CAPSTONE PROJECT

Industrial 4.0 of EMS – Synergy of Foxconn Order Fulfillment systems and processes

SUNG, YU-YI

TECHNOLOGY INNOVATION & MANAGEMENT

Contents

1. Project Motivation

Electronics Manufacturing Service (EMS) is a term used for companies that offer the value-add services, such as design, manufacture, test, distribute, repair, and reverse logistics services for electronic components and assemblies for original equipment manufacturers (OEMs). The essence of EMS business model is to specialize in pooling resources of in-house manufacturing, raw materials (RMs) procurement, and finished goods (FGs) logistics delivery with maximized economies of scale, flexibility, and service quality as well as minimum operating costs.

High Mix Low Volume (HMLV) and High Volume Low Mix (HVLM) typically represent the service types when it involves with production line arrangement. The mix is usually regarded the complexity of production process because of high-customization or the high frequency of production swifts. The rapidly growing customized demands have brought the impacts led by unpredictable and unbalanced sales demands as well as the increasing customer requests (CSRs).In response to the HMLV market characteristics in Europe, the development of manpower skills, systematic processes, and the conceptually smart systems enable the rapid order fulfillments cycles and balance demand and supply.

In addition to the traditional advantages on lean management, service values reinforcement and IT systems integration are the common managerial approaches to extend EMS serviceability. In order to continually enhance the competiveness, the more streamlined operational process is a must for well balancing supply and demand dilemma that significantly involves to capacity management, output management, and real-time decision-making. According to the practice, the traditional improvement is reactive and not practical enough in solving problem. This paper, therefore, will shift the focus to the growing digital transformation under Industry 4.0 framework, working proactively with customer on system & platform synergy, in increasing information transparency, standardizing the digital systems communications, and automating electronic manufacturing services.

2. Project Scope & Methodology

This study attempts to study the integration of order fulfillment process between Brand Company and EMS, discussing the digital transformation, empirically presenting the quantitative analysis of investments and returns as well as recommendation. To accomplish this goal, this paper is going to cover the relevant information regarding to EMS operations to clarify the industry characteristics of Electronic Manufacturing Service. The as-is operational model and the feasible proposed models, composed of physical flows and information flow, will be demonstrated accordingly. Last, this paper will qualitatively and quantitatively analyze efficiency, investments costs and returns in Chapter 5. Finally, in Conclusion, the study will give recommendations based on the strengths and weaknesses of each indicator. The application of Expert Meeting Law and Brain Storming carefully examine and discover the to-be improved operational process and come up with 3 integration solutions: Front-end integration, Back-end integration, and the 3rd party integration.

3. As-is Operation Model Introduction

The as-is EMS model is based on contracted manufacturing business term, with B/S procurement type. The configure-to-order value-add services cover assembly, test, packing, quality inspection, warehousing, and logistics, for Telecom service providers. Because of Buy-and-Sell, Brand Company is liable to materials planning, transacting, and handling, and sells to EMS partner who sells back the finished goods (FGs) after value-creation services.

The whole process of order fulfillment can be divided into 9 steps: (1) The customer sorts out the EMEA market orders, and distributes them to the corresponding EMS partners for processing (including Foxconn) according to the order types and bidding contracts, (2) Timely refresh mass production scheduling (MPS) and materials

replenishment planning (MRP) input when receives new EMEA orders, for materials driving and SCM operations, (3) Foxconn plans the capacity based on customer's forecast and orders, (4) Foxconn delivers the reports of output, materials shortage, capacity, production plan to customer's MRP system timely, (5) Materials simulation and shortage solving, (6) Inbound materials handling and warehousing activities, (7) Execution of PO configuration, production, and packing, (8) FGs shipments and logistics activities, (9) Custom and Financial payment activities.

Foxconn's IT strategy is to globally import SAP, SFC systems and All Part systems to provide semi-automated standardization services. In this service, Foxconn can guarantee the basis of materials movements and trading between internal and external stakeholders, and finished product transaction with customers. At the same time, through the self-developed system (SFC & All Part), the key information of the bar code (stick on the labels) can be stored, and the real-time production status can be monitored and tracked to ensure production quality and production historical resume integrity.

At present, Foxconn and its customers use different management systems and platforms for the Order Fulfillment process. A small amount of information is transmitted through B2B, but most of the data and information are still transmitted through manual operation, which has caused a lot of agility insufficiency in the response of PO changes, PO cancel, and abrupt demand and supply changes. According to the experience, the whole order processing procedure, deriving from raw materials exporting from Hong Kong to finished goods shipping in Hungary, usually takes around 3 months. After evaluation of system communications synergy, there are three proposals to reduce the lead time from 12 weeks to 9 weeks.

4. Proposed Solutions

According to the position of integrator, this paper proposes (1) Front-end Integration, (2) Back-end Integration, and (3) The 3rd Party Integration. The Front-end integration is proposed and dominated by customer side, which the client is going to merge the systems communication in-between timely and realize the electronic automation information exchange. On the contrary, the Back-end integration will be conducted by Foxconn, who proactively broadens the function of SFC system by instantly handling the information feed from customer. The 3rd party integration is the solution that using a hybrid cloud service, enabling real-time information sharing and complex cloud computing in accomplishing system synergy under Industry 4.0.

The future operation may be split to 3 functions: Order processing, Materials Preparation and Purchasing, and FGs Logistics & Delivery, horizontally. To split by functions, there will be 7 blocks, such as Order & Batch release, Task & Schedule release, EMS manufacturing & Order Fulfillment, Purchasing, Warehousing, Transportation & Delivery scheduling, and EMS Custom & Financial Systems. After several rounds of brainstorming and opinions exchanges, we expect to shorten the current order fulfillment cycle from 3 months to 2 months through the integration of information systems and the application of information agility. The summarized essence and flow for the three proposals will be introduced as follows.

4.1 Proposal A: Front-End Integration

Customer desires to get more control on the integrated MRP simulation for their fluctuated customer demands in order to properly schedule materials replenishment plan to avoid materials E&O (excess and obsolete) compared to as-is model. To achieve this, customer will be in charge of incorporating the IT system synergy and infrastructure solutions, as well as operational flow designs under Foxconn's operational inputs.

4.2 Proposal B: Back-End Integration

Foxconn proactively centralizes the order fulfillment functions from customers, especially materials simulation and order processing. Foxconn incorporate detailed order simulation, plan the priority based on the given order tasks, manage raw materials level, lean production, and custom & financial activities to save the fulfillment cycle time. The order simulation may deploy the relevant simulation of materials shortages, inventory control, pending FGs, and the similar to be the input, driving Huawei ESC systems work independently. To realize the possibility of system automation, Foxconn has to authorize the customer's visit from B2B, SFC system, and the firewall setting.

4.3 Proposal C: Hybrid Cloud Solution

Using a 3rd party hybrid cloud as an independent information storage and exchange system is major essence. This solution does not require a full IT integrated development from either customer side or Foxconn but is required to engage with the 3rd party cloud service supplier in coordinating data exchange, storage, cloud computing service, real-time algorithms, and so forth. The hybrid cloud service takes care of detailed mass production scheduling and materials replenishment planning tasks with committed services availability, reliability, maintainability, and serviceability.

The Industry 4.0 plan expects to spend 6 months carrying out from cradle to service release. The development contains 3 phases: solution work-out, product configuration, and service release. The empirical results will be shared in the following section.

5. Empirical Results

The ROI of Front-end integration expects to be 0.66, which is the fastest solution to get breakeven. The Front-end integration does not need to have infrastructure investment for Foxconn; however, the necessary IT development and project input will costs Foxconn $122K USD. The saving in terms of operational headcount expects to achieve $184K USD annually. The ROI index for the rests solutions are bigger than 1.5 because of heavy self-development costs or slow savings from operation. In the proposal of Back-end integration, the investments on infrastructure and personnel for software design will cost $340K USD; nevertheless, the return is expected $225K USD. With less investments on personnel, Hybrid cloud solution costs at around $200K USD. In terms of project benefits, we foresee $125K USD from operation efficiency per year.

Although the longer return on investment of Hybrid Cloud solution, we expect the biggest advantage for mutual party. Both parties can retain and keep the maximum as-is operational status without re-arranging the entire order fulfillment processes chains, without management risks and political issues in terms of customer and supplier relationship. One big problem is to ensure how to effectively collaborate the individual system automation design timeline since this task will be performed separately. If one of the development schedule is delayed, the overall development delays, the development costs increase, and the benefits of putting into operation will be realized later for sure.

6. Conclusion and Recommendation

Through the mode and process analysis, all three solutions are able to shorten the time of existing order fulfillment from three months to two months, after a 6-month development and collaboration with external supplier or customer. The ROI for the three proposed solutions are within one and half year because of abundant reduction on relevant operational expenditure regarding to investments on personnel and infrastructure.

Taking the non-quantitative factor into consideration, Foxconn inclines to the solution with Hybrid cloud more based on the reasons: (1) this program does not need to be desperate to invest large sums of money; (2) customer has no EMS backup solution, and (3) no need to change the existing processes and functions of both parties.