 hours of project management

Workshop Document Lay-out Trainingsdata:
April 19th at 09:15 - 16:30 € 300,00 Including lunch. Bring your own laptop.
Advanced Forms
For Multi Instance customers we now have the possibility to offer a new application in NAV that makes it much easier for end users to create reports themselves. This is an application from Quadira, called Advanced Forms. If there is interest in this, sales can have a quotation made.

This recommendation provides the alternate track not taken.

Result 4: Demonstration of Forecasting capabilities of NAV

Research Involved:

- 9. KPI Analysis and overview.
- 13. Essential Resources gathering and key milestone indications.
- 23. New skills acquired upon company influence.

Description:

This demonstration arranged to show stakeholders the forecasting capabilities of NAV. After a test environment created in NAV, anticipated production quantities provided by stakeholder, placed over a monthly basis for a certain product.

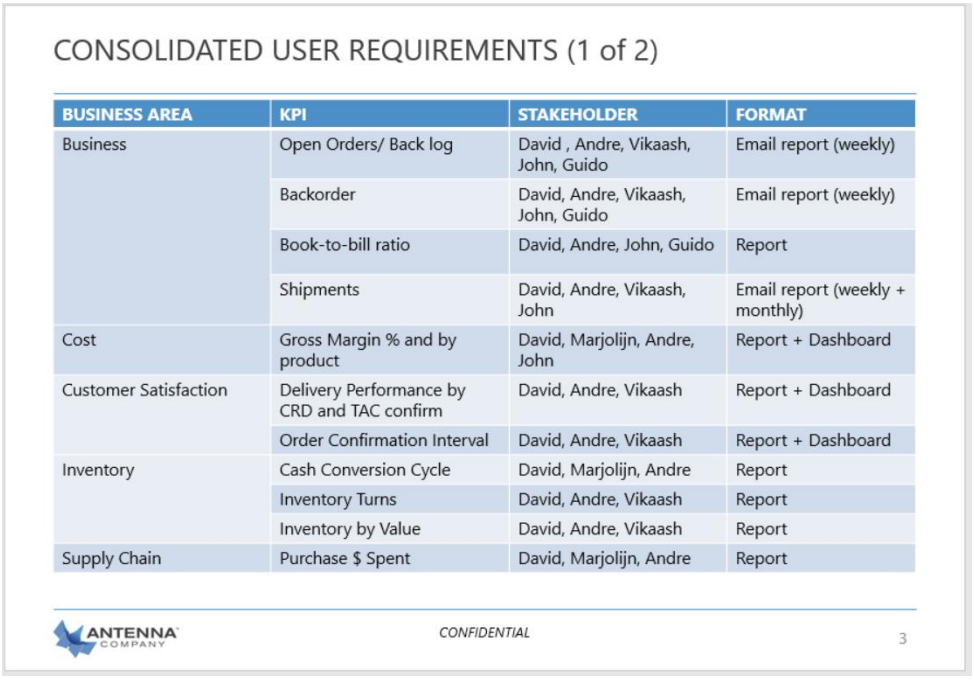
Result 5: Consolidated format of user requirements

Research Involved:

- 7. KPIs as a basis of user requirements with supporting functionality.
- 8. Recording of user requirements and feedback.
- 23. New skills acquired upon company influence.

Description:

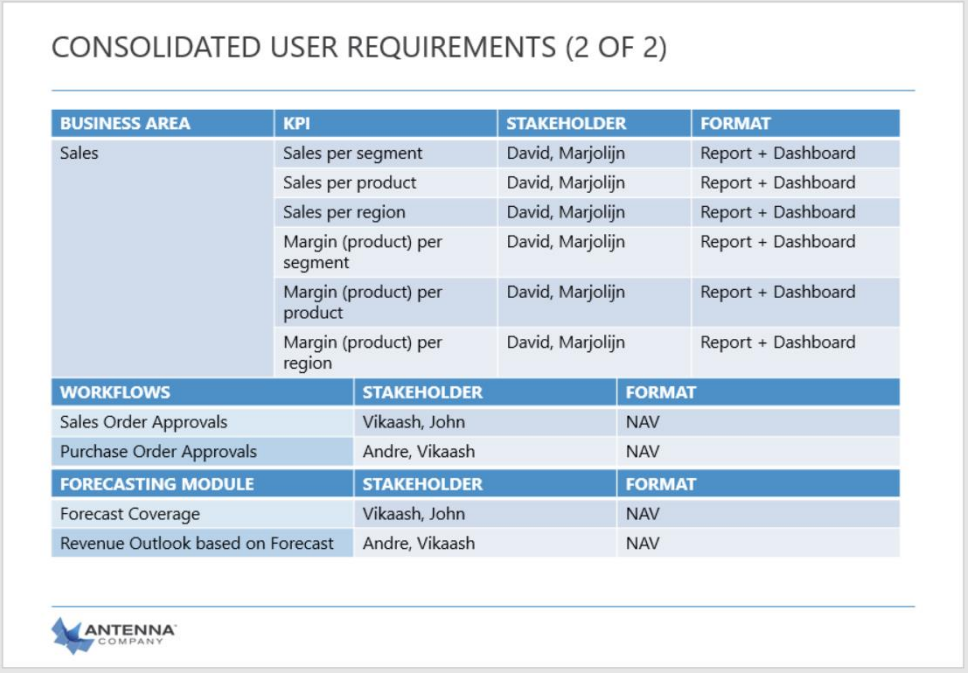
Slides (Fig.3,4) showing user requirements presented to all stakeholders meeting on April 23rd as part of a presentation on all-stakeholder meeting.


CONSOLIDATED USER REQUIREMENTS (1 of 2)

BUSINESS AREA	KPI	STAKEHOLDER	FORMAT
Business	Open Orders/ Back log	David , Andre, Vikaash, John, Guido	Email report (weekly)
	Backorder	David, Andre, Vikaash, John, Guido	Email report (weekly)
	Book-to-bill ratio	David, Andre, John, Guido	Report
	Shipments	David, Andre, Vikaash, John	Email report (weekly + monthly)
Cost	Gross Margin % and by product	David, Marjolijn, Andre, John	Report + Dashboard
Customer Satisfaction	Delivery Performance by CRD and TAC confirm	David, Andre, Vikaash	Report + Dashboard
	Order Confirmation Interval	David, Andre, Vikaash	Report + Dashboard
Inventory	Cash Conversion Cycle	David, Marjolijn, Andre	Report
	Inventory Turns	David, Andre, Vikaash	Report
	Inventory by Value	David, Andre, Vikaash	Report
Supply Chain	Purchase $ Spent	David, Marjolijn, Andre	Report

ANTENNA COMPANY CONFIDENTIAL 3

Fig.3



CONSOLIDATED USER REQUIREMENTS (2 OF 2)

BUSINESS AREA	KPI	STAKEHOLDER	FORMAT
Sales	Sales per segment	David, Marjolijn	Report + Dashboard
	Sales per product	David, Marjolijn	Report + Dashboard
	Sales per region	David, Marjolijn	Report + Dashboard
	Margin (product) per segment	David, Marjolijn	Report + Dashboard
	Margin (product) per product	David, Marjolijn	Report + Dashboard
	Margin (product) per region	David, Marjolijn	Report + Dashboard

WORKFLOWS	STAKEHOLDER	FORMAT
Sales Order Approvals	Vikaash, John	NAV
Purchase Order Approvals	Andre, Vikaash	NAV

FORECASTING MODULE	STAKEHOLDER	FORMAT
Forecast Coverage	Vikaash, John	NAV
Revenue Outlook based on Forecast	Andre, Vikaash	NAV

ANTENNA COMPANY

Fig.4

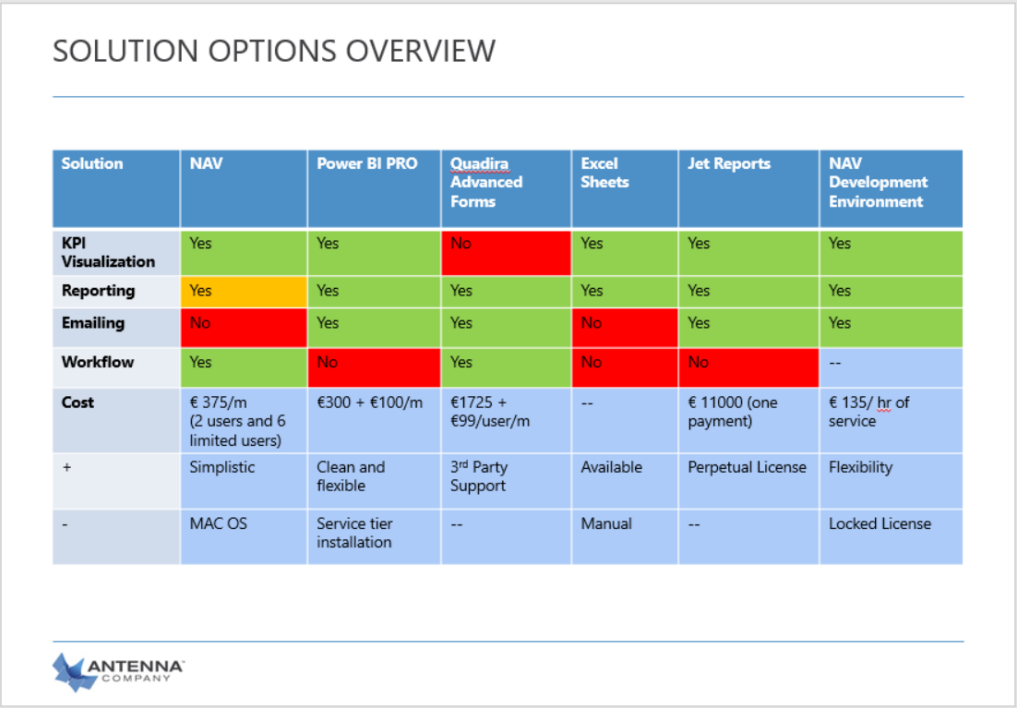
Result 6: Market research to form a long-term and short-term recommendation

Research Involved:

- 4. Justification of key decisions made
- 10. Presentations to stakeholders on project update and availability.
- 23. New skills acquired upon company influence.

Description:

A slide (Fig.5) presented to all stakeholder meeting of April 23, with a purpose to deduce a long term and short-term recommendation of possible integration options with NAV and a benchmarking tool with a criterion set for KPI visualization, reporting and automated emailing.



SOLUTION OPTIONS OVERVIEW

Solution	NAV	Power BI PRO	Quadira Advanced Forms	Excel Sheets	Jet Reports	NAV Development Environment
KPI Visualization	Yes	Yes	No	Yes	Yes	Yes
Reporting	Yes	Yes	Yes	Yes	Yes	Yes
Emailing	No	Yes	Yes	No	Yes	Yes
Workflow	Yes	No	Yes	No	No	--
Cost	€ 375/m (2 users and 6 limited users)	€300 + €100/m	€1725 + €99/user/m	--	€ 11000 (one payment)	€ 135/ hr of service
+	Simplistic	Clean and flexible	3rd Party Support	Available	Perpetual License	Flexibility
-	MAC OS	Service tier installation	--	Manual	--	Locked License

ANTENNA COMPANY

Fig.5

Result 7: Initial planning and availability

Research Involved:

- 5. Initial Planning: How it differed from its actual run.
- 23. New skills acquired upon company research.

Description:

This slide (Fig.6) presented at the all stakeholder's meeting on April 23rd, to show how initial planning was set to all deliverables based off estimation on deadlines before a solution breakdown presented and NAV reporting constraints surfaced.

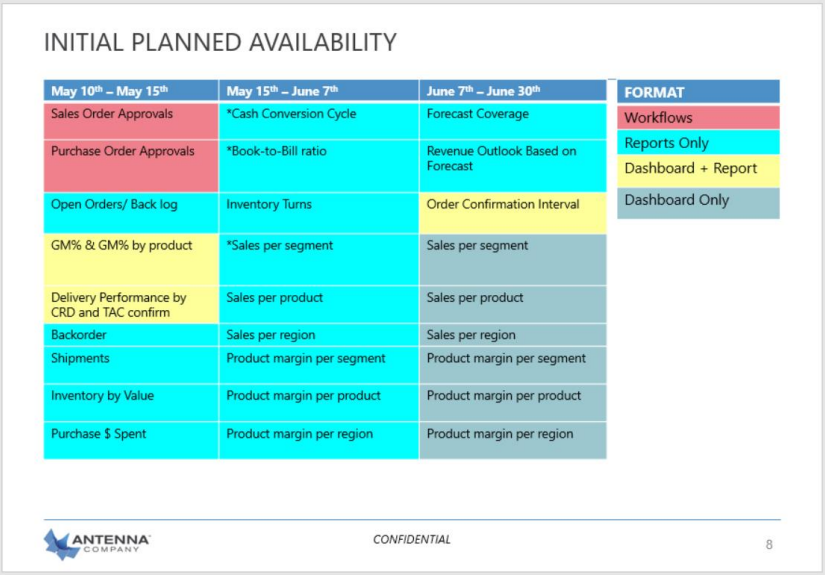


Fig.6

Result 8: Project Update format of May 14th

Research Involved:

- 10. Presentations to stakeholders on project update and availability.
- 21. Review of Scope- MoSCoW method

Description:

This slide (Fig.7) produced on a Project Update presentation attended by four major stakeholder, in cluding CEO via conference call and proposal for **G4-NAV** as workaround solution.

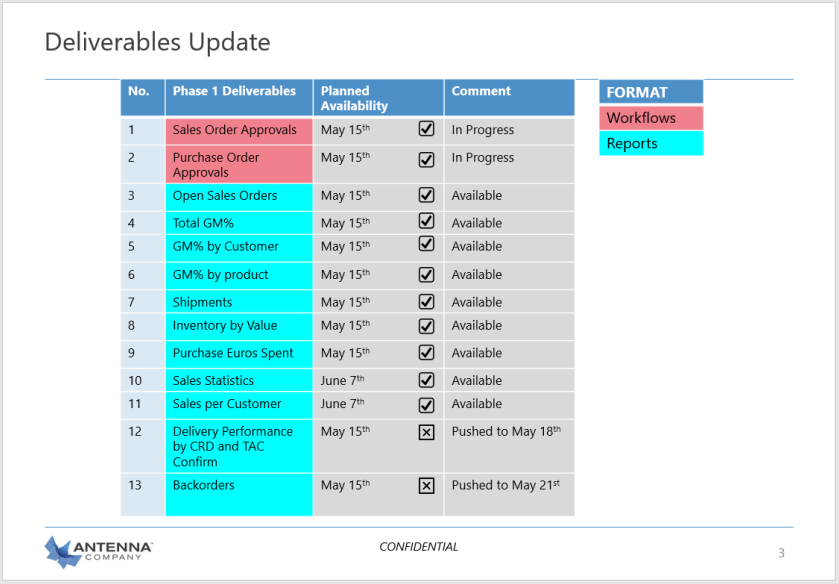


Fig.7

Result 9: Initial Solutions Breakdown overview

Research Involved:

- 1. Project Foundation Building and Microsoft NAV.
- 9. KPI Analysis and overview.
- 12. Hypotheses defined, and the state of confirmation applied.
- 14. Solution breakdown and deadline management.
- 23. New skills acquired upon company influence.

Description:

The table produced below provides a consolidated view of how to approach each KPI using NAV and as a quick reference tool (Table-3).

Table-3

REPORT ID IN NAV	INVOLVES KPI
50,002	**Open Sales Order Lines** • 1. Open Sales/Backlog
718	**Inventory – Sales Back Orders** • 2. Back Orders
112 & **50,000**	**Sales Statistics** & **Sales Shipment Lines** • 3. Book to Bill ratio
50,001	**Sales Shipment Lines 2** • 4. Shipments
112	**Sales Statistics** • 5. Total Gross Margin % • 6. Gross Margin % by Customer • 7. Gross Margin % by Region • 8. Total Sales • 9. Sales by Customer • 10. Sales by Region
113 ⋈ 313	**Customer/Item Sales ⋈ Vendor/Item Purchases** • 11. Margin by Product • 12. Margin by Segment • 13. Margin by Region
712	**Inventory- Sales Statistics** • 14. Gross Margin % by Product • 15. Sales by Product • 16. Gross Margin % by Segment • 17. Sales by Segment
50,000	**Sales Shipment Lines** • 18. Delivery Performance by CRD • 19. Delivery Performance by TAC confirm • 20. Order Confirmation Interval
1,001	**Inventory Valuation** • 21. Inventory by Value
112 ⋈ 1,001	**Sales Statistics ⋈ Inventory Valuation** • 22. Inventory Turnover
***1** & **112** & **1,001** & **5**	***Chart of Accounts** & **Sales Statistics** & **Inventory Valuation** & **Receivables – Payables** • 23. Cash Conversion Cycle
309	**Vendor - Purchase List** • 24. Purchase $ Spent
Forecast Excel Sheet	• 25. Forecast Coverage
99,003,804	**Production Forecast** • 26. Revenue Outlook based on Forecast

Result 10: Margin as a difference between Customer/Item Sales and Vendor/Item Purchases

Research Involved:

- 12. Hypotheses defined, and the state of confirmation applied.
- 23. New skills acquired upon company research.

Description:

The initial purpose of this research was to validate Investopedia.com as a correct source for creating KPI functions. To achieve a confirmation state three reports within NAV considered, namely Customer/Item Sales, Vendor/Item Purchases, Sales Statistics and financial data over March 2018 and the following observations made:

- Only a certain product sold in that month and the quantity sold for that month were the same in both the Customer/Item Sales and Vendor/Item Purchase reports.
- The vendor costs of that month and the beginning inventory of that month is the same.
- The difference between the sales of that month and the vendor costs of that month to the difference between gross profit margin and ending inventory value of that month is the same.
- The Cost of Goods Sold on that month is also the same.
- Investopedia.com defines Cost of Goods Sold as follows:
  "COGS = Beginning Inventory + Purchases during the period – Ending Inventory" [24]
  Based on this formula, the value of the Cost of Goods Sold from the Sales Statistics report equals the sum of the Beginning Inventory value from the Inventory Valuation report and negative Ending Inventory value from the Inventory Valuation report with consideration to no other purchases made because of production over that period.
- Investopedia.com defines Margin as "the difference between a product or service's selling price and cost of production". [25]

Based on these observations, the following deductions were possible:

- Cost amount in the Vendor/Item Purchases report and the Beginning Inventory value in the Inventory Valuation report is the same measure.
- NAV holds well with the functions provided by Inventopedia.com.

Based on these deductions, the hypothesis that Margin is the difference between the sales figure in Customer/Item Sales report and the Vendor/Item Purchases report by a confirmation state applied from the equal difference between the sales and the vendor costs to the difference between gross profit margin and ending inventory value of that month.

Result 11: SQL access enquiry and NAV-Standard Operating Procedure for accelerated NAV use

Research Involved:

- 1. Project Foundation Building and Microsoft NAV.
- 13. Essential Resources gathering and key milestone indications.
- 22. Key competences of new deliverable proposal.
- 23. New skills acquired upon company research.

Description:

The screen shots shown below represents the SQL authentication failure to connect to the "DataSource" for which the form fields SQL Server credential requirements (Fig.8,9).

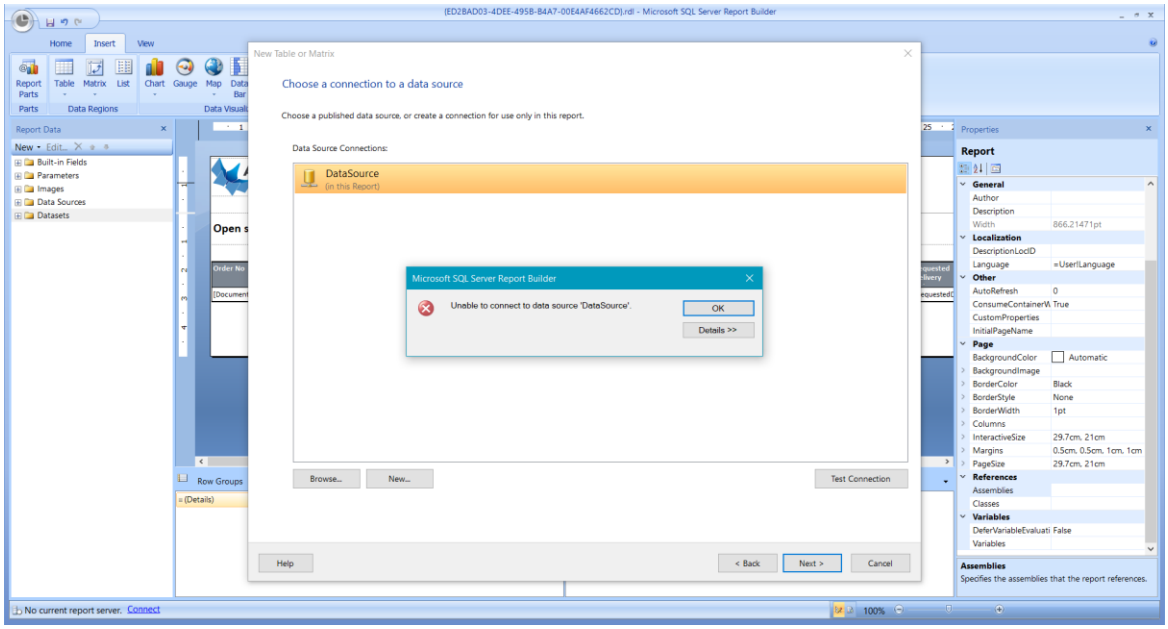


Fig.8

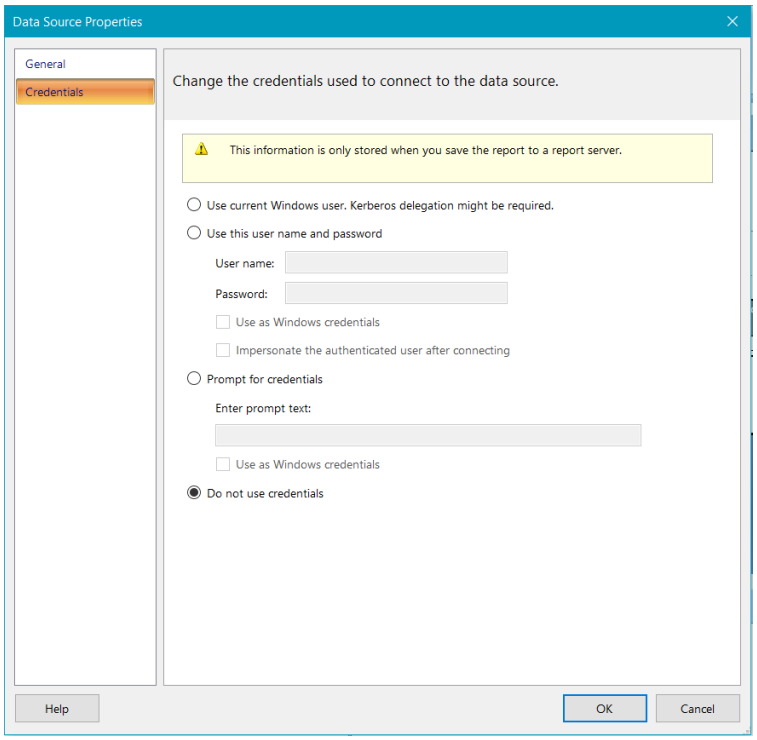


Fig.9

The workable solution in the form of a SOP (Standard Operating Procedure) for NAV usage with the following characteristics:

- **Name: G4-NAV**
- Step wise walk-throughs to create KPI reports from scratch supplemented by screenshots.
- MAC and Windows compatible layouts within one overview.
- Embedded Excel modules for users to work on the run.
- With pre-requisite walkthroughs of NAV functionality besides KPI reporting.
- Approved and user-feedback incorporated.
- Walkthroughs with estimated completion times based on practice.
- NAV reports custom sorted and modified within system to comply with G4-NAV.

Sequence Diagram of Solution System (Fig.10):

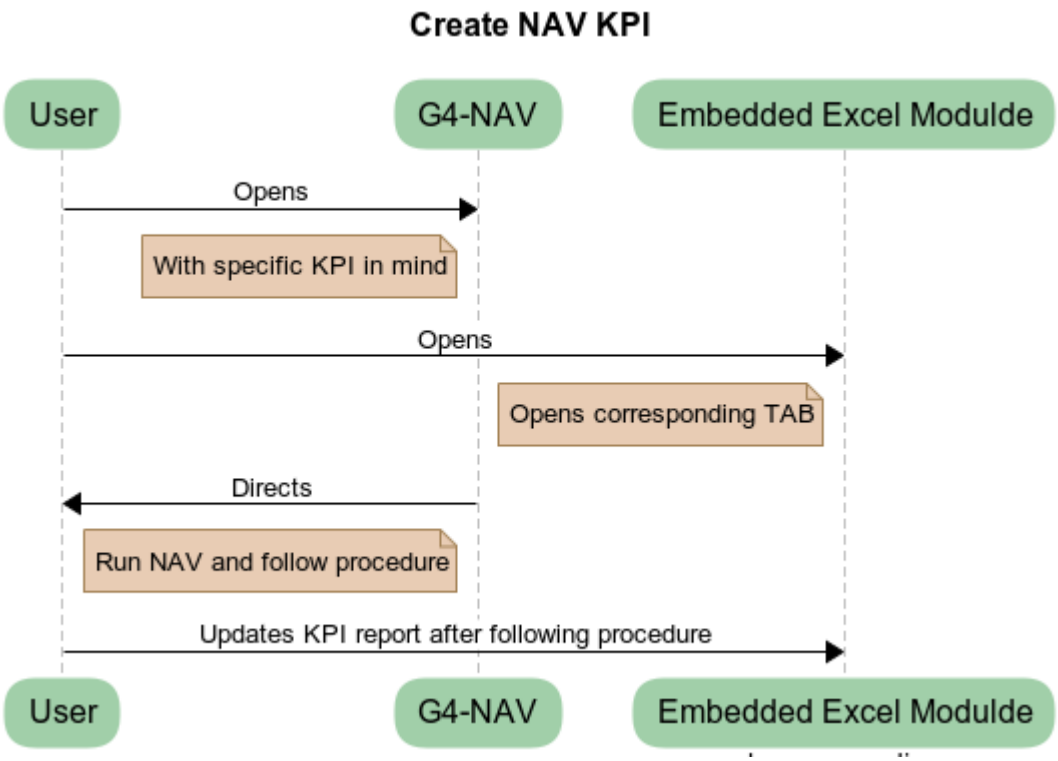


Fig. 10

Result 12: Conclusive Report of May 28th Meeting discussion with NAV supplier- ABC E Business

Research Involved:

- 2. External role and influence on project.
- 4. Justification of key decisions made.
- 13. Essential Resources gathering and key milestone indications.
- 23. New skills acquired upon company influence.

Description:

A discussion occurred with ABC E Business over SQL Authentication denial for The Antenna Company. To get a better insight to the solutions a meeting arranged on May 28th at The Antenna Company, Eindhoven.

Conclusion:

The NAV database of The Antenna Company hosted in a cloud by another company named SAASPLAZA and their company policy is to not allow SQL Authentication for customers, reason being mitigation of any risks involved with SQL manipulation, causing system errors. Further, the discussion continues over to proposing an on-premise solution where the database hosted by company, liberating it from third party control, however, exposing it to damage caused during installation and possible data loss or to a subscription of POWER BI Pro where the database provided access upon a service tier charge and monthly subscription.

Chapter 6: Conclusions and Recommendation

The key goal is to automate the generation of user-specified reports from the system. The project plan constructed initially did not accommodate system acquaintance and constraints uniquely associated with the project over its entirety. Research and development in this regard left on hold in pre-alpha phase to focus on tangibly achievable results within time-frame allotted.

A two-prong approach for this situation was to construct a simple planning of the deliverables by long term and short-term recommendations, without compromising requested format and schedule of user-requirement deliverables. Successful implementation of this approach required self-training and of stakeholder group constituted as part of the whole solution pack.

The turn of events during project cycle dictate how perspective on user-requirements had addressed to arrive at a workable solution.

A short-term recommendation is to allow supervised access to database by SQL or work on copies of the database, join reports based on the solution breakdown by query to accommodate the KPIs, then implement them in production environment. After establishing all SQL relations, along with a structure of a yearly overview of results by month, the produced report layouts designed to user specifications.

Further down the line, the potential for this project seen from user experience to provide ease and quick access to the required information. A long-term recommendation would indeed be to invest in complete access to the data via POWER BI Pro for its automated update and report delivery scheduling along with multiple formats of visualization. However, certain company policies regarding transparency of information discussed and negotiated among key users first, to allow this transparency that comes with access to the data.

Evaluation

Looking back this project leveraged many of the skills and experiences picked up throughout the study of ICT and Business at Fontys. Lessons and conceptual roots from mathematical induction, project management, business economics, trends and hypes, Excel, sequence diagrams from system development and databases applied in a professional setting. This manifests the criteria for learning goals set apart as applied in Data Driven Business Lab and the experience associated with Internship, to account for tangibility of process.

How it all falls in place to come together is indeed a beautiful mystery where I stand evaluated by the unravel of events on their own time yet content with my actions to step forth and not look, as I do so in pursuit of knowledge and building my foundation. Considering difficulty as part of growth, I realize its necessity. Times when I could not understand my actions, reflect upon and analyze the true depth of this learning experience helped me follow through with my goals to the end.

References

1. Wikipediaorg. 2018. Wikipediaorg. [Online]. [23 May 2018]. Available from: https://nl.wikipedia.org/wiki/Enterprise_resource_planning
2. Wikipediaorg. 2018. Wikipediaorg. [Online]. [23 May 2018]. Available from: https://en.wikipedia.org/wiki/Microsoft_Dynamics_NAV
3. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://nl.wikipedia.org/wiki/Business_intelligence
4. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://nl.wikipedia.org/wiki/SQL
5. Wikipediaorg. 2018. Wikipediaorg. [Online]. [11 June 2018]. Available from: https://en.wikipedia.org/wiki/Original_design_manufacturer
6. Wikipediaorg. 2018. Wikipediaorg. [Online]. [11 June 2018]. Available from: https://en.wikipedia.org/wiki/Original_equipment_manufacturer
7. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://nl.wikipedia.org/wiki/Global_positioning_system
8. Wikipediaorg. 2018. Wikipediaorg. [Online]. [11 June 2018]. Available from: https://en.wikipedia.org/wiki/Business-to-business
9. Wikipediaorg. 2018. Wikipediaorg. [Online]. [11 June 2018]. Available from: https://en.wikipedia.org/wiki/Contract_manufacturer
10. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://en.wikipedia.org/wiki/Research_and_development
11. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://en.wikipedia.org/wiki/Purchase_order
12. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://en.wikipedia.org/wiki/Sales_order
13. Wikipediaorg. 2018. Wikipediaorg. [Online]. [11 June 2018]. Available from: https://en.wikipedia.org/wiki/Performance_indicator
14. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://nl.wikipedia.org/wiki/Microsoft_Power_BI
15. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://nl.wikipedia.org/wiki/Dataset
16. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://en.wikipedia.org/wiki/Workflow
17. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://en.wikipedia.org/wiki/URL
18. Wikipediaorg. 2018. Wikipediaorg. [Online]. [8 June 2018]. Available from: https://nl.wikipedia.org/wiki/Entity-relationshipmodel
19. Wikipediaorg. 2018. Wikipediaorg. [Online]. [11 June 2018]. Available from: https://en.wikipedia.org/wiki/MoSCoW_method
20. Wikipediaorg. 2018. Wikipediaorg. [Online]. [11 June 2018]. Available from: https://en.wikipedia.org/wiki/Standard_operating_procedure
21. Abcebusinessnl. 2018. Abcebusinessnl. [Online]. [11 June 2018]. Available from: http://nav2016-mi.abcebusiness.nl:49000/main.aspx?lang=en
22. Alex chow (2016). Implementing Microsoft Dynamics NAV. (Third Edition ed.): Packt Publishing Limited.
23. Bernard Marr (2012). Key Performance Indicators. The 75 measures every manager needs to know: Pearson.
24. Osi momoh. 2003. Investopedia. [Online]. [11 June 2018]. Available from: https://www.investopedia.com/terms/c/cogs.asp
25. Investopedia staff. 2003. Investopedia. [Online]. [11 June 2018]. Available from: https://www.investopedia.com/terms/m/margin.asp

APPENDIX 1- Initial Project Plan