6. CHAPTER
6. 章節

ODOOS ACOMPLISHMENTS REGARDING PLM AND MES

ODOO 在 PLM 和 MES 方面的成就

This chapter aims to summarize the strengths and weaknesses of the Odoo software focusing on the questions raised on section 4.2. It will also comment Odoo functionalities or lack thereof noticed throughout the simulation also taking the questions into account.

本章旨在總結 Odoo 軟體的優勢和劣勢，重點關注第4.2節提出的問題。也將評論在模擬過程中注意到的 Odoo 功能或其缺失之處，同樣考慮這些問題。

6.1. How does the software deals with items?
6.1. 軟體如何處理項目?

Overall, the Odoo software presents the user with a wide variety of digital items that can be used to represent several aspects of manufacturing as well as other aspects of business. This is mainly due to the way the Odoo ERP functionality uses items to track the pull and push actions throughout its use, that is also how automation is achieved in the software.

總體而言，Odoo 軟體為用戶提供了各種數位項目，這些項目可以用來表示製造和業務的各個方面。這主要歸功於 Odoo ERP 功能使用項目來跟蹤其使用過程中的推動和拉動動作，這也是該軟體實現自動化的方式。

6.1.1. Are all aspects of the product lifecycle represented?
6.1.1. 產品生命周期的所有方面是否都被表示?

One of the disadvantages of being derived from a ERP system is that it focus on the primary scope of ERP (Figure 2) ,that is, production and sales. The Items in Odoo reflect that. For instance, the development part of the life cycle during the simulation, although the representation was possible it certainly felt like a stretch of functionalities made for the production phase rather than development is self (Figure 70). When developing prototypes for instance many of the steps like creating an ECO just to carry files in the beginning and going through many steps every time an adjustment in the prototype was made felt too bureaucratic or too much of a workaround.

由於來自 ERP 系統的缺點之一是它專注於 ERP 的主要範疇（圖2），即生產和銷售。在模擬過程中，雖然可以表示生命周期的開發部分，但感覺這更像是為生產階段而非開發本身設計的功能擴展。例如，在開發原型時，很多步驟如在開始時創建一個 ECO 來攜帶文件，以及每次調整原型時都要經過許多步驟，感覺過於繁瑣或過於曲折。

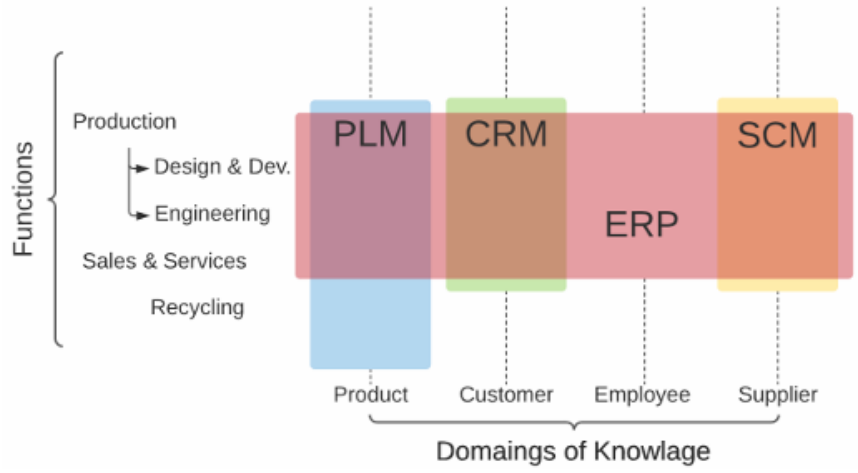

Figure 70 Diagram representing Odoo scope of ERP

6.1.2. How well are each of those items represented?
6.1.2 每個項目表示得如何?

Representation levels of the items vary depending on how the item is used. A good example of that is the material focus of product items. In the sense that everything is considered a product with very little distinction between prototypes or raw materials. The representation of product items or BOM items is very high with a lot of metadata and useful connections to other items. However, even within the manufacturing application there are some items that lack attention. Operations for instance are items that could benefit greatly from more upload capabilities like 3D printing or CNC files. As automation is becoming more widespread in production it is no longer enough to have only PDF or slide instructions. Additionally, other items do not have the ability of holding files not even with the use of ECOs

項目的表示水平取決於項目的使用方式。產品項目的材料焦點是一個很好的例子。就所有東西都被認為是產品而言，原型或原材料之間的區別很小。產品項目或BOM項目的表示非常高，具有大量元數據和與其他項目的有用連接。然而，即使在製造應用中，也有些項目缺乏關注。操作項目，例如，可以從更多的上傳功能（如3D打印或CNC文件）中受益。隨著自動化在生產中變得越來越普遍，僅有PDF或幻燈片說明已經不夠了。此外，其他項目即使使用ECO也無法攜帶文件。

6.2. How easy it is to create a brand-new product?
6.2 創建全新產品有多容易?

Product creation is one of the most straightforward procedures in Odoo, it really comes down to using either the Inventory application or the Manufacturing application to create a new Product and then fill in its metadata.
在Odoo中，產品創建是最簡單的操作之一，基本上就是使用庫存應用或製造應用來創建新產品，然後填寫其元數據。

6.2.1. How is the product depicted?
6.2.1 產品如何被描述?

The product depiction is clear and concise, the product item allows for an image to be uploaded to the item and used as an icon. The ERP nature of the product items in Odoo means that the metadata is reasonably bias toward information that is used to manage storage and inventory (Weight, Volume, Quantity etc.) but the item also allows for written description as well as providing links to the BOMs and ECOs related to the product.

產品描述清晰簡潔，產品項目允許上傳圖像並用作圖標。由於Odoo中的產品項目具有ERP性質，因此其元數據偏向於管理存儲和庫存的信息（如重量、體積、數量等），但該項目還允許撰寫描述，並提供與BOM和ECO相關的鏈接。

6.2.2. How does the product integrate and reference relevant files?
6.2.2 產品如何整合和參考相關文件?

There is surely a reasonable attempt in allowing the most valuable items (Product and BOMs) to be able to manage and reference relevant files. However, Odoo does not implement much more than the bare minimum as far as file management goes. The most it can do is allow for files to be uploaded and download manually. This means that whenever someone makes a change in a file it needs to be manually uploaded in ECO. Integration with most files is inexistent except for operation items because the instruction files can be opened and interacted within Odoo during the production.

Odoo確實在允許最有價值的項目（產品和BOM）管理和參考相關文件方面做出了合理的嘗試。然而，Odoo在文件管理方面僅實現了基本功能，最多允許手動上傳和下載文件。這意味著每當有人更改文件時，都需要在ECO中手動上傳。除了操作項目可以在生產過程中打開和交互的指令文件外，與大多數文件的集成是不存在的。

6.2.3. Does changing one affects the other?
6.2.3 更改一個會影響另一個嗎?

It does not, files are mostly dealt by Odoo as paperwork for later reference. Anything added file wise that could entail a change in the product or BOM metadata will require

someone to be aware of the change and update the information manually.

不會，Odoo主要將文件視為供以後參考的文書工作。任何文件上的添加都可能涉及產品或BOM元數據的變更，這需要有人注意到變更並手動更新信息。

6.3. How easy it is to create a brand-new production process?
6.3 創建全新生產過程有多容易?

As mentioned before the item the best represents the process is the bill of materials. This item class requires an existing product to be associated with, other that the BOM is no harder to create than a product item.

如前所述，最能代表過程的項目是物料清單（BOM）。此項目類別需要關聯一個現有產品，除此之外，創建BOM並不比創建產品項目難。

6.3.1. How the process is depicted?
6.3.1 過程如何被描述?

The process is depicted in the BOM as a list of components (other product items) and operations that are carried out in as specific order to produce a number of end products. This representation seems to sit well with the production procedure. Metadata is kept to a minimum but there is still the capability to offer a text description.

過程在BOM中被描述為組成部分（其他產品項目）和按照特定順序執行的操作的列表，以生產一定數量的最終產品。這種表示似乎非常符合生產程序。元數據保持在最低限度，但仍有提供文本描述的能力。

6.3.2. How does the process integrate and reference the product it produces?
6.3.2 過程如何整合和參考其生產的產品?

The integration between the BOM and the product items is by far the most well done in Odoo. Changes made in the BOM affect production and are directly linked to the product. Whenever metadata changes are possible and said aspect is represented in the product item as well the change of one is inherited by the other.

BOM和產品項目之間的集成在Odoo中做得最好。對BOM的更改會影響生產，並且與產品直接相關。只要元數據更改是可能的，而該方面在產品項目中也有表示，則一個的更改會被另一個繼承。

6.3.3. Does changing one affects the other?
6.3.3 更改一個會影響另一個嗎?

As far as inventory and manufacturing is concerned integration is and referencing is well implemented. Production results flawlessly in the resulting changes in inventory and the navigation path of the GUI is very well optimized. It does not take more than 3 or 4 clicks to get from one product to another or to navigate to other relevant items.

就庫存和製造而言，集成和參考實現得非常好。生產結果會毫不費力地反映在庫存變化中，GUI的導航路徑也非常優化。從一個產品導航到另一個或導航到其他相關項目不需要超過3或4次點擊。

6.4. How easy is to improve an existing product/ production process?
6.4 改進現有產品/生產過程有多容易?

As mentioned previously, all improvements in Odoo are performed using engineering change orders. These are applied to product items or bill of materials. Creating ECOs is quite easy and organized, the ECO is an item on itself that symbolizes a signal given to create change, once effective, it symbolizes an increment on the product or process.

如前所述，所有改進在Odoo中都是通過工程變更單（ECO）進行的。這些應用於產品項目或物料清單。創建ECO相當容易且有條理，ECO本身是一個象徵著創建變更信號的項目，一旦生效，它象徵著產品或過程的增量。

6.4.1. How easy it is to update its metadata
6.4.1 更新元數據有多容易?

It is easy to update any metadata regarding any item in Odoo; however, it is wise to point out that since the ECOs are separate items that are just point by products or BOMs many of the changes are not automatic and require manual intervention. I.e. an ECO will not change the text description of the product for instance. If the new update were to require a change on that description it would require a manual intervention from the user in the product item. Doing that is easy, but it is an extra task that will not be tracked by the ECO.

更新Odoo中任何項目的任何元數據都很容易；然而，值得指出的是，由於ECO是單獨的項目，只是指向產品或BOM，許多變更不是自動的，需要手動干預。例如，ECO不會更改產品的文本描述。如果新更新需要更改該描述，則需要用戶在產品項目中手動干預。這樣做很容易，但這是一個ECO不會跟踪的額外任務。

6.4.2. How easy it is to determine the effects of the change?
6.4.2 確定變更效果有多容易?

Odoo feedback of information is mainly done in a manufacturing order basis. The information available is clear and ECOs do not affect MOs that are already under way so the effects of an applied ECO would not be hard to notice. However, it is good to point out that in the way the performance information is displayed there is no indication of the product revision or the ECO applied. This means that the user would need to first figure when the ECO was applied, then navigate to the equivalent MO in the data to draw its conclusions. Although not a problem for recent changes this does becomes problematic if someone want to analyze effects of old changes.

Odoo中的變更管理主要通過ECO進行。對於每個ECO，都有詳細的記錄和追踪，以確保變更是可見的，並且其影響是可測量的。這使得確定變更的效果變得相對簡單，特別是在生產環境中。

6.4.3. How does the software deals with different product revisions?
6.4.3 軟體如何處理不同的產品版本?

Version control is something well covered by the 1 to N relation between product/BOM and linked ECOs. Every product will have a tab containing all the ECOs applied to it in chronological order effectively working as a timeline representing the item evolution.

Odoo允許創建和管理多個產品版本，這些版本可以通過ECO進行變更和更新。每個版本都有其獨立的元數據和歷史記錄，這使得管理和追踪產品變更變得更加高效。

6.5. How easy is to find data related to product or process?
6.5 查找與產品或過程相關的數據有多容易?

Most of the data related to performance regarding production is concentrated under the reporting tab as mentioned in the previous chapter (Figure 71).
與生產績效相關的大多數數據都集中在 報告選項卡，如上一章所述（圖 71）。

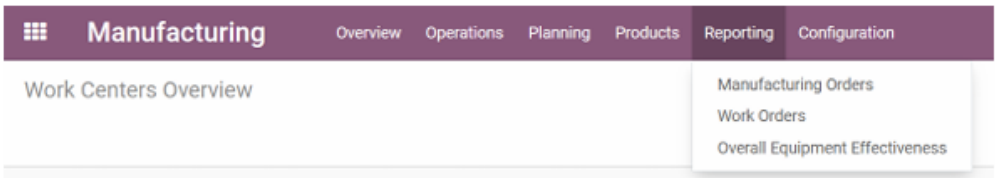

Figure 71 GUI Options of data reporting

This means that as far as performance is concerned it is quite easy to find the data. The previous chapter will show examples of possible information that are available within

those tabs.

這意味著就效能而言，查找數據非常容易。 這前一章將展示這些內容中可能提供的資訊的範例選項卡。

In addition to using this path the UI of the product item also has a tab that point to the monthly comparison of production volume regarding the product (Figure 72). Which would be more impressive if there was more than one month in the trial version of Odoo.

除了使用此路徑外，產品項的UI還具有一個指向 產品的月度產量比較（圖72）。這將 如果Odoo的試用版超過一個月，那就更令人印象深刻了。

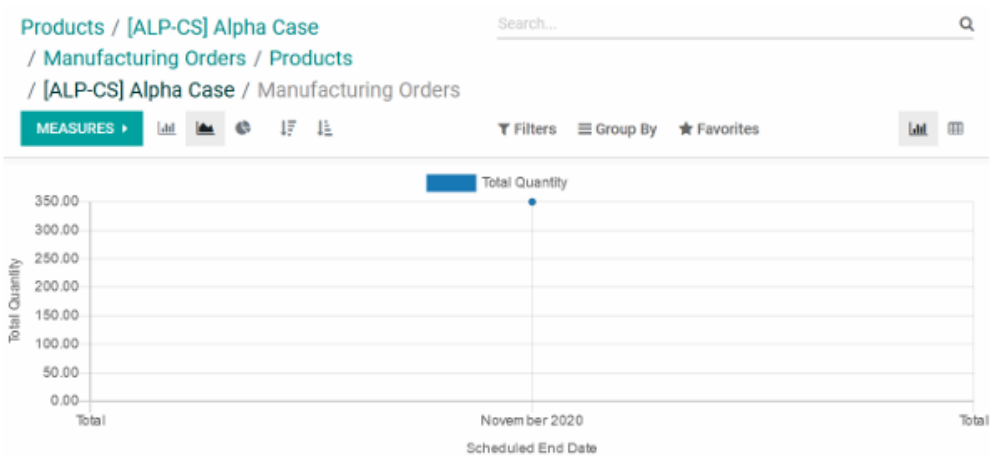

Figure 72 Total quantity regarding MO from product item

6.5.1. How easy is find production numbers? 6.5.1 查找生產數量有多容易?

In addition to the previously mentioned ways, Odoo also makes available a unit forecast graph that records the ins and outs of the inventory. This is particularly useful to estimate sales and balance storage with demand (Figure 73). This feature is not mentioned to much in this work because supply and demand is not so much a MES functionality, but it is to useful to have an overview of the production.

除了前面提到的方法外，Odoo還提供單位預測 記錄庫存來龍去脈的圖表。這對於估計特別有用銷售並平衡存儲與需求（圖 73）。這個功能在 這項工作是因為供求關係與其說是MES功能，不如說是有用的 以了解生產情況。

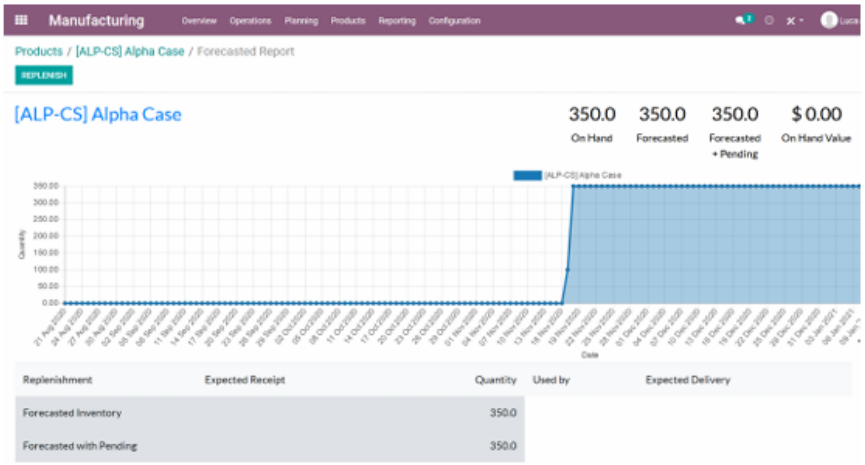

Figure 73 Unit forecast overview

6.5.2. How does Odoo generate performance data?
6.5.2 Odoo如何生成性能數據?

The astute reader will notice that all the data mentioned so far is derived from the time to completion of the operations been carried out, the related amount to the MO and the workcenter utilized. Even so it is impressive how much information can be drawn especially considering that it is all generated automatically.

敏銳的讀者會注意到，到目前為止提到的所有數據都是從 完成操作后，MO和MO的相關金額已完成。已使用工作中心。即便如此，可以繪製多少信息還是令人印象深刻，尤其是 考慮到它都是自動生成的。

6.5.3. How does the software present performance change as a result of a upgrade?
6.5.3 軟體如何展示升級後的性能變化?

In order to identify the change, the user must identify the MOs following the change and see the difference based on that. Ideally it would be nice if the graphical information showed the revision of the product, but this is not present as of Odoo V13.

為了識別更改，用戶必須識別更改後的MO，並且 基於此查看差異。理想情況下，如果顯示圖形資訊會很好產品的修訂版，但從Odoo V13開始就不存在了。

CONCLUSION

In chapter 2 I referenced a diagram that represents a theoretical ideal of how the integration of PLM with other systems should be (Figure 74). In that diagram the reader can notice that ideally PLM would be the center of the system with other systems (Including ERP) attached to it. Different from said diagram the Odoo software takes ERP as the center with other systems attached to it. This work has shown that it is certainly possible to use Odoo for PLM and MES however it has also shown that the PLM and MES implementation presents some weaknesses.

在第2章中，我引用了一張圖表，該圖表代表了如何PLM應該與其他系統集成（圖74）。在該圖中，讀者可以請注意，理想情況下，PLM 將是系統的中心，與其他系統（包括 ERP）附加到它。與上述圖表不同的是，Odoo軟體以ERP為中心並附有其他系統。這項工作表明，使用然而，Odoo用於PLM和MES的實施存在一些弱點。

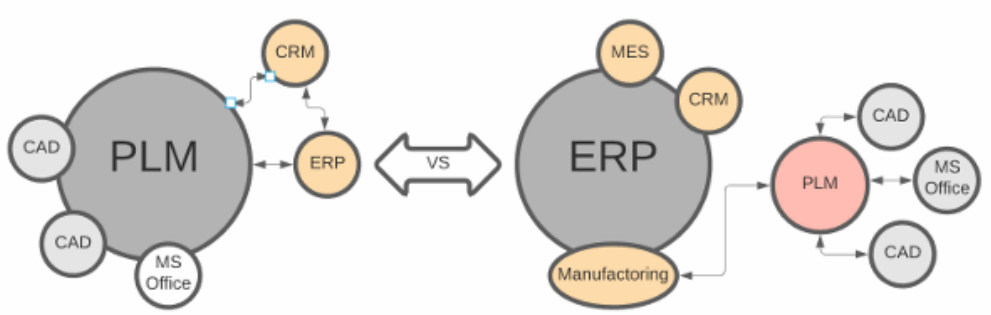

Figure 74 Comparison to the left the adapted diagram as theorized by Saaksvuori, A. and Immonen, A. (2008), to the right Odoo take on how systems interact.

The lack of file upload support on things like operation items, work centers or equipment is something of some concern especially considering 3D printing or CNC because access to the CAD files would prove helpful to the operators. Also, there is a gap in between the facets of product and tool when the company is taking upon themselves to develop and produce said tooling (similar situation founded when developing the molds in the simulation).

缺乏對操作專案、工作中心或設備等內容的檔上傳支援 這是一些值得關注的問題，特別是考慮到3D列印或CNC，因為可以訪問CAD檔將對操作員有所說明。此外，刻面之間也存在間隙當公司自行開發和生產時，產品和工具所述工具（在類比中開發模具時出現類似情況）。

In addition, although MES provide detailed graphical representation regarding the dataset that it has, it is limited to data derived from the time to completion of the operations been carried out. For instance, it would be very valuable if graphical representation regarding quality control was easily available as well.

此外，儘管MES提供了有關數據集的詳細圖形表示它有，它僅限於從操作完成時間得出的數據進行。例如，如果圖形表示品質控制也很容易獲得。

All that said, applying ECOs to BOMs in Odoo is a procedure deserving of praise. The ECO holds the information until it is ready to be applied and then it updates the BOM automatically once the ECO is validated by responsible personnel. It might not look like something so important now because this simulation is dealing with very simple products, but it becomes exponentially more important as complexity increases. E.g. A car with thousands of parts and hundreds of nested BOMs would be considered a nightmare to control and keep track of change if a system like this was not present.

綜上所述，將ECO應用於Odoo中的BOM是一個值得稱讚的過程。這ECO會保留資訊，直到準備好應用，然後更新BOM一旦ECO由負責人員驗證，就會自動執行。它可能看起來不像 現在非常重要，因為這個類比正在處理非常簡單的產品，但隨著複雜性的增加，它變得越來越重要。例如，一輛汽車數千個零件和數百個嵌套BOM將被視為控制的噩夢如果沒有這樣的系統，請跟蹤更改。

This software is not perfect for PLM or MES implementation, but it does hold value in the sense of availability and integration with other systems. The functionality is there specially regarding product and process and the software has an extremely interesting integration with its natural ERP functionalities. All this makes up for a system that would suit better:

該軟體對於PLM或MES實施並不完美，但它確實具有價值可用性和與其他系統的整合感。功能就在那裡特別是關於產品和工藝，軟體有一個非常有趣的與其自然的ERP功能集成。所有這些都彌補了一個系統，該系統將更適合：

- Small business that could use PLM and MES in a smaller scale.
- 可以在較小規模中使用 PLM 和 MES 的小型企業。
- Companies that deal with less manufacturing and more assembly or distribution taking advantage of the All in One nature of the software.
- 處理較少製造和更多組裝或分銷的公司 利用軟體的多合一性質。

It is important to mention that the limitations of Odoo are not in the complexity of the product itself but in the complexity of the operations that surround its development. All things considered you could track a large and complex assembly if it includes only simple manufacturing operations or if more complex engineering tasks are done by suppliers. I.e. you could track the assembly of a motorcycle with ease in Odoo, but the PLM features are not polish enough to track the full evolution/development of its powertrain. It is certainly possible to do so but it would take too much time and effort from the engineering team to be considered worth it just for the sake of having an all in one solution with ERP features.

值得一提的是，Odoo的局限性不在於Odoo的複雜性。產品本身，但在圍繞其開發的操作的複雜性中。萬物考慮您可以跟蹤大型複雜裝配體，如果它只包含簡單的製造操作，或者更複雜的工程任務由供應商完成。即您可以在Odoo中輕鬆跟蹤摩托車的裝配，但PLM功能是不夠完善，無法跟蹤其動力總成的完整演變/發展。當然是 可以這樣做，但工程團隊需要花費太多的時間和精力僅僅為了擁有具有ERP功能的多合一解決方案而被認為是值得的。

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