Automation and Standardization of the Quote to Cash process on SAP by Design for Halifax Fan Ltd

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BUSINESS PROJECT ACCEPTANCE CERTIFICATE

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Abstract

Halifax Fan Group is an industrial fan manufacturing company currently located in 5 locations worldwide, operating either through owned manufacturing facilities or in partnership with local manufacturers as sub-contractors. There are currently plans in place to expand to other underserved regions in the world and capture those markets. Due to the low-cost nature of said markets, the consideration is to work with local partners. To support this a process is required where HF can share its systems infrastructure with said partners all the while ensuring that the critical proprietary technical designs of their products are maintained under strict access control. This can be managed via setting up a standard design structure in SAP in conjunction with external configuration systems and taking away the need to design products at the partner products, this in turn also ensures that the partners can focus on their core business which is manufacturing and do not have to expand resources on designing, planning, and setting up systems.

Here comes the requirement for this business project, where said process is to be designed where the process is standard across multiple product configurations and is set up in a way which leverages the best practice capabilities of the systems involved. Here are the two main components involved:

1. SAP Business ByDesign: SAP's offering based on cloud infrastructure and a Saas model catering to mid-sized entities
2. An external proprietary fan configurator: Which communicates with SAP using a two-way API with built-in real-time quotation capabilities in

The process being designed as a whole is a Quote to Cash order involving multiple components of SAP including Production Planning, Supply Chain and Warehousing, Materials Management, Sales and Distribution as well as Finance. There are touch points within each of the areas and the process is aimed to set up in a way which leverages automation capabilities in each of the modules. This project will mainly revolve around creating production hierarchies using Bills of Materials and Bills of Operations while ensuring that the process does not exceed two or three hierarchies within the design structure. The project will also be covering the system configurations to support these hierarchies and creation of products within the system.

1. Introduction

The group currently has physical presence in 5 locations globally with two facilities in China. The first company based in UK was formed over 50 years ago and boasts its significant experience in the industry and its proprietary technical designs as its USPs over its competitors. The fan industry is now becoming saturated with multiple competitors competing for different chunks of the market. Halifax Fan has a strategy of operating with a lower cost but mid to high quality product offering. The companies specialize in different types of fans catering to different industries as well as ATEX (explosion proof) fans.

Following is a map of how the entities are spread out globally under a unified strategy to cover different regions:

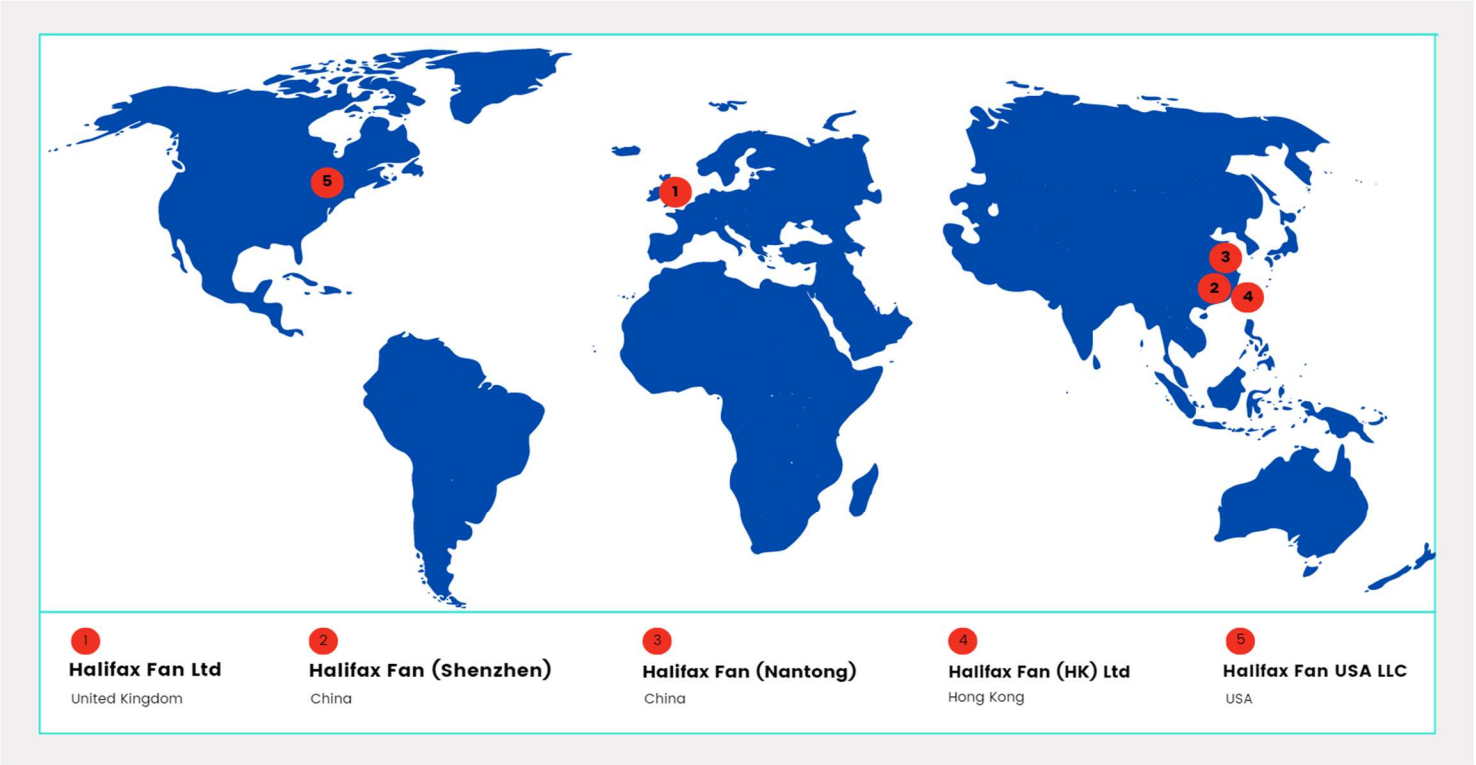

Figure 1 Sites around the world

These are the main industries the group is serving:

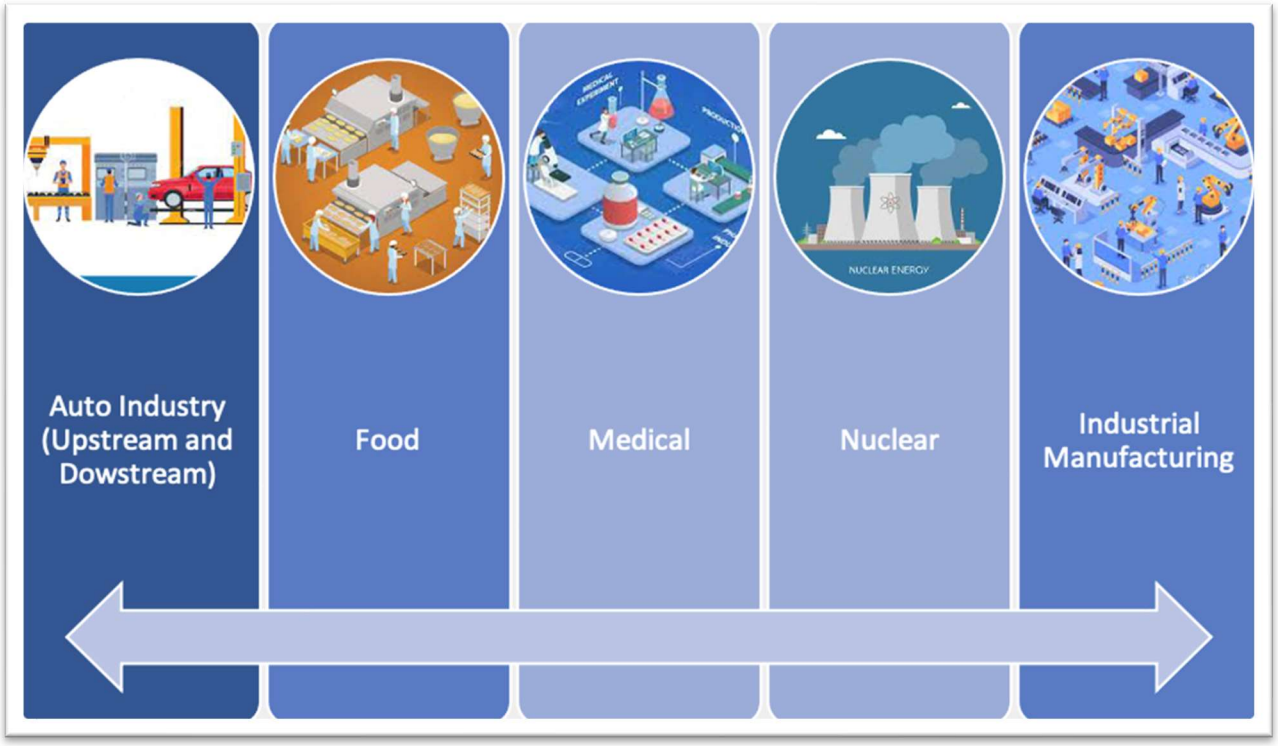

Figure 2 Key customer industries

Figure 3 An Industrial Fan

2. Digital Infrastructure

There is a significant emphasis on ensuring that all data and processes are on the cloud which enables ease of access throughout the multiple locations the company is based in, as well as an offshore office that is based in Pakistan. This creates a unified data structure and does away with the need for data duplication and all documents created in the past can be accessed via the cloud. This also ensures that the access to said documents and data can be controlled and each employee's access levels can be managed.

2.1. Microsoft Office 365

There is a significant reliance on Microsoft's services when it comes to managing documentation and the use of applications like Excel, Word, Projects, and Teams. With teams working across multiple continents real time collaboration is essential for efficient operations and reporting. Furthermore, since we are in a COVID impacted landscape when it comes to workplace interactions these tools are even more critical as the customers that partners be it customers or suppliers are increasingly adopting similar tools as wells leading to further ease of collaboration between companies' workforces.

2.2. SAP Business ByDesign (ByD)

SAP ByD is a cloud ERP offered by SAP to users on a SaaS model, this is the precursor to S/4 HANA albeit with the difference being that HANA is aimed at large enterprises whereas SAP ByD is aimed at capturing entities in the mid-sized market, ideally entities turning over between $5M to $300M.

Halifax Fan have been one of the earliest customers of ByD and entered into an agreement directly with SAP in 2011 when the company moved over from Oracle Netsuite to ByDesign. There were two main considerations behind this decision:

1. Management's past success and long working history with SAP products and the best practice offerings in the system to support a robust supply chain and manufacturing operations

2. An ERP based completely on the cloud which could be accessed from anywhere and the cost could be controlled as the company grew as opposed to shelling out huge sums to implement the software early on when the companies could be ideally using that cash to grow its operations

During this period the group has seen a growth in turnover which is over 300% and as the headcount has grown, so has the cost for the SAP licenses in keeping with the number of users. Further, ByD has allowed the company to expand into new regions without any concerns for digital infrastructure costs that usually go with setting local servers and hiring IT staff for each site. All that has been needed is a laptop and an internet connection.

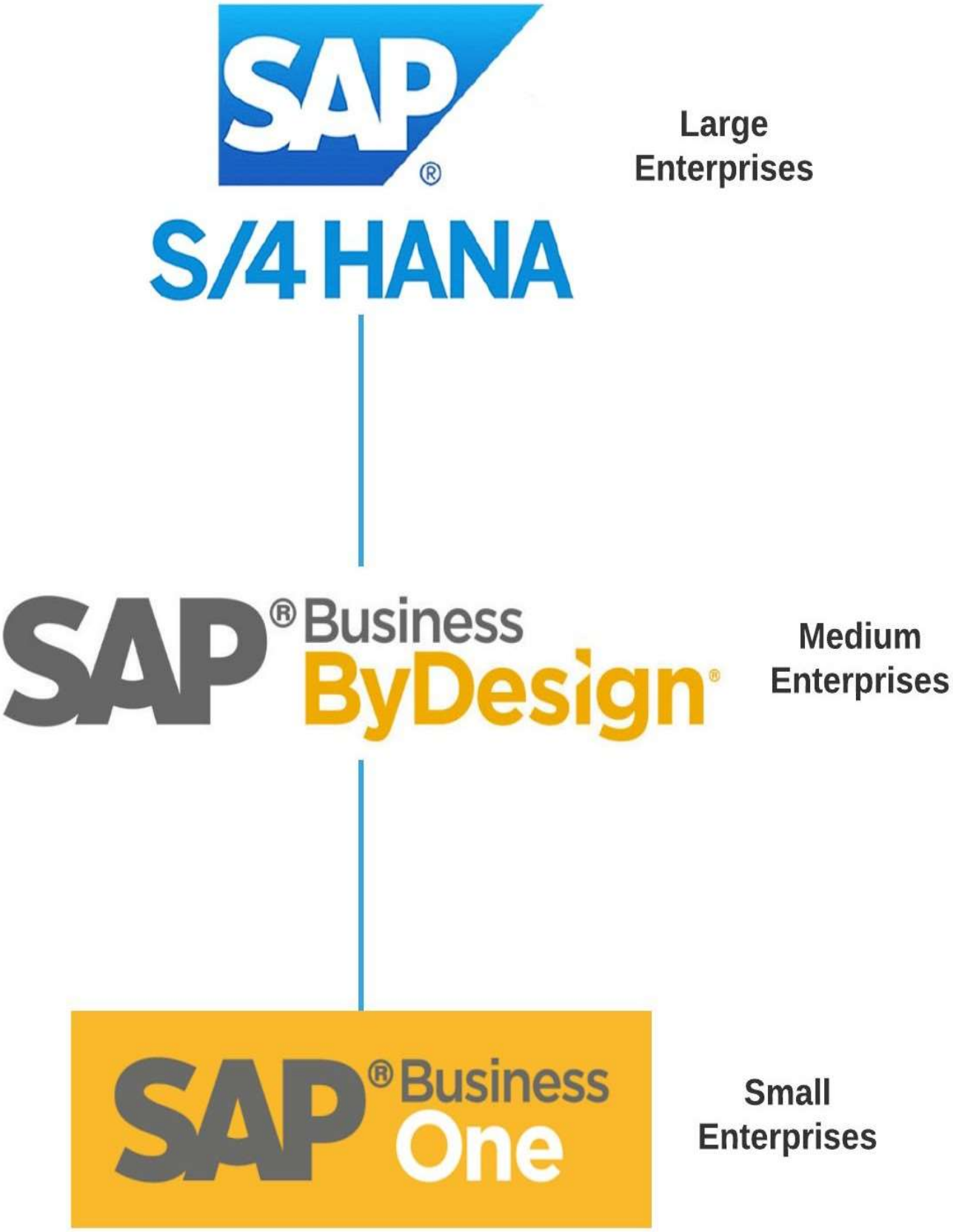

Figure 4 SAP's product offerings for each market

3. Scope of the project

This business project is one part of a significant digital transformation exercise being undertaken by Halifax Fan Group. This project is working on standardizing and automating three following key areas:

1. Fan configuration and pricing without requirement of significant product technical knowledge
2. Automating the process flow between the quote stage, all the way to customer invoicing with key touchpoints in the following areas on SAP:
    a. Sales and distribution
    b. Materials management
    c. Production planning
    d. Warehousing and logistics
    e. Master data management
    f. Supply chain and procurement
3. Standardization of fan design metrics using iLogic allowing the system to design and provide recommendations for customer requirements doing away with the need of designer input on every order

This business project's focus is centered on the technical transformation captured in step 2. A process will be designed from the ground up which automates the workflows through different modules of SAP only requiring input at critical stages where decisions need to be made. The process is expected to drive planning and scheduling on the shop floor as well to ensure that SAP acts as a central control point for all activities and sites as well as ensuring that the system data is true allowing for quality data reporting in real time.

4. Criticality of the project

The project is of significant strategic importance to the Halifax Fan group in terms of global expansion strategy. Currently each site has been managing their data and processes on the system based on a best fit scenario. Processes are not yet streamlined and require a lot of manual input and communication between different functions. This has worked albeit with some flaws for each of the sites.

Now with the idea of expansion being looked at there are two main considerations which need standard, repeatable, and automated processes:

1. Manual processes with a lot of outside the system communications expose the company to greater breakdown risk as they are scaled to either multiple sites or high volumes
2. Standardization is critical to the success of sub-contracting strategy in the more remote markets as the sub-contractors may not welcome the idea of hiring staff to process transactions or data and systems experts to support in case there are any issues

A standard process will ensure that it can be managed remotely, it will also reduce the manual overhead that is required with the current process. The key to success for this strategy is to design a process that is breakdown proof which allows the companies to keep their focus on technical innovation of their products and not be bogged down by issues on the system holding up production.

A successful process also ensures that the social transformation that follows the project has a higher chance to succeed as well. To attain maximum possible user buy-in the process has to be robust, play to SAP's strengths, leverage the system's best practices and still be easy enough for most users to wrap their head around. Since this new process is expected to be a major departure from the existing practices therefore, it is expected that certain teams will struggle, consequently, it is up to the process designers to design a process that caters to the normal user as well as the super users involved in the project display a high aptitude for SAP and tend to know fixes and workarounds for most of the system's flaws.

5. Desired Process Structure

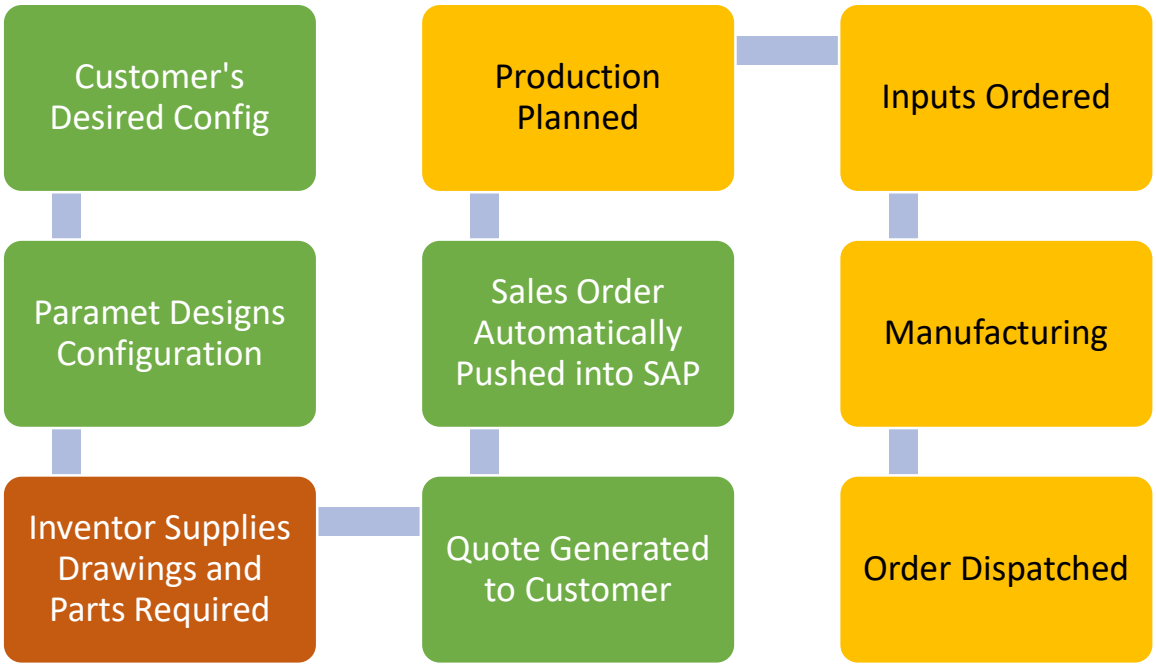

Figure 5 Flow of Information Through the 3 Systems

6. Key business objects on SAP ByDesign

For the scope of work within SAP, there are four main elements/objects of the system that will need to be standardized:

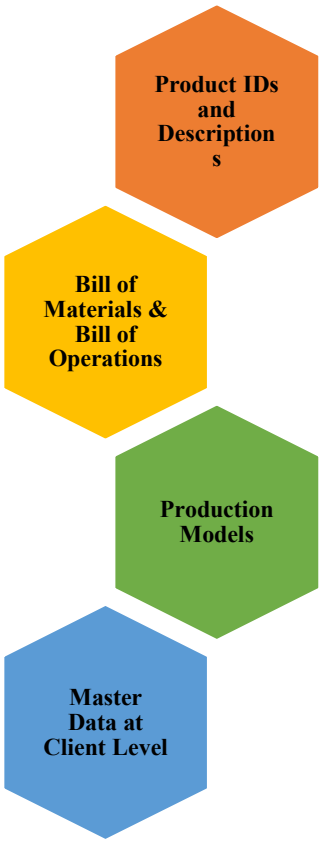

Figure 6 Standard Objects within SAP

6.1. Product IDs and Descriptions

All objects in the system exist in the form of IDs, this includes all inputs, outputs, and engineering items. There is a choice in the system to allow the IDs to be either numerical or alphanumerical based on the nature and use of the item. SAP has a numbering range for each object type in the system and the configuration setting allow ways to control policies around numbering ranges.

In a similar vein, all objects must carry a description. The limit for the description is 40 characters which is applied system wide and represents a challenge for items that need to carry more

information. It is quite often difficult for users to remember IDs and therefore descriptions need to be used to search for IDs with a combination of wildcard search.

6.2. Bills of Materials (BoM) and Bills of Operations (BoO)

These engineering objects are the pillars of all manufacturing processes within SAP which define what inputs will be required for each item being manufactured. For any entity using demand driven production and procurement planning these two items serve as the main areas of planning data along with inventory recorded within the system.

Bills of Materials lay out what material inputs and in what quantities will be required for a said product. Bills of Materials usually work in hierarchies and there can be multiple BoMs under a single high level BoM. Units of measurements can be defined based on what the inputs are.

Bills of Operations lay out the services that will need to be performed in the manufacturing process to process outputs. Normally these would be labor intensive services and the unit of measurement is often hours since they are manually performed services or even if they are automated they will still be recorded as hours.

6.3. Production Models

Production Models serve as a parent item and a bridge to connect which BoM and BoO combination can be used for which specific product. Production Models have no significant information within them other than the Material Product ID, all the actual data is derived is from the underlying BoO and BoM.

Engineering Change Orders (ECO) are also supporting items which are normally generated and required when a new BoM is created or an existing one is changed. Once the change is locked in the ECO is now completed and cannot be reopened.

6.4. Master Data at Client Level

Master Data is perhaps the most critical part of this exercise and has to be standardized throughout the system. All key decisions are made and reflected at the Master Data level, one of the main ones being the policy which drives planning strategy, logistics and then finally the 'Make or Buy Decision'. When it comes to automation and standardization all of these decisions have to be predefined and ensured that they do not need to be made again otherwise it causes a breakdown in the workflows set up.

7. External Data Communication Arrangements with SAP

Under the objectives of this project, there is a significant amount of data that must be pushed into SAP and simultaneously extracted from SAP at any given time and stage of the project. While in the implementation and design phase of the project, a significant amount of objects/IDs have to be created in the system at once which will be detailed later in this project.

To create objects/IDs such as BoMs, BoOs, Materials etc. the SAP migration functionality will be used. This is standard procedure for all implementations. The migration functionality bypasses the HTML based UI and allows the Admin users to access the backend Netweaver database which allows en masse creation of objects. The data is input into the system through pre-defined excel based templates.

The second components which allows the external configurator called ‘Paramet’ to communicate with SAP through a two way channel are the webservices which allows access to different areas and data tables within the system which allows reading all data and writing selected sets of data in real time using SQL codes and WDSL/HTML based scripting. This will be expanded upon as well in the later sections.

8. Standardization Approach to Products

This section is outside the purview of this project and not one of the objectives of this project however, a brief detail will be discussed here as this has a significant impact on the process defined within SAP ByD.

The engineering team has defined each possible combination for all of the mid to high level products and combinations that may ever be required to ensure that the process implemented now is future proof and no further work is necessary down the line when the process is being used in the more remote sub-contracted regions.

The engineering definitions are based on the following key items for all fans or final products:

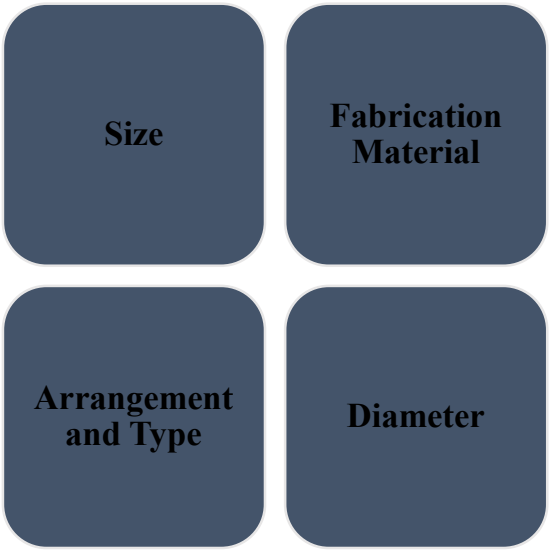

Figure 7 Standards of Fan Selection

Every possible combination of these standards has been designed based on standard specifications, even including fans based on combinations which are not used or likely to be used by any industry to cover off all future eventualities.

Similar to how the fans have been defined, the underlying mid-level inputs and key components have also been defined in a similar way. Normally a very high level of fan BoM would look something like this:

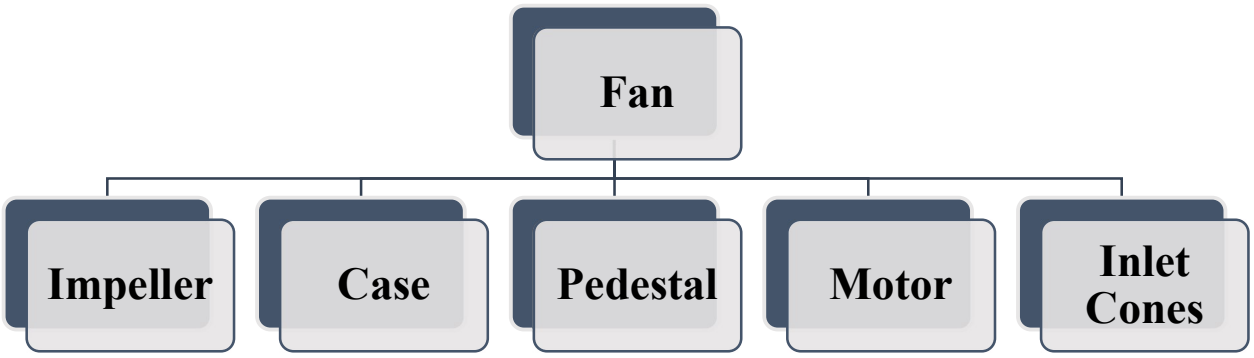

Figure 8 Basic Fan Components

The challenge after the definitions above is to ensure that every input other than low value consumable is captured, which can only be done once we accurate design drawings of the fan have been made which in normal cases are only created at the time when an order has been confirmed. Based on said drawings production and procurement is planned.

As we go further down the BoM hierarchies, the number of inputs increases at each levels. For example, a fan has 5 main inputs. Each of these 5 inputs have at minimum 3 further inputs taking it to 15 items now. Any single item missed has significant consequences both in terms of costing but also production planning as well.

This process is already underway and is being worked on a component-to-component basis. A year has been invested into this exercise by the engineering team and is expected to be completed later this year.

9. Standardization Approach to Job Numbers

All previous iterations or production process relied on an internally/manually generated 5-character job code, which was then populated in different fields within SAP to ensure that the jobs could be searched in different areas under finance as well as production planning. The key document in SAP that is the center for all job-related information is a Sales Order. In SAP ByD, all sales orders are assigned a numbering range between 100000 – 999999 limiting them to a 6-character ID. Owing to the considerations below, a decision was made to use the sales order ID as the job ID in all areas both in-system and outside.

9.1. Challenge with using Job ID in SAP

Job IDs entered manually are not a standard option in the system and therefore, this ID may not be carried over to some areas in the system where the sales order ID is the only connector between the output products and the system areas involved in production. This has often caused confusion when the Job ID does not return any results, and this has often led to a support ticket to the consultants or super users only to be discovered later when sales order ID was used.

With this new process, there was an opportunity to tackle that challenge as well. Since here the job scheduling will only start once the sales order has been released in the system, at which the sales order ID is already available. Therefore, it was decided to base the job ID on the floor and production schedule based off the sales order ID.

This brings two-fold advantages, one being that it is now significantly more efficient to trace and search for jobs in various areas of the system. For instance, the production task control is not likely to bring up any results if you search for the legacy job ID, leading to the users querying the code for the output product which in turn causes confusion as a similar output product could be being sold to multiple customers at once.

The second advantage is the ability to now track and trace physical inventory outside the system. As discussed above, two different orders could be calling up demand for two exactly identical products which are understandably based on different schedules. There is a risk that said part ordered for one order could be consumed for a different job resulting in delays. This is where the Identified Stock is used for tagging physical products ensuring that they are booked in to the correct jobs.

9.2. Identified Stock and Product Specifications

The identified stock model was in use previously during the legacy job ID era. The identified stock code was the same as the 5-character job ID and all products were tagged using this code whether in-system or outside. While it made life easier outside the system, the in-system was quite difficult to manage due to the lack of traceability in the system for job IDs in certain areas.

With this new process of using uniform IDs throughout, all issues have been sorted. Product Specifications and Identified Stock IDs are all the same as the sales order ID. It has significantly reduced the risk of any inefficient processes and information flows. It has even made the customer invoicing process more streamlined allowing for automation and reducing queries from customers as their orders now carry one fulfillment ID instead of two under the legacy process.

10. Project Management methodology used?

Previous iterations of this project, which were on a much smaller scale, were set up on a Waterfall methodology. Even with the small scale of implementation there were still significant issues discovered once the structure went live especially in terms of actual usability by both the Materials team as well as the Production Planning team.

This is mainly because project management was not a central concern, and the project was mostly focused on the technical aspects of getting the process set up and running. This overly technical focus meant that most stakeholders and users never really got to know the system until they were expected to use it day in and day out. The fact that this process was a significant departure from what they were used to made it more problematic.

The decision this time around was made easier in light of the issues above. The technical team stayed the same but this time around a representative from each of the organizational stakeholders was included on the project to elicit inputs at the time of decision making instead of implementation. Furthermore, perhaps the most critical part was to take the project forward using Agile methodology by incorporating a pilot structure and then a phased final structure a few months later.

11. Defining Structure on SAP ByDesign

This is the area which will be under the scope of this business project, with the engineering team working on design and logging all the required data for every fan component it is upon me to design an efficient structure within SAP which can withstand the challenges detailed in earlier sections and deliver on the objectives that the management has envisioned for this transformation.

The challenges have already been discussed during the introduction section of this project. However, to reiterate the process has to work around system limitations while still retaining the original intended structure designed by the management. SAP is very strong when it comes to manufacturing hierarchies and processes, however, along the same lines these strengths can often be an impediment in case the standard processes are not an exact fit.

12. Proposal 1 – An Interim Pilot Structure

An initial structure was proposed to ensure that the amount of data required and any objects that need to be created can be assessed. This structure was driven strictly by system's best use capabilities and was intended to be used as a pilot to test in the system in a production scenario and assess the shortfalls. Furthermore, this structure was to fill in the time which would be required to do a risk and redundancy analysis and to come up with ideas to make the system as error proof as possible.

12.1. Considerations before Implementation

Even though a pilot, there are significant considerations that need to be considered:

- The structure cannot be a significant departure from the final product.
- Portions of the structure and process can be reused or recycled for the final structure.
- All objects/materials set up in SAP must be reused.
- The current records of use have to reconcile between the two structures.
- The new structure should not need the operational users to be retrained.

These considerations are shared between the management and the project team. These considerations are being considered as objectives to ensure that risks are minimized and time for proper risk assessment is bought while still being able to use some functionalities of the process to assess usability and functionality.

12.2. Step 1: Product Descriptions

The product descriptions or names have been designed in a way that a user can at a glance get an idea of the make-up and technical specifications of the product all the while keeping in mind the 40-character limit for all descriptions. In addition to this, the descriptions still have to be clear enough that a search can bring the correct results.

As discussed briefly previously, this has been achieved using the standardized approach to products directly translated in the system. Resultantly, all item descriptions in the system will look like this:

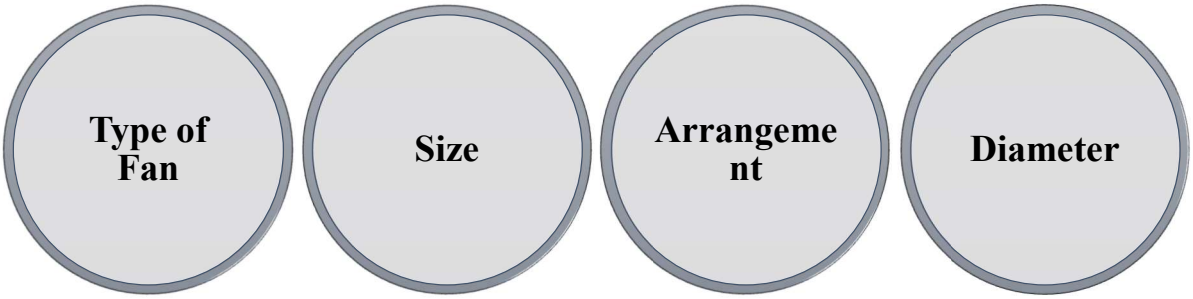

Figure 9 Product Description Template

12.3. Step 2: Product IDs

Product IDs have undergone a similar treatment as well. The significance of standardization here is the two way data connection with the external API which will configure fans. The API needs to read product IDs to be able to use them accordingly, which is done via strings of code. To ensure that the code can work repeatedly, the IDs have had to be numerical instead of being alphanumerical.

SAP normally limits user access to creating numerical IDs, and any user created IDs have to carry an alphanumerical code which are referred to as Intelligent Codes. The issue with such codes is that with different users creating products each user could interpret an intelligent code differently, defeating the purpose of standardization as well as the string of code. Hence the IDs are all numerical and sequentially generated by the system by unlocking the numbering range in SAP.

To achieve this, once the IDs have been uploaded into the system via the migration templates, they are then fed into the code for each product type to ensure that the external configurator can read and write them using the webservice based API.

12.4. Step 3: Planning Object IDs

Planning object IDs include Production Models, Bill of Materials, Bill of Operations and Engineering Change Orders. There are two main reasons for standardizing these items; one is to keep everything in line with the standardization philosophy and the second is to ensure traceability to the underlying products while simultaneously ensuring that even with a significant amount of objects a clarity remains.

The system-based limitation with this is that all IDs have to be alpha-numeric, Therefore, a similar ID scheme as the underlying output product cannot be used. Since alphabets are allowed, the decision was to make use of said alphabets and reflect the location this object will be used as each object is business residence specific. So, an example object ID would be 1234567_AB, with the numerical portion reflecting the underlying product ID.

12.5. Step 4: Number of Hierarchies

The norm with such decisions is to ensure that the number of hierarchies or levels is kept to a minimum, as the number hierarchies increase the planning becomes more tedious and the risk of user error increases significantly. As it stands currently, two levels will be necessary. One for the final product and another one for the inputs to standard fan components such as Impellers, Cones etc.

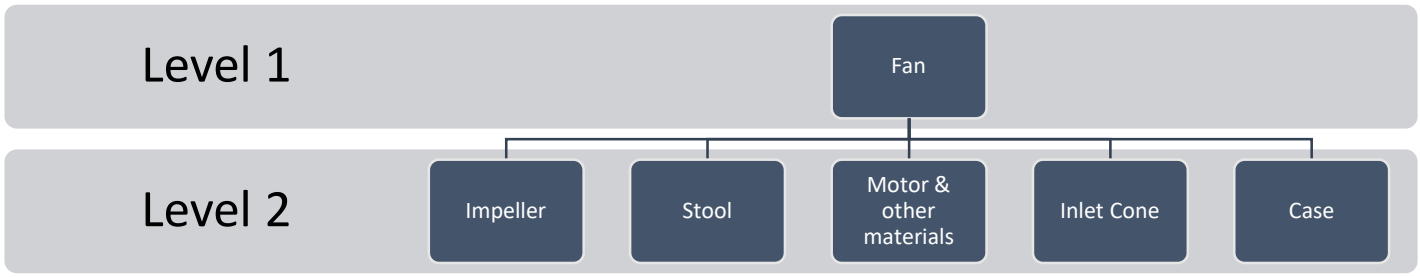

Figure 10 Overview of Planning structure

Both Level 1 and 2 are expected to be eligible for planning in this case. Once the planning is triggered at Level 2, or a multi-BoM planning is run at Level 1, Level 3 should automatically be covered for with the system either pushing stock requests or purchase requests since items at Level 3 are not items that will required to be manufactured and will often be consumed directly from stock.

12.6. Step 5: Order of Object Upload into SAP

Materials would be the first items to be mass created in the system using an upload template as all the other items are dependent on these materials being in the system. Furthermore, once we have the IDs for each material and product, we will be able to define their respective planning objects. As discussed above, there are 4 planning objects, and each has a different relationship with the other.

The following chart shows the relationship between the 4 planning objects:

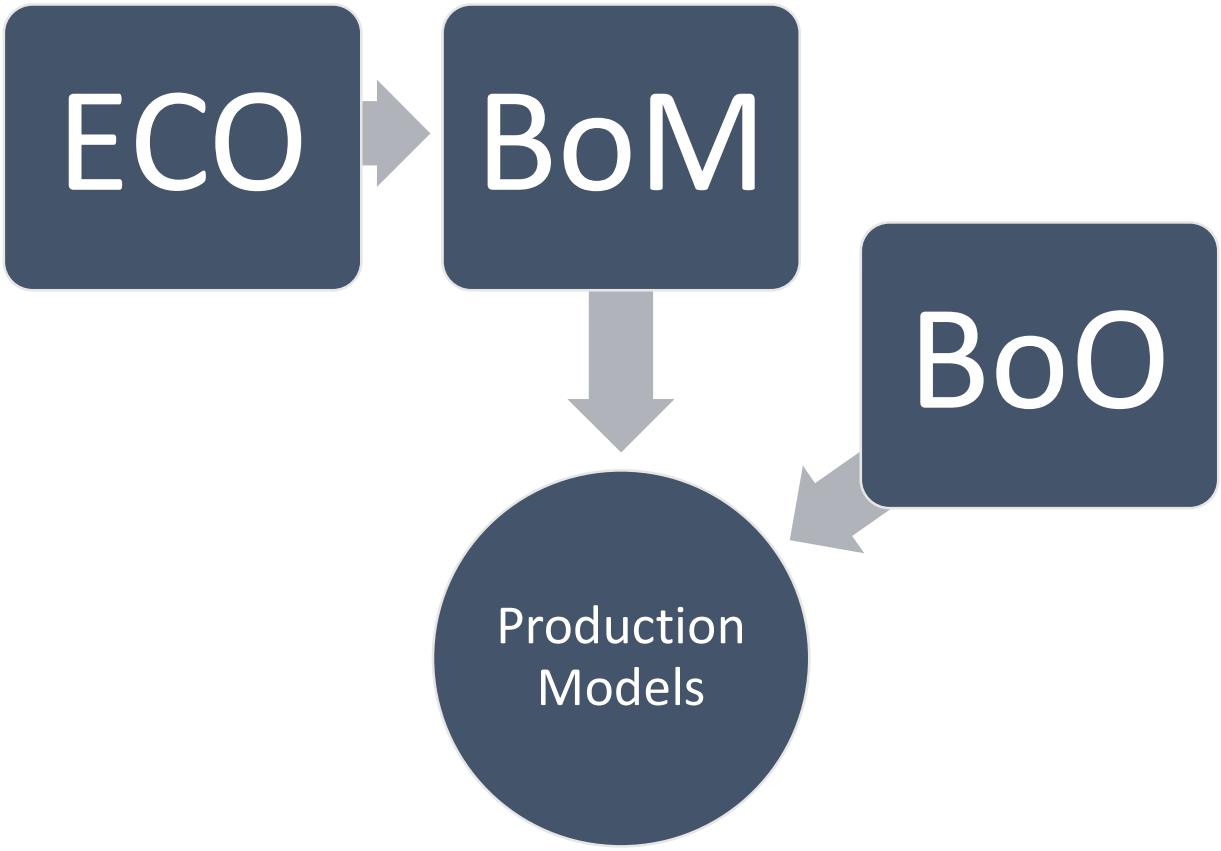

Figure 11 Planning Objects relationships

Based on the relationships above, BoOs and ECOs must be in the system first and Production models can only be updated at the end. The upload has to be done at both hierarchy levels starting with level 2 first.

12.7. Information flow through the structure

Once the fan is configured, the external API Paramet will have pinpointed the Products that will be used for this particular order. Upon confirmation, the data will be pushed into SAP populating a new sales order. Once this new sales order is completed, the products are now available for planning. This planning area is where the structure designed above is expected to be utilized.

Confirmation of the sales order above populates all products within the customer demand screen where planning can be ran. Planning gives rise to work orders and purchase requests based on the nature of each input material. The items which have a BoM and a BoO behind them would usually

turn into work/production orders whereas all of the other items would be bought out if not available in inventory.

The standardization is expected to perform in a way so that human intervention is only required while running planning and while processing purchase requests. Any other areas where human intervention is needed likely means that the planned structure has not worked as intended.

13. Key findings from Proposal 1

Generally, proposal 1 has worked as intended with human intervention only required at the following areas:

- Populating sale prices in the sales order
- Operations on the planning screen
- Processing purchase requests
- Confirmation of order completion and processing outbound deliveries
- Creation of customer invoices

The above interventions were expected and were not catered for during the implementation of proposal 1. The aim here was to achieve standardization to ensure that no human input was needed while selecting inputs and labor hours right until the end. However, it is quite obvious that there are still understandable gaps where automation can be achieved to ensure that the process can be made more efficient and error proof.

14. Business Cases not covered by Proposal 1

When it comes to the extent of labor involved, perhaps the costliest resource is cutting steel sheets using a laser machine. This is costly in two terms, one being the labor being expensive when it comes to an hourly rate, the second being the cost to acquire and then operate laser machine. A laser machine, depending upon the specifications, can range between £400,000 to £1M and this was a consideration under discussion as proposal 1 was being tested.

14.1. Laser machining not available in-house

This gives rise to our first consideration. For a lot of the remote subcontractors, the investment in a laser machine may not be worth the investment. That is a lot of specialized inputs that a mere fabrication company might not require. Hence, they may choose to have the parts laser cut from an external partner, normally such partners specialize in selling steel sheets cut or uncut based on your requirements.

The parts that need to be laser cut, lie at level 2 namely Cases, Impellers, Inlet Cones, Stools etc., current configuration in the system has them set up to call up work orders a standard operating procedure. This would counter the ground realities on most of the sites where these items would likely be purchased. Therefore, this gave rise to the requirement of a '*Make or Buy'* decision around level 2.

14.2. Purchase of steel sheets from a related entity

The second business case was an extension of this case with one entity not having an in-house laser machine and having the steel sheets cutout from a related entity (shared ownership structure). This in one sense is the case described above being played out in actual sense with one difference being that instead of an outside and unrelated supplier (easily handled in SAP) this is an entity which exists in SAP.

With the related entity being an operating entity in SAP, this presents unique opportunities and hurdles from a process perspective. The general process of accounting for purchases from external suppliers is quite straight forward, it is a purchase like any other component in the BoM structure. When it is an internal entity, we now have to handle both sides of the transaction needing double the operation overhead.

15. Second Iteration of the structure

Initially, the expectation around the second iteration was just to find gaps where automation can be integrated to decrease the manual work and risk of errors. However, with the case above and the one topic of laser machining still under review by the time proposal 1 was implemented a need was discovered to make further changes to the existing structure.

15.1. Need for a changed hierarchy

The two business cases above gave rise to the need for another hierarchy as those conditions cannot be catered for in our existing structure. Let's use Impellers as an example to explain the limitation of a two-hierarchy structure. As described above, for an impeller the main material inputs are steel sheets. When it comes to labor there are three activities that need to be performed to get the steel sheets to end up as an impeller:

Figure 12 Labor Inputs for an Impeller

The blue items in the figure are something Halifax Fan will need to do internally as they are based on the exact fan spec as well as a the paint coding requirements of the customer. These two generally do not require significant labor time or costly expertise. The green item being the laser cutting is different from site to site, majority of the sites own their own lasers and hence can carry

this out internally except one site, which has loaned theirs to a related entity under a royalty agreement.

The first idea considered was to look at the possibility of raising a purchase request for laser cutting while keeping the other two items in-house. Here this idea becomes unfeasible owing to a system limitation where labor activities cannot be ordered externally as they are contained in the BoO. SAP only allows creation of purchase requests for items that are in the BoM. While the steel sheets could be bought from the external entity, there would be no way to charge laser labor to said entity.

The solution to this was to create a bundle item which contained all the cut steel sheets and the labor cost, essentially a kit much like what the automakers do in Pakistan. That leaves finishing and welding as well as surface finishing and painting to be done once the complete kit has been received from the external entity. While sensible on paper, this cannot be achieved in SAP due to the limitations with BoOs and the kit containing elements of both a BoM and a BoO.

This necessitates addition of another level in the current hierarchy, with kits lying below the main items with the master data set to '*External Procurement'*. The following figures gives an idea of a changed hierarchy:

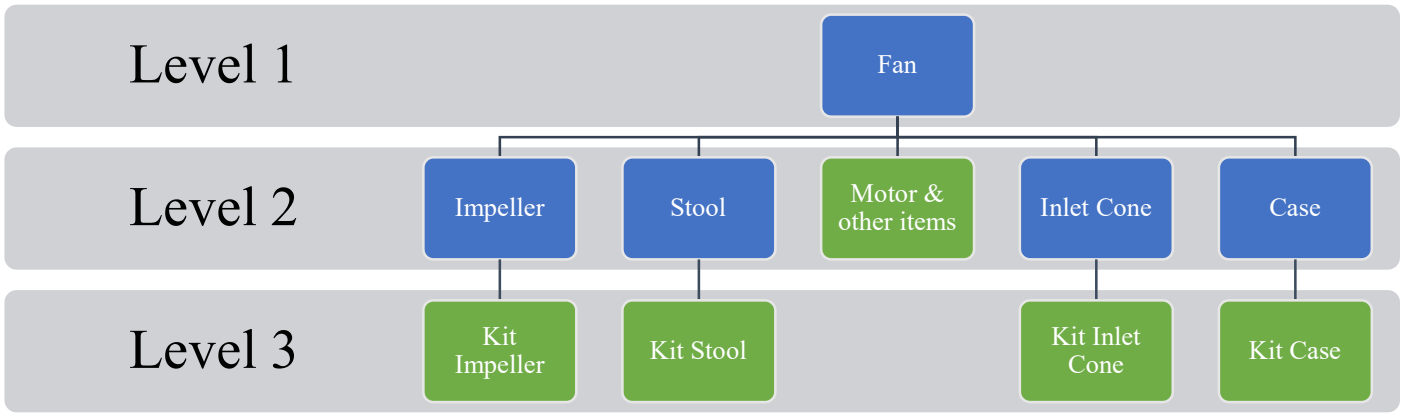

Figure 13 Revised Product Planning Hierarchy

The blue items above will now be set to be internally manufactured and will trigger a work order, whereas the green items will be set to external procurement. Based on the above structure items on Level 3 of hierarchy are now also eligible for planning which leads towards the requirement of

a plan on how best to recycle the current data in the system with the least amount of data uploads into SAP.

15.2. Reconciling Material IDs between both iterations

The changes to the hierarchy levels now present an additional challenge in the form that the existing IDs and planning objects cannot be used exactly as they exist in the system. As with the original objective that IDs are used in the system in such a way that they can be reused in the subsequent iterations. Going off of this, we have two options now:

1. Use the existing IDs as level 2 and introduce new IDs for kits at level 3.
2. Modify existing IDs to be used as level 3 and introduce new IDs for level 2.

The choice was mainly based on two factors, the first was to ensure that the least number of objects in the system were left obsolete, the second was to ensure that the amount of work required to get this structure active was kept to a minimum. To this end, going with option 1 was not feasible as it would have left almost all of the planning objects obsolete.

Opting for level 2 was a much more efficient process as it would enable us to use the same planning objects that already exist in the system. This option has one added benefit which is critical to ensuring that the *'Make or buy decision'* can be made with regards to each site's capabilities. This is explained in the next section. The main changes made to enable this are reflected in the figure below using impellers as a reference point:

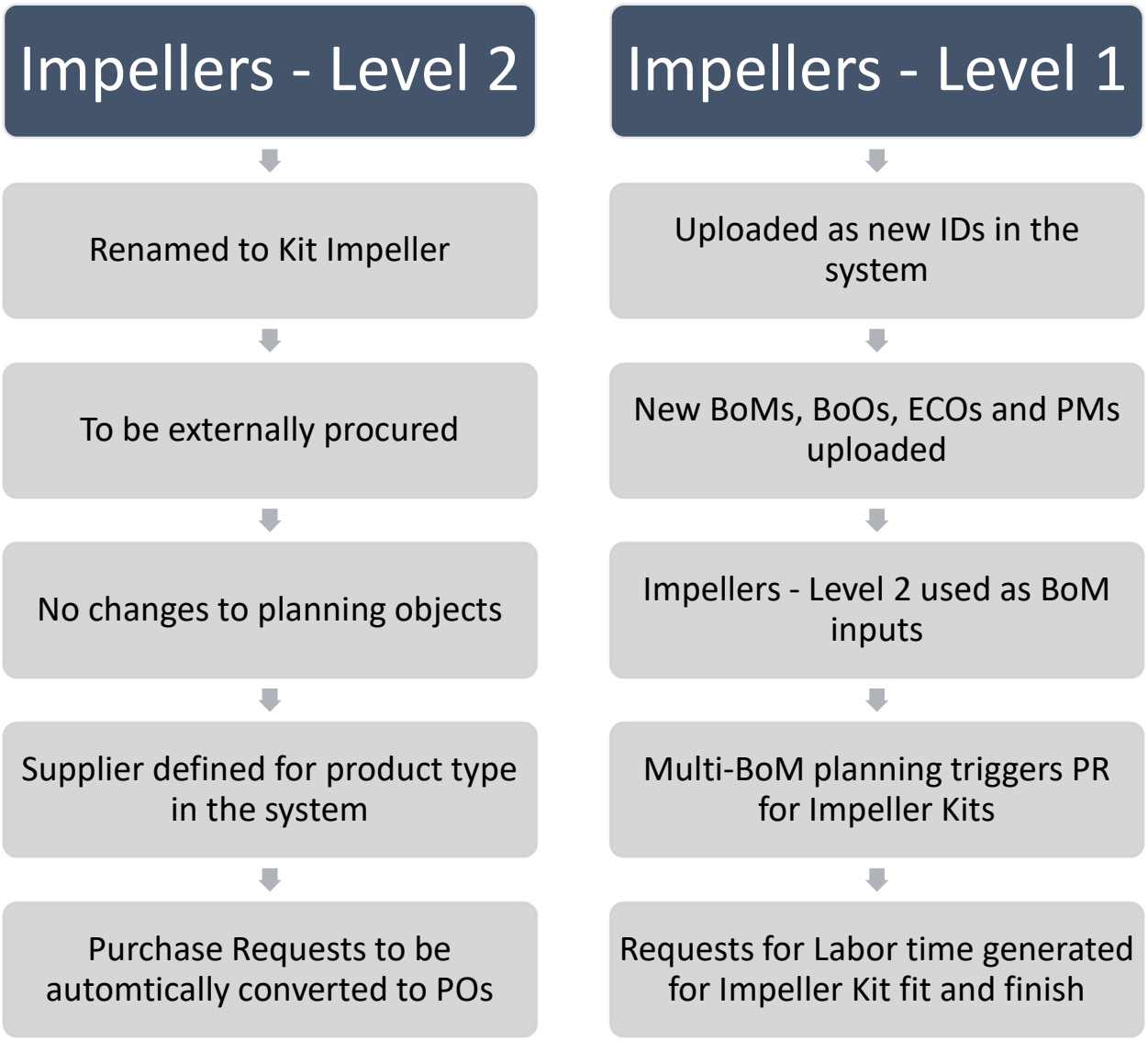

Figure 14 Summary of changes to existing structure

15.3. Implementation of a Make or Buy decision

This decision is critical to ensure that the second iteration of this project can scale to all entities worldwide and not cater to one scenario which is expected to be more prevalent throughout the group and their subcontractors. As discussed in detail above, the availability of a laser machine and adequate resources is the key variable that is likely to affect how each entity will navigate the new process. The following flow-chart explains the decision process:

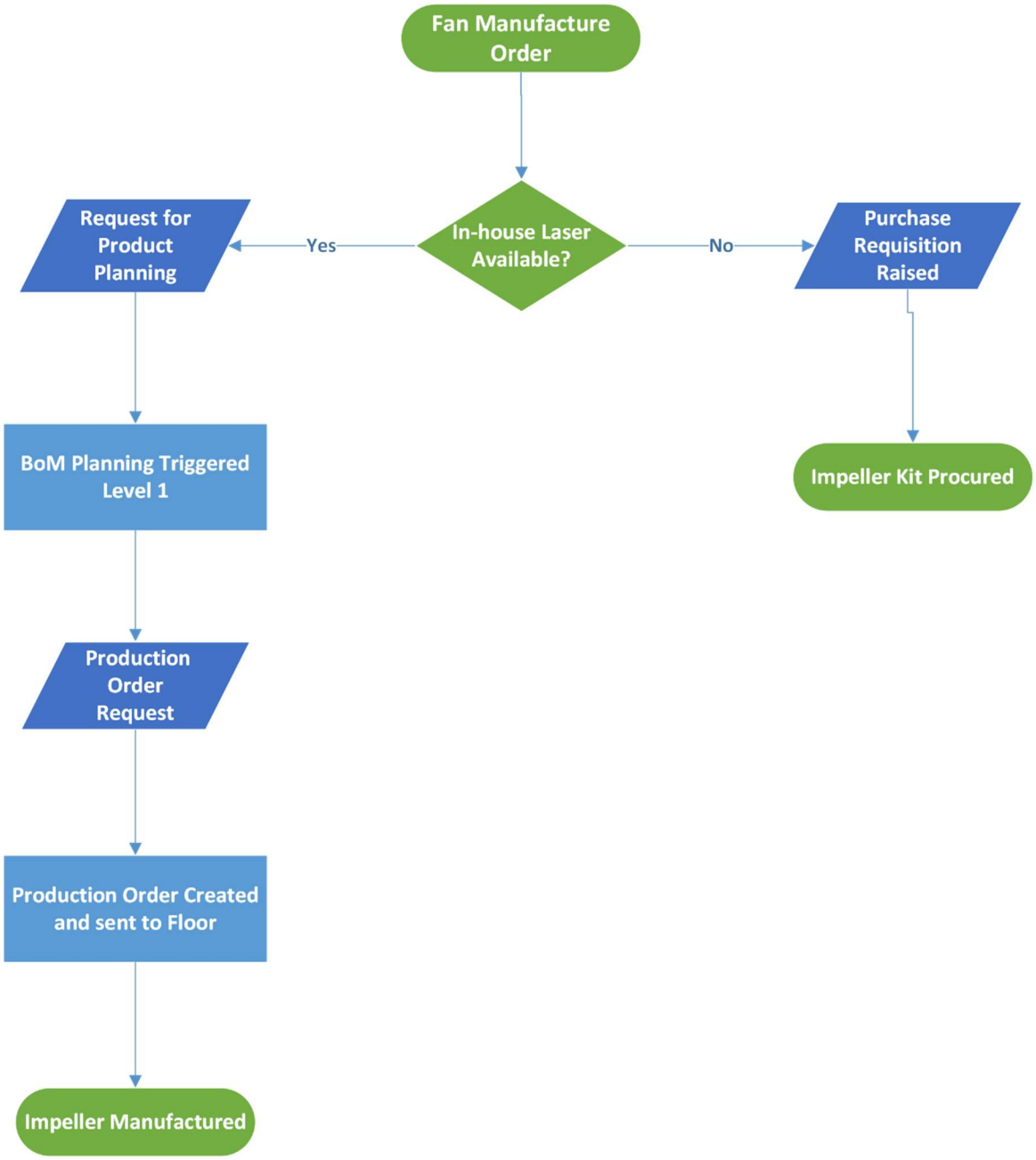

Figure 15 Decision Matrix for Make or Buy

15.4. Integration of the related company providing Kits

This was the second area highlighted as challenges that were observed after implementation of the first iteration. The process designed under both iteration 1 and 2 are set up in a way that can keep the process simplified and leveraging the best use capabilities of the system. However, this case

came up mid-way during the implementation phase and in true agile fashion had to be integrated into the structure being developed.

During the planning stage, it was clear that this was going to be the most difficult part of the project due to the inherent nature of overlapping transactions and business documents involved in SAP. However, with this there was also the option of some interesting automation opportunities offered by the system which need time to be explored as they were never required beforehand.

The planning stage for this area was broken down into multiple sub-steps to identify areas of risk, documents generated and opportunities that allowed for automation due to the number of transactions involved and the data being similar going both ways.

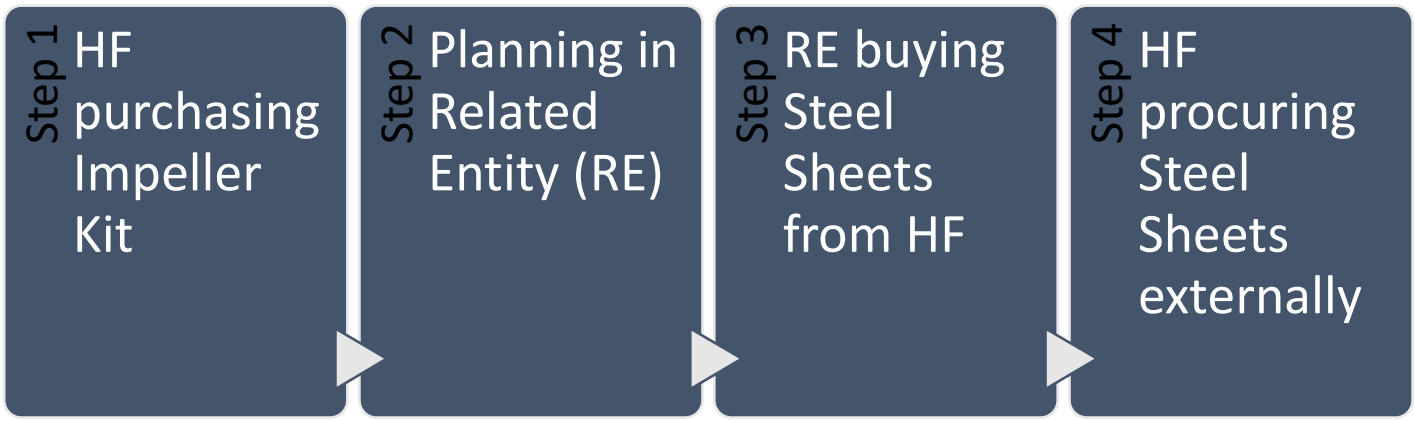

Figure 16 WBS for Related Entity integration

Detailed in the sections below, Steps 3 and 4 are interlinked using the 3PL service in SAP to ensure that the movement of goods between the supplier, HF and RE are recorded simultaneously.
A high-level view of this integration is presented in the process flow below:

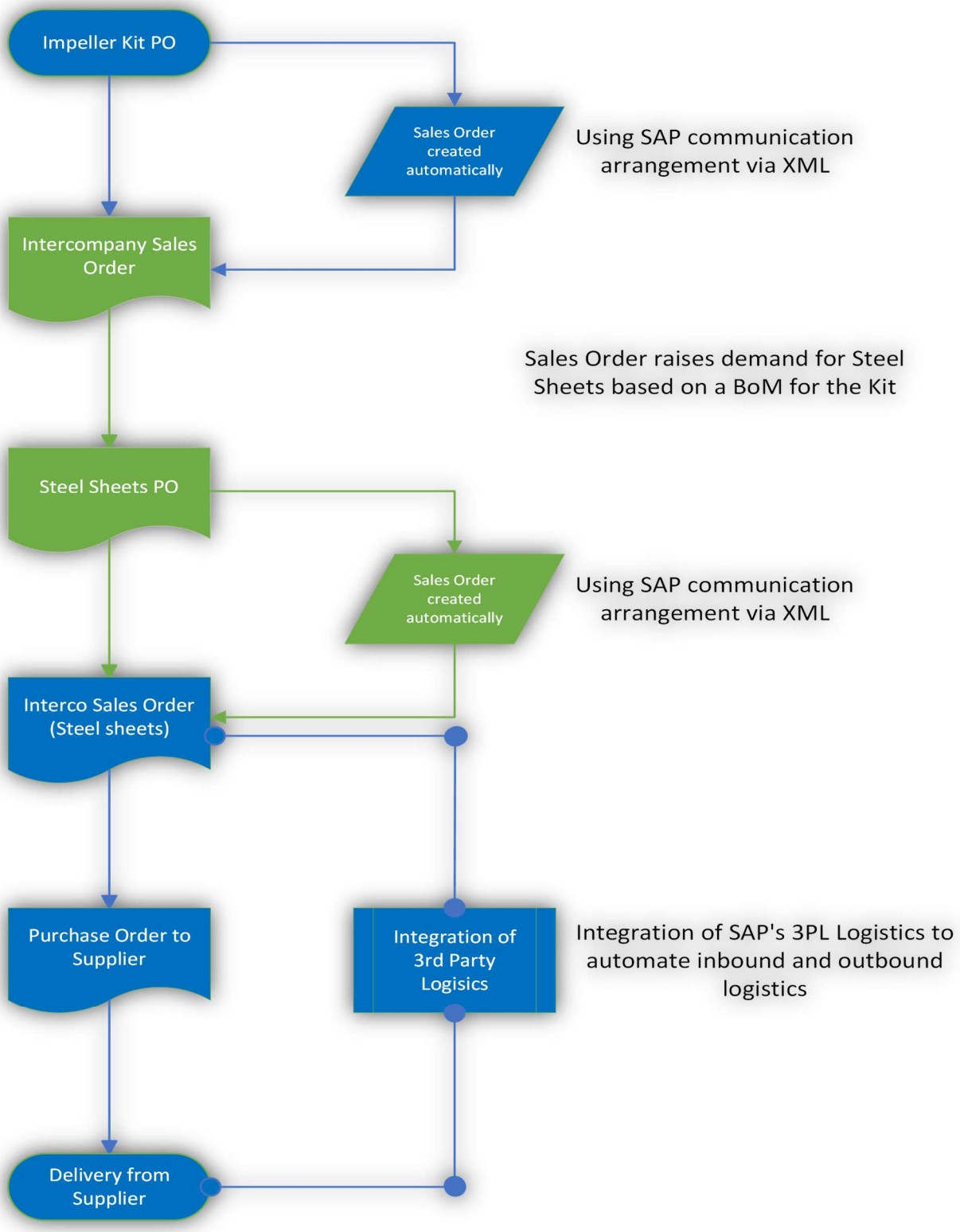

Figure 17 Process flow of RE integration with the main process

15.4.1. Step 1: HF Purchasing Impeller Kit

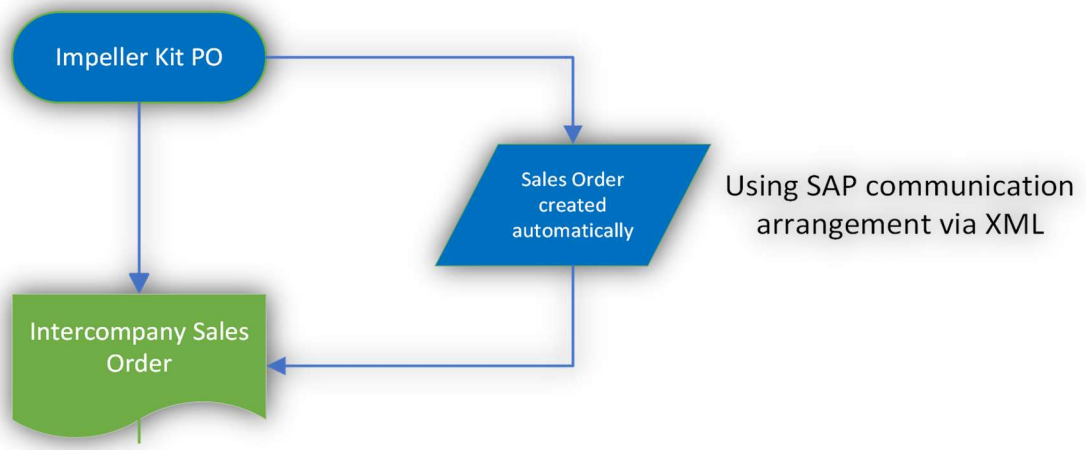

Figure 18 Impeller Kit Purchase Sequence

The PO is triggered automatically based when Multi-BoM planning is executed in HF. This PO automatically gives rise to a corresponding sales order in Steel Works. Normally SAP does not populate prices in the intercompany orders until a price list is maintained at the backend, which has to be maintained manually. In this an automation at the back-end has this side sorted, which is detailed in the next section of this project.

The sales order is then released once a user has reviewed the relevant financial details giving rise to customer demand. As detailed above, planning objects now exist in the RE as well which enable BoM planning leading to step 2.

15.4.2. Step 2: Planning in RE

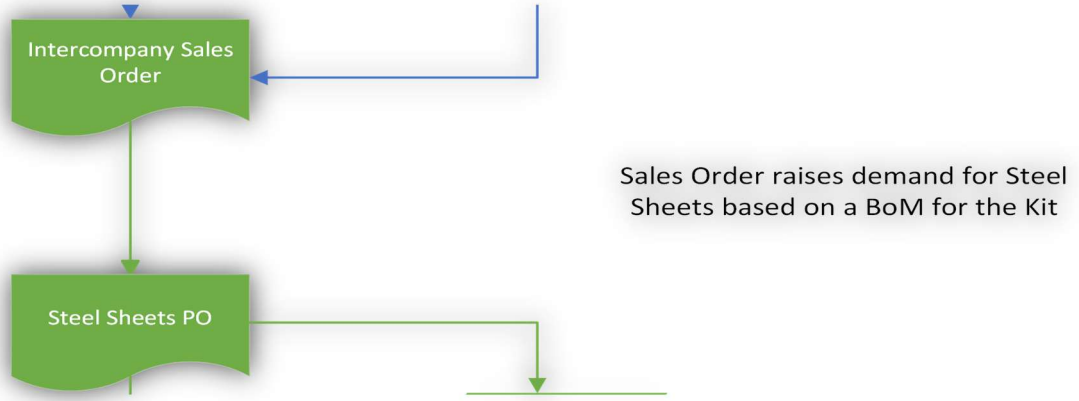

Figure 19 Planning in RE

The planning gives rise to purchase requests for the required steel sheets based on the BoM, for laser cutting. This process is entirely MRP driven and thus orders are triggered as and when the inventory levels decrease as the steel sheets are set to be externally procured. The PO is placed on Halifax Fan Ltd, as the RE is yet too early in its infancy to obtain lucrative credit terms with Steel suppliers. This leads us to Step 3.

15.4.3. Step 3: RE buying Steel Sheets from HF

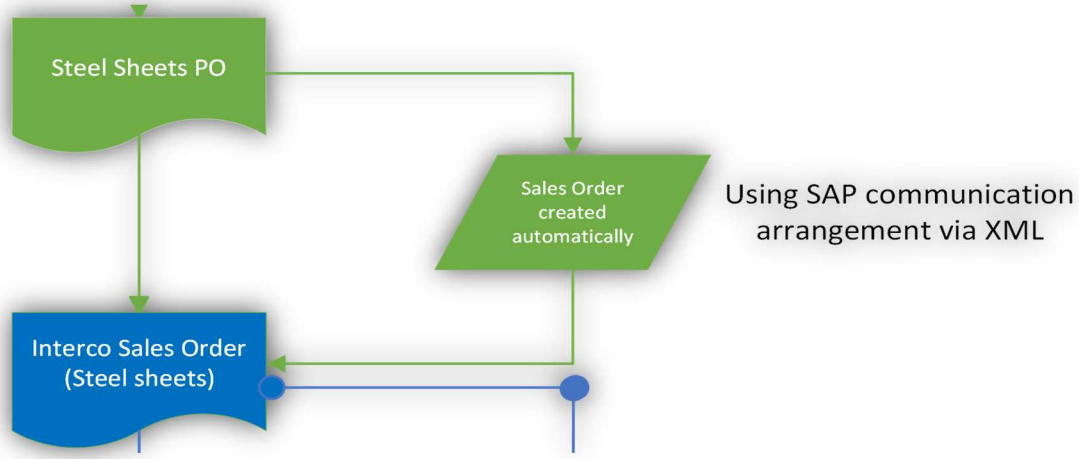

Figure 20 RE ordering Steel Sheets from HF

Like Step 1 above, the PO here uses the intercompany order functionality giving rise to a sales order in HF. The products are populated in the sales order based off of the SO and the prices are pulled using price lists. Once reviewed and released, the sales order gives rise to a purchase request for the relevant steel sheets as the system is set to buy them externally. This leads to step 4, which is the most critical in this subset of the process.

15.4.4. Step 4: HF procuring Steel Sheets externally

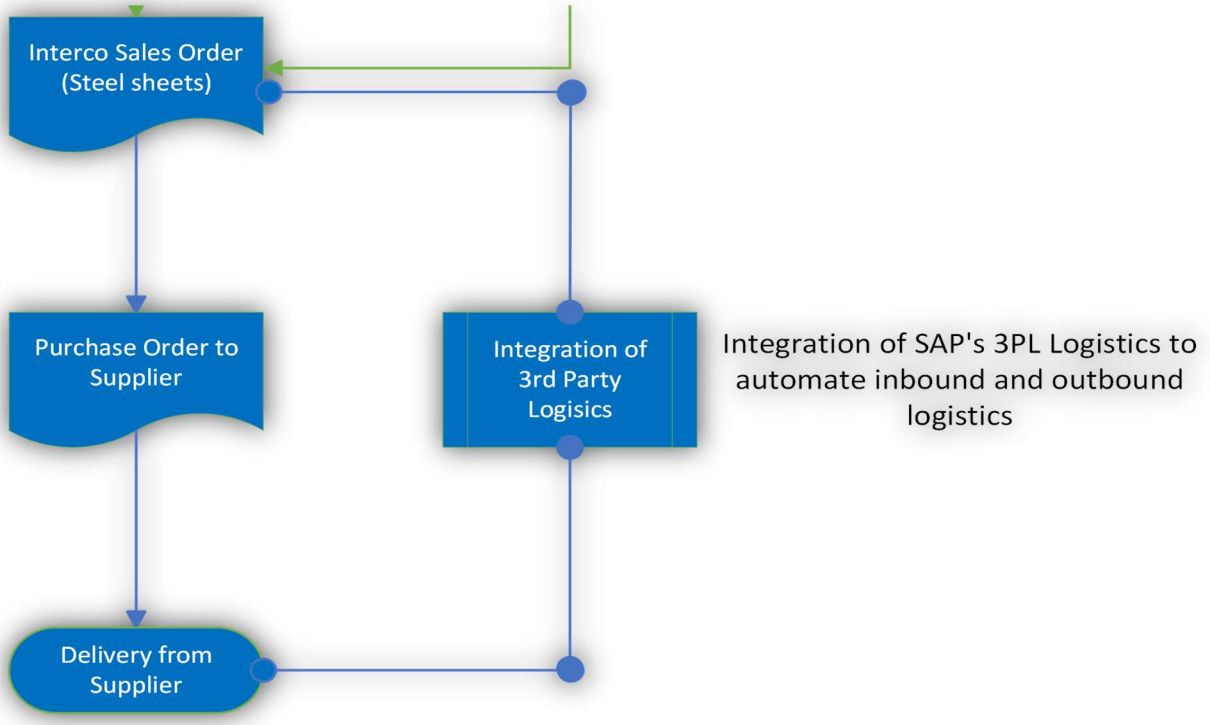

Figure 21 3PL Implementation in Steel Sheet purchase

This part required significant discussion within the teams including the finance, procurement and project management teams to ensure that 3PL is implemented successfully. Since the process essentially automates transactions through two entities, the data preconfigured for these transactions has to be correct beforehand. Here, the biggest decision was the choice of supplier for each steel sheet order to ensure that the transaction was eligible for 3PL.

To provide a brief description of how 3PL works, the process works backwards from Supplier Delivery. Once the receipt from the supplier is booked into HF, it automatically generates an

outbound delivery from HF to RE and books in the goods in the RE as well. Normally, without 3PL the outbound from HF and the receipt in RE must be booked in manually and with the volume of transactions the risk of mismatches and unreconciled transactions is quite high.

15.5. Processes automated

During the implementation of the second phase, automation has been introduced at different levels to increase the efficiency and ensure that minimal human intervention is needed. A lot of these areas were highlighted during the first iteration. Some of the instances are highlighted below:

15.5.1. Automation of PR to PO

One of the key areas that could be automated was during Step 1 of the process where HF places an order on RE for the Kits. As HF is always likely to place an order on RE for such an item, the system automatically converts any PRs generated into POs to RE, price is extracted from list prices maintained in the system and quantity is pushed through the BoM.

15.5.2. Intercompany Sales Orders

A communication arrangement was set up between HF and RE going both ways to ensure that each PO gives rise to a sales order. The quantity comes pre-populated, whereas the price is pulled from a price list maintained in the system. A sales order when populated manually is a time-consuming task, this arrangement helps save around 5-10 minutes per order and about 2 user hours per day.

15.5.3. Price List and List Price maintenance

Price lists are maintained in the system to reflect selling prices for each stock item, whereas list prices are maintained to reflect purchase prices for each stock item. Unfortunately, as standard the system does not have a mass upload functionality to manage each list and therefore, each must be input manually line by line.

To provide an idea, the system has just 86k impellers and each has to be input manually; once in the price list and once in the list price. This is a time-sink and has to be repeated manually at least once a month. This presents a significant risk both in terms of keeping up with changing prices as well as the risk of incorrect data which has far reaching consequences towards revenue and profitability.

To achieve this, Paramet has been utilized once again. The data within SAP is accessed using webservices for each area in the system. For List Prices, Paramet first accesses the webservice for *'Material Valuation Master Data'* which contains average purchase prices for materials, once these prices are extracted Paramet then accesses the webservice for *'Maintain List Prices'* and populates list prices using the company ID and the material ID as the constants.

Similarly for Price Lists, Paramet first accesses *'Material Valuation Master Data'* to extract the rolled-up cost based on the BoMs, afterwards a code adds a margin on this price for scrap percentage and then pushes this adjusted figure back into SAP's Price Lists using the webservice *'Maintain Price Lists'*. Both routines are triggered once a month to ensure that the data reflected is correct.

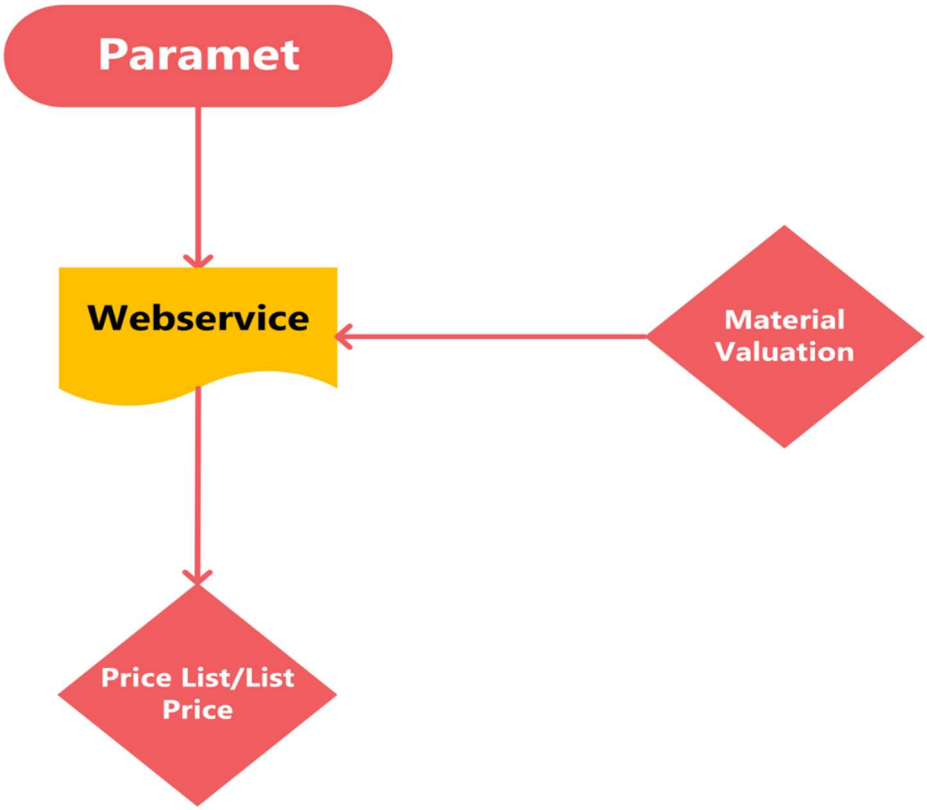

Figure 22 Paramet-Webservice integration

15.5.4. Customer Invoice Automation

With the legacy process, customer invoices were created manually after written confirmation of goods dispatch. Goods dispatch couldn't be reflected in the system when the original process was being used. The current process designed in this project supports intimation of goods dispatch within the system without need of written confirmation via email. Based on said intimation an invoice can be created and sent to the customer.

To truly automate the process from a Quote to Cash perspective, SAP does provide an option to automatically convert an outbound delivery/goods dispatch into a customer invoice. This option was set to active to save time processing customer invoices. Going one step ahead, SAP ByD also provides an option to recognize revenue upon release of an invoice as opposed to cumulatively recognizing as part of month-end close; this has been activated as well to reduce month-end workload.

16. Conclusions and Future Recommendations

The resulting process has significantly decreased the requirement for manual intervention into the process ensuring that not only is it efficient but also reduces the mistakes from the human end, which has plagued the previous process for the company. The estimated cost saving is about 40% in terms of manual hours spent; this is backed by a decrease in staff required per task on old process vs the current process. For instance, the Finance team has effectively decreased from 6 to 3, Procurement team only requires 2 members down from 4. Production Planning team has gone down from 8 to just 2 full time team members and one of the said team members manages the translation of plans to the floor.

This process on a very high level has presented Halifax Fan with an external business opportunity, from the learnings and developments of this exercise this trio of products has become an offering on its own which can down the line be looked at as something that other external entities can use to scale their processes and use to supplement their growth. This is especially useful for entities looking to grow from micro, small entities to medium sized entities. This also gives Halifax Fan an opportunity to offer the ERP process solution to other entities looking to move from their excel based processes. This provides them a risk free and cost effective process especially when you look at the rate of failure for ERP implementations.