

# **Preparing for integrating supply chain with design and development operations process in a medium sized heavy machinery Original Equipment Manufacturer**

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### **Abstract:**

*This study outlines the work carried out as part of a Knowledge Transfer Partnership (KTP) between Dando Drilling International Limited and the University of Brighton. Dando are a UK based Original Equipment Manufacturer (OEM) of on-shore drilling rigs which operates as an Engineer-To-Order (ETO) and Make-To-Order (MTO) organisation. Compared to research into large organisations, only a limited amount of research has been published on supply chain integration and its prerequisite for ETO/MTO Medium Sized organisations which are Original Equipment Manufacturers. The aim of this paper is therefore to fill this gap using the KTP programme to investigate what steps can be taken to prepare companies such as Dando for an impactful supply chain integration. .*

*In this paper the authors discuss and analyse the implementation of the “Business Process Renovation” method which can be employed to prepare and align the described type of organisation for a successful Supply Chain Integration (SCI). The paper highlights a number of key tools and techniques (developed in-house) that can be used with a major positive impact on Operations performance. These tools and techniques can also support the successful SCI and help to reduce the technology costs and rate of adoption challenges that are prominent in this type of organisation.*

*The report concludes with the results achieved in terms of employee-hour saving, improvement in On-Time-Availability, improvement in overall product value by reducing the number of errors and the types and importance of open gates maintained in the renovated process to enable successful SCI.*

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### **Introduction/ Background:**

Supply Chain Integration (SCI) is now-a-days frequently referred as a key issue for all types of organisations (Daniel, 2003). However, the subject of SCI is vast and the level and type of integration required are governed by many strategic and operational factors. Small-

Medium sized Enterprises (SME's) are not exceptional when it comes to SCI. Many SME's have started implementing SCI. However, the major challenges faced by the SME's for a successful SCI implementation are the rate of integration technology adoption and its cost, which has resulted to a slow SCI

adoption among SMEs. (Chen & Themistocleous, 2004).

This paper highlights the importance of methods of preparing, and tools and techniques that could be utilised in aligning the Medium Sized Engineer-To-Order/ Make-To-Order (ETO/MTO) organisation towards supply chain integration.

In this paper, the authors: (1) Will review the existing literature on SCM and SCI definition, importance of SCI in SME, benefits if SCI, problems of SCI and importance of business process renovation in SCI. (2) Introduction of the company considered for case study and its strategy deployed. (3) Attempt to explore the work done as a part of the case study and (4) analyse and conclude the findings.

### **Literature review:**

As defined by the Chartered Institute of Purchasing and Supply (CIPS), the supply chain management (SCM) is an integrated set of functions or business processes and resources that are planned, developed, controlled, informed and monitored within and between linked suppliers so that the integrated system meets the overall strategic goal (The Chartered Institute of Purchasing and Supply, 2012). Now-a-days' supply chain management and integration of the supply chain with the company's strategic operation has become a vital part of the organisation's success stories. However the dynamism of the commercial world poses its own challenges, both strategic as well as tactical and operational, on the successful supply chain integration and

management. (The Chartered Institute of Purchasing and Supply, 2012)

To gain a competitive edge in today's world, a firm needs to overcome the SCM challenge and develop an effective system to coordinate process within and beyond the boundary to convert competitive advantage into profitability (Simatupang, Wright, & Sridharan, 2002). Irrespective of the number of challenges present, the core principle of the successful supply chain integration (SCI) is the information sharing. Throughout the supply chain, the diversity of the information type ranges from planning to design and development to manufacturing to logistic etc.; that is to each and every function of the business. To successfully meet the commercial goal, this diverse information requires a strategic utilisation. Different companies have sought different strategies like collaborating new product development, integrating planning and other key business processes. Each of these types of integration can generally lead to reduced lead time, improved manufacturing quality, improved flexibility/response, risk distribution and low inventory levels (Persson & Olhager, 2002). Based on the organisation's business model and strategy, the objective of the supply chain integration should be framed considering the effective mix of the set of information to be shared and used. It is at this stage where the concept of Business Process Modelling and Renovation can be of great support in accomplishing the required coordination. (Trkman & Groznik, 2006).

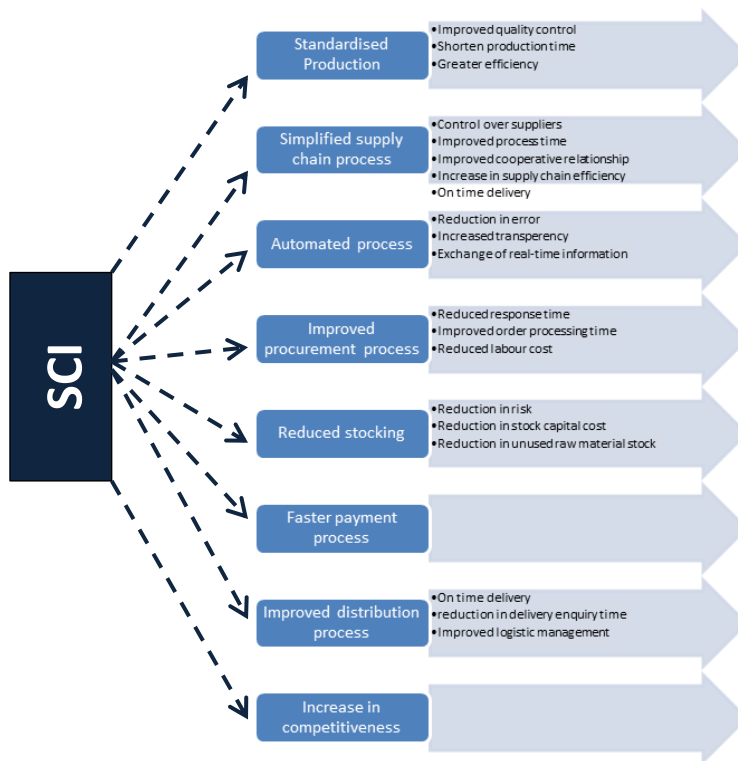


Figure 1 - Summary of benefits that can be realised with SCI (Chen & Themistocleous, 2004)

As per Prasad (1999), process renovation is the re-engineering act of critically examining the current business policies, procedures and practices and rethinking and redesigning them to align with mission critical services, products and processes (Prasad, 1999). Considering the integration of the supply chain, the most common strategic process problems found are:

- 1) Slow flow of information resulting in high cost because of poor execution.
- 2) High cost associated due to poor decision making because of improper information at the wrong time to inappropriate personnel.
- 3) Each decision making member in a chain trying for local optimisation rather than overall chain optimisation.

Thus prior to successful supply chain integration it is crucial to map the current

business model and process. As stated by Trkman and Groznik (2006), a business process map is a generalisation of the flow of information and its conversion to a value adding service or product within the organisation. Its final purpose is to provide a clear pictorial and understandable current state of the enterprise and support in framing its future. As analysed in Trkman and Groznik (2006), there are many different types of process mapping options available, however they have proposed a simple AS-IS and TO-BE swim lane process model which is an effective tool for process analysis. AS-IS process model involves mapping of the current complete process on a department/function based swim-lane diagram and determining the gap by re-plotting the TO-BE model similarly. This analysis helps in effectively identifying the process/error gap with regards to the business objectives and helps in framing the action plan. (Trkman & Groznik, 2006)

## Discussion:

### A) Introduction to the case company:

According to the Confederation of British Industry (CBI), the UK's premier business lobbying organisation, medium sized organisations with £10m to £100m turnover and with 50 to 500 employees are the firms that face unique challenges to grow. However, these firms represent 1% of all SMEs and large firms and also account for 22% of economic revenue and 16% of total employment (30% in manufacturing) (CBI, 2011).

Dando Drilling International Limited (DANDO) is a UK based medium sized OEM (Original Equipment Manufacturer) of drilling rigs serving global mining, water-well drilling and geotechnical market, from a single site based in UK which employs 55 employees. The core competency of the DANDO is its strength of designing and manufacturing the bespoke drilling rigs. With the core competency, also associated are some core problems. To remain competitive, DANDO has to strive towards reducing project delivery time, cost and improving quality assurance and flexibility. DANDO has adopted blend of Engineer-To-Order (ETO) and Make-To-Order (MTO) business model. With its adopted strategy of outsourcing the manufacturing to UK subcontractors and in-house assembling and

designing, DANDO has experienced a 5.1% increase in sales from year 2012 to mid-2013.

With the increasing sales, the challenge in meeting more flexible demand at much tighter deadline and competitive cost and quality becomes the requirement of the complete operational system. However the strategy of subcontracting has resulted into increased risk due to the loss of operational control (Association for Project Management, 2012). This is a limiting factor on the future growth.

According to a survey conducted by BMG Research for Department for Business Innovation & Skills- UK, 54% of the UK SME's consider themselves strong at operational improvement, 42% consider themselves strong at business systems and 40% consider themselves strong at introducing new products and services. However, it is challenging for a medium sized firm to be strong at all the above three points. (BMG Research, 2013)

To overcome this limitation, DANDO has realised a need of not only making internal operation but also external operation transparent, flexible, and cost and time competitive. Hence, the next section of this paper highlights the importance of and types of key internal operational improvements for a medium sized organisation like DANDO prior to successfully integrating supply chain.

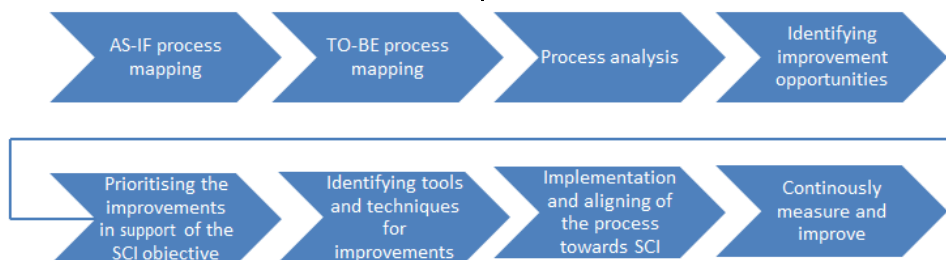


Figure 2- Generic process flow adopted for Business Renovation Project at Dando

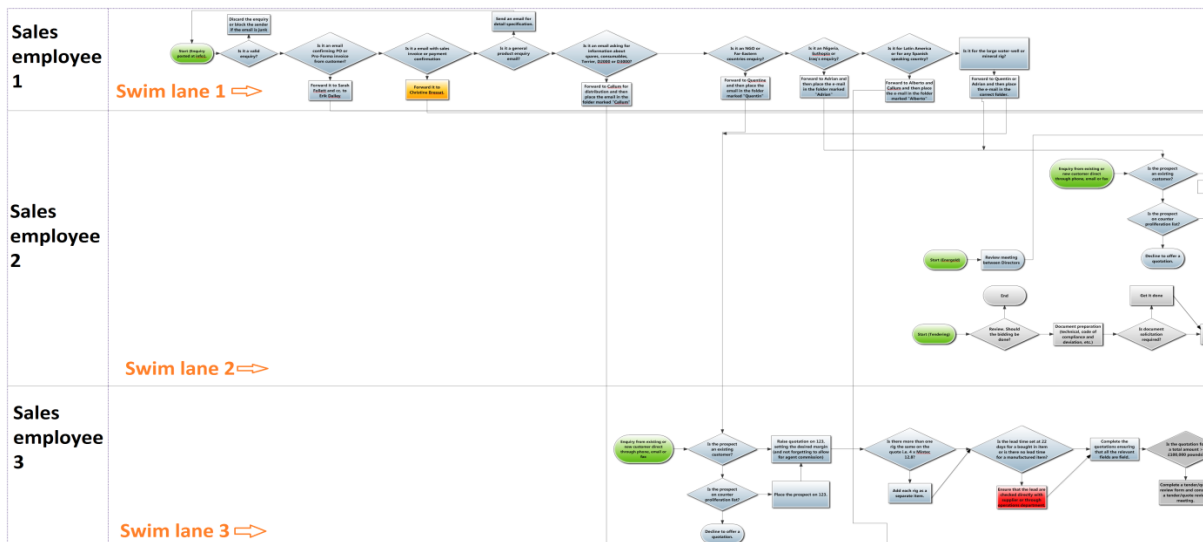


Figure 3- Snap-shot of a tool used to map the complete AS-IF and TO-BE process at Dando

B) Internal operational improvements and process alignment to support SCI at Dando:

*“In today’s world of competitive business it is no longer companies that compete, but supply chains.”* (Chen & Themistocleous, 2004)

With the intention of overcoming the limitations discussed above and extending the domain beyond the company boundary, the task of identifying existing weaknesses began by mapping the current business process from enquiry to after-sales service using the AS-IF swim lane process mapping technique (Refer figure 3).

A swim-lane diagram was deployed to map the detail process. The level of detail adopted was to the each and every manager’s and engineer’s work flow from all departments plotted on a visual flow diagram (Refer figure-3). This process flow diagram was compared with the TO-BE swim lane process map and

analysed critically involving internal and external, fresh and experienced mind-sets. This exposed key weaknesses with a direct impact on the core competence process of the company i.e.: design. (Refer Table-1 below).

Even though some of the above weaknesses may sound obvious, it is crucial to identify exactly where in the flow of information are problems arising, how and when any errors are being made and by whom; because these issues contribute towards internal weaknesses. This was achieved with a swim-lane process map. Making the everyday work visible on a chart also helped in convincing the importance of the Business Process Renovation and need for the employees participation.

Table 1- Outcome from the AS-IF and TO-BE process analysis

Key Errors / Gaps:	Major impacts:
1) Unclear specification agreement and finalisation between design and sales.	1) Effect on value addition 2) delay due to redraw and remanufacture.
2) Low input of design department while order processing.	1) Effect on customer commitment 2) Effect on planning leading to internal bullwhip effect 4) Problems in effective external skill allocation/utilisation.
3) Low input from downstream supply chain in design agreement, project planning and capability planning.	
4) Minimal consultation within internal departments.	1) Delay due to redrawing of models 2) Effect on project's On-Time-Delivery 3) delay in completing procurement 4) resource waste due to rework.
5) Non-standard design hand-over to production and suppliers	1) Fire-fighting arising from drawing issue management problems and a lack of flagging system 2) effect on On-Time-Delivery 3) delay in completing procurement 4) resource wastage due to rework.
6) Engineering Change Requisition (ECR) limited to internal production, which is a manual process with paper documentation.	
7) Insufficient tracing and tracking of the order from design to despatch because of ERP system not customised to company's operation strategy	1) Effect on value addition 2) Effect on customer commitment 3) penalty loss for not meeting deadline 4) fire-fighting

As shown in the Figures 2 and -3, after successfully identifying the weaknesses contributing towards the loss of competitiveness, the right tools and techniques were identified to fill the prioritised gaps. The selection of the tools and techniques involved: considering the possibility of integrating the supply chain, the speed of deployment, acceptability/user-friendliness to the staff and cost effectiveness. These considerations also reflected the fact that SME's fail to make SCI successful because of slow adaptation to technology and high cost involved. With these considerations, it was most suitable and appropriate to move forward in developing and deploying tools and techniques with the effective use of the existing in-house resources.

As a part of this strategy, the following tools were designed, developed and implemented in-house:

i) An Operations Tracking Chart:

This tool was developed and deployed to overcome gaps 4 & 7 (see Table-1). The existing Enterprise Resource Planning (ERP) system lacked the capabilities of ETO/MTO operation. As the name implies, the function of this tool was to work in parallel with the existing ERP system and provide more transparency and an issue flagging system that was aligned to ETO/MTO operation. This system integrated Microsoft Excel 2010, Microsoft Project 2010, Microsoft Access 2010 and 123-Insight ERP to allow users from procurement and production to enter the purchase order and work order chase details. The system is designed to calculate the effect of any changes on the related Sales/Forecast order and flag up the issue in real-time, thus assuring the right issue goes to right person at the right time. This also dynamically reflects the changes against the planned Gantt chart on MS Project 2010, thus improving the

project update in real-time and avoiding a call for a dedicated employee meeting. Following is the basic PO Chase process flow, which is one of the sections within whole tracking, pre and post Business Renovation (Refer Figure-4 and Figure-5 below);

This tool was developed considering the SCI objective of integrating the suppliers build plan information with the DANDO's build plan to improve overall delivery cycle time.

II) Design Data Management system (DDM):

The other key tool employed is similar to most Product Data Management packages available in the market currently. DANDO design involves the use of Solidworks 2013 for its CAD/FEA work. As stated by Dewhurst (2010), 70% of the product's total manufacturing cost and time is decided in the design phase (Dewhurst , 2010). Thus design data

management is crucial. This system was developed and employed to overcome gaps 4, 5, 6 and 7 (Refer Table-1). This is a bespoke system developed in-house in the span of 30 days and at 10% of cost of most of the known packages available in market. It was developed using the existing software resources like MS Access 2010, Solidworks 2013 and Microsoft Windows Server 2008. DDM consists of four major modules: Engineering Change Notes/Requisition (ECN) management, part codification management, drawing file management and drawing handover/approval management. This system also incorporates the issue flagging system, which flags up issues by visual warning and sending an automated email to the correct employee which ensures the correct information goes to the right person at the right time thus avoiding fire-fighting. Following is the post renovation process flow with SCI consideration; (Refer Figure-6 below)

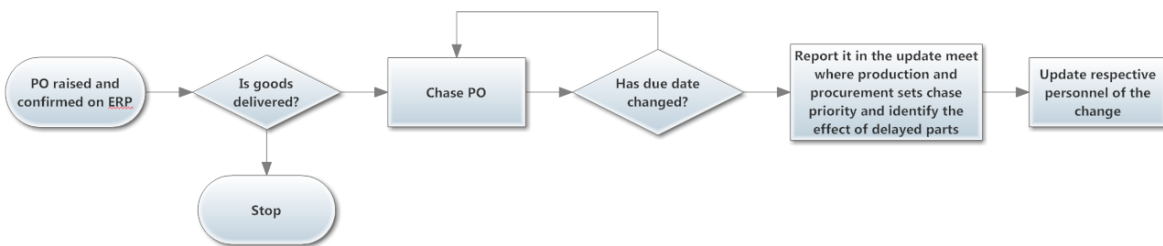


Figure 4- Po chasing process pre Business Renovation

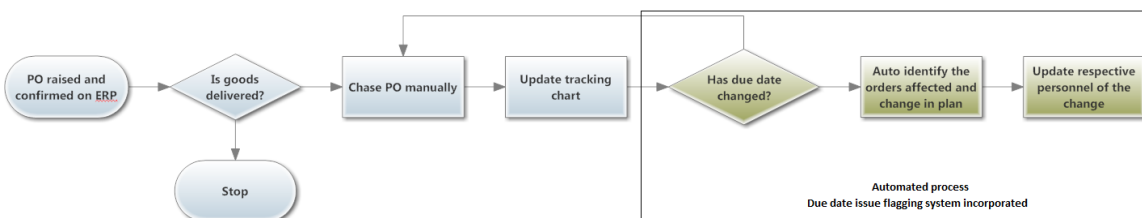


Figure 5- PO chasing process pre and post Business Renovation

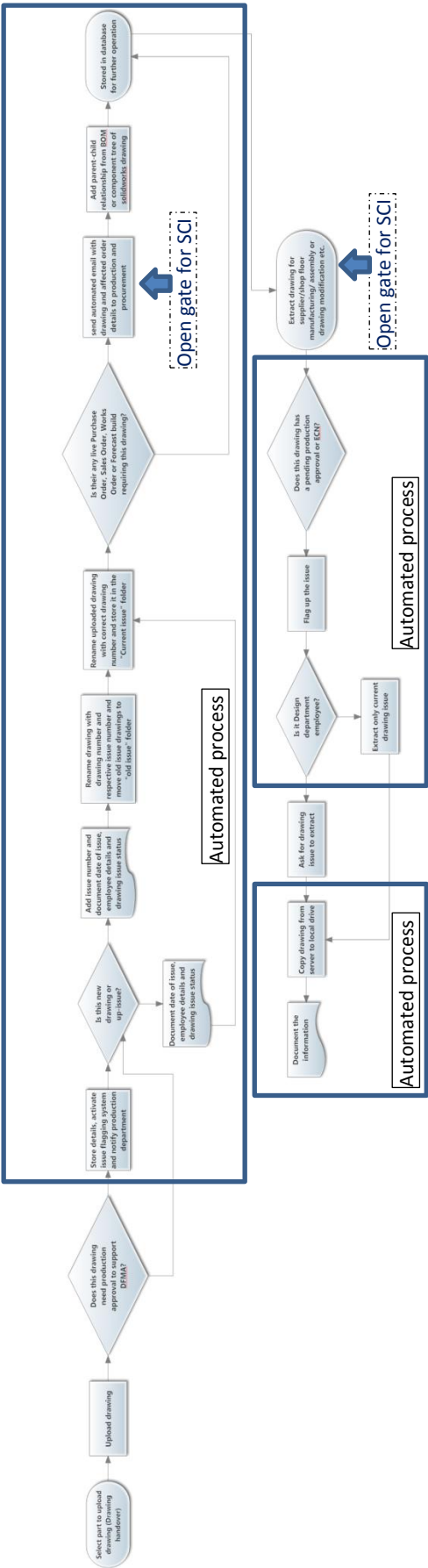


Figure 6- Drawing handover and drawing distribution process post Business Renovation



## Conclusion:

There are clearly unexplored methods of supporting and integrating supply chain in SME OEM Companies. With the use of in-house IT technology and thorough analysis, a custom system could be developed and deployed at low cost and at high adoption rate to realise benefit on-time. Post business renovation, the information sharing was more transparent as everyone was using a single source of planning and chasing system. The use of an Operations Tracking Chart itself resulted in 3 hours (12 hours in total) of each production and purchase employee (2 in each department) savings per week and 5% of increase in On-Time-Availability of parts due to improved process transparency and reduced fire fighting. However, tools like Operations Tracking and DDM has many hidden benefits for which a refined Key Performance Indicator (KPI) should be established to support the logging of benefits from process improvements and SCI. The implementation and analysis of the KPI system and SCI is considered as a future work for this programme which could be carried out concurrently.

Apart from the operational performance benefits, the operations process now have three open gates in the existing process where suppliers and their processes can be integrated successfully to reduce the cycle/response time and improve flexibility. These gates in the process has increased the feasibility of integrating 26 key suppliers (out of 145 total suppliers) governing between 70% - 80% of the Dando's cash flow and 80% of the actual lead time. Out of these 26 suppliers, 15 suppliers (contributing towards 34% of the total invoice) works/rely on Dando's created design drawings. Even 1% of improvement from error-cost saving by integrating these 15 suppliers with Dando's Design and Development operations process will result in improvement of total annual cost savings by 5.44%.

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