

USING THE SUPPLY-CHAIN OPERATIONS REFERENCE MODEL (SCOR) TO MODEL THE PRODUCTION OF NAUTICAL CHARTS BY THE SA NAVY HYDROGRAPHIC OFFICE

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Background and Objectives

The Supply-Chain Council developed in conjunction with industry such as Toyota, Lockheed-Martin, Bayer, Boeing and Siemens the Supply-Chain Operations Reference (SCOR) Model. The SCOR model, which is an industry standard model and in its 10th version, consist of five management processes that constitutes a supply chain, namely Plan, Source, Make, Deliver and Return.

Plan is the management process that involves all the planning activities with regards to a specific supply chain. Source management process looks at processes involved to obtain the required products needed by the supply chain from its various suppliers. Make is the actual production of a product by the company or entity and the different processes involved during the production process. Deliver management process looks at the various processes involved when delivering the completed product to customer. Return looks at the various processes involved when defective products are returned to the supplying entity. Other return processes are the processes dealing with products that are returned for maintenance, repair or overhaul as well as excess products that are returned for recycling or disposal purposes.

The SCOR model consists of three levels, namely the five management processes as discussed in the previous paragraph, which is Level 1. Level 2 breaks each management process down into several process categories that are used to define the supply. There are three types of products created in the SCOR model, namely stocked products, make-to-order products and engineer-to-order products. Make-to-order products have standard operating procedures in place to create a product once an order is received. Engineer-to-order products are customer specific products. These products are designed from scratch and the end product is a once-off product.

Level 3 in turn breaks down each process category into various process elements that is needed to execute the process category. As an example process category Source Stocked Product (S1) of the management process SOURCE (S) is broken down into the following process elements: Schedule Product Deliveries (S1.1), Receive Product (S1.2), Verify Product (S1.3), Transfer Product (S1.4) and Authorise Supplier Payment (S1.5) (Supply-Chain Council, 2008). Level 4, which is the implementation level for each process element, is outside the scope of the SCOR model since it is very company specific.

The SA Navy Hydrographic Office is the national authority for the provision of hydrographic services for South African and Namibian waters. The Mission of SA Navy Hydrographic Office is to provide Hydrographic information and Products essential for the Navy; whilst providing a Professional Hydrographic Service to the Maritime Community in order to aid Safe Navigation around the Coast of South Africa. The Vision of SA Navy Hydrographic Office is as follows: The Hydrographic Office is recognised as the Centre of Hydrographic Excellence in Africa by the International Hydrographic Community through its proven professional conduct, products, innovation and supreme service.

The value proposition of the SA Navy Hydrographic Office is to deliver high quality products that comply with international standards as set by the International Maritime Organisation (IMO) for maritime safety and the International Hydrographic Organisation (IHO) for international hydrographic standards. The second value proposition is to provide affordable and reliable navigational charts to the maritime community at large.

Chart production is a process in which data is collected and production materials are sourced from suppliers; transformed into charts and made available to a customer base by the SA Navy Hydrographic Office. This production process is a basic supply chain as defined by Mentzer, et al (2001) namely there are suppliers that provide the data as well as the production material; the SA Navy Hydrographic Office is the firm that produces the charts; and the customers such as the South African Navy and ship chandlers obtain the charts from the hydrographic office.

Since chart production can be seen as a supply chain, it was decided to model the chart production using the SCOR model in order to determine whether the current high standard of chart production can be further improved upon. The SA Navy Hydrographic Office produces various products ranging from the National Nautical Chart Series in paper format and electronic format in the form of Electronic Navigational Charts, General Bathymetric Charts of the Oceans (GEBCO's), monthly SA Notices to Mariners (Correction of Charts and Publications) through to Navigational Publications (SAN HO). The specific product that is used in this research is the National Nautical Chart Series published in paper format by the SA Navy Hydrographic Office. Figure 1 gives a high level overview of the SA Navy Hydrographic Office's supply chain with regards to the production of the National Nautical Chart Series in paper format.

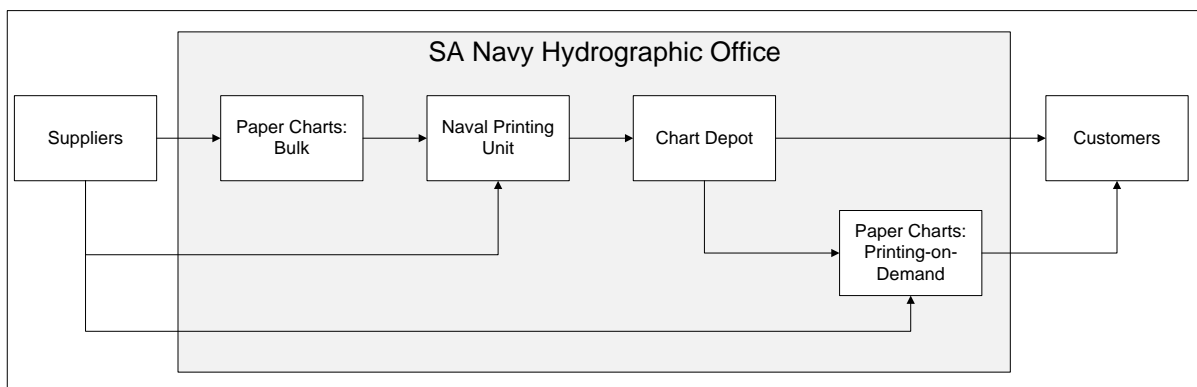


Figure 1: High level SA Navy Hydrographic Office Nautical Chart Production supply chain.

The high level supply chain consists of suppliers to the Paper Charts: Bulk, the Naval Printing Unit and Paper Charts: Printing-on-Demand. The Naval Printing Unit is an entity of

its own at a different location than the Hydrographic Office, but is seen as integral part of the supply chain under direct control by the office when the charts are printed. The Chart Depot stores and releases the printed charts when required. Since paper charts are snapshots in time and thus need to be updated on a regular basis. Paper Charts: Printing-on-Demand is responsible for updating paper charts between scheduled updates in order to keep the charts current.

Research approach:

The research approach is a case study approach where the SCOR model is used to map the supply chain of the National Nautical Chart Series published in paper format. The first part of the process is to establish the current AS IS supply chain. This includes all the supply chain partners in the supply chain. The supply chain is configured using Level 2 of the SCOR model. Once the supply chain has been configured the supply chain data is captured at Level 3 and Level 4.

Once the AS IS supply chain has been established the TO BE supply chain will be configured at Level 2 and then expanded at Levels 3 and 4. The TO BE supply chain is the improved supply chain based on the analysis of the AS IS supply chain.

Findings and Originality:

The AS IS supply chain has been configured at Level 2 of the SCOR model using the high level supply chain illustrated in Figure 1 as a guideline. Currently the process of capturing the AS IS supply chain is ongoing at Levels 3 and 4. The data gathered to date provided sufficient information that the authors are of opinion that charting entities can benefit in using supply chain analysis and management to improve the production process. It is envisaged that the case study will be completed within the next two to three months and that the full AS IS and TO BE supply chain will be presented at the conference.

The National Nautical Chart Series (paper format) supply chain consists of the following entities, namely the SA Navy Hydrographic Office, various suppliers of information, data and materials, the Naval printing Unit and the customers such as the South African Navy, ship chandlers and other maritime entities. The configured AS IS supply chain is shown in Figure 2.

The AS IS supply chain can be summarised as follows:

- The overall planning of the supply chain is done by the Officer Commanding of the SA Navy Hydrographic Office in conjunction with Fleet Command to meet the SA Navy's needs as well as using inputs from other maritime entities to ensure safe navigation around South African and Namibian waters.
- The identified suppliers are the hydrographic survey vessel of the SA Navy, the SAS PROTEA, small craft hydrographic survey vessels that are used to do hydrographic surveys in shallow and inland waters and are attached to the SAS PROTEA, land based survey data that is used to establish the topography around harbours, estuaries and the shore area as well as a few dams that are used extensively by leisure craft such as the Vapl Dam near Johannesburg, South Africa, the hydrographic office's archive, other maritime entities such as undersea cable companies, oil exploration companies, Lighthouse Services, harbour engineers, the National Ports Authority, foreign hydrographic offices, and the suppliers that provide paper and other printing materials for the printing of the paper charts.

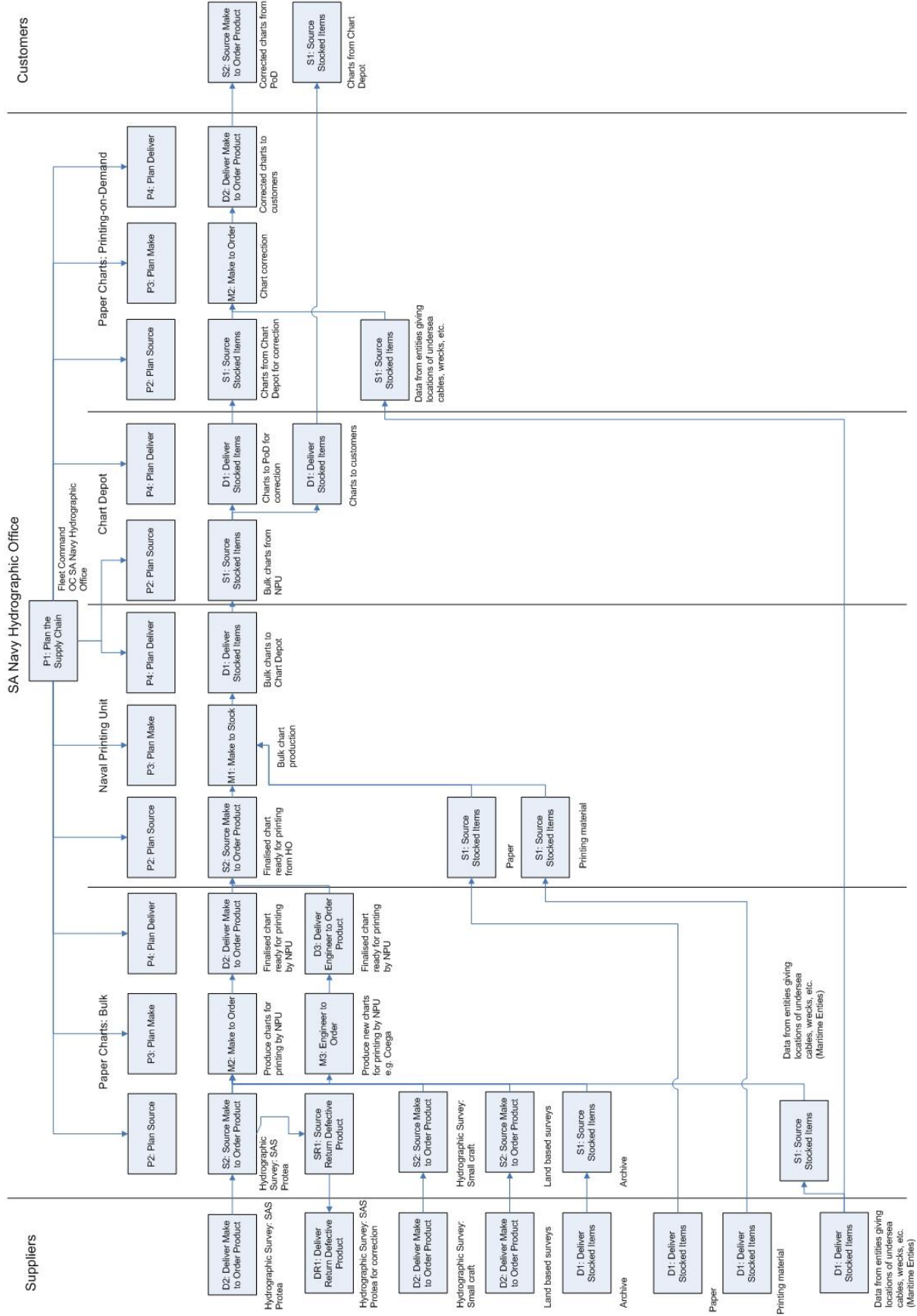


Figure 2: The AS IS National Nautical Chart Series (paper format) supply chain.

- Paper Charts: Bulk as shown in Figure 2 is responsible for the integration of data and information from various suppliers as well as the final design layout of the nautical chart and delivers it in a print ready format to the Naval Printing Unit.
- The Naval Printing Unit (NPU) receives the paper and other printing materials from its suppliers and prints the paper charts and delivers the printed charts to the Chart Depot. The Printing-on-Demand facility supplements this procedure outside the NPU printing schedules.
- The Chart Depot (dispatches or provides) the printed charts to various customers such as the SA Navy and ship chandlers.
- The charts are updated on a regular basis at determined time intervals, however changes may occur during these update intervals that endanger the safe navigation of South African and Namibian waters. These updates are done by hand or printed as corrections on existing charts by the Printing-on-Demand facility of the SA Navy Hydrographic Office before delivery to customers.

Research impact:

This is an extension of the principal author's completed PhD research. The PhD research was based on using supply chains and supply chain management to improve the data production of GIS units (Schmitz, 2007). Furthermore the CSIR is currently developing a comprehensive logistic model for the South African National Defence Force based on the SCOR model and the ISO 15288 life cycle model (Schmitz, Engelbrecht and Bean, 2010) and that the SA Navy Hydrographic Office is used as one of the case studies to illustrate the use of the newly developed model for the SANDF. The SCOR version is presented here as to make the concept available to map production entities in general.

Applying the concept of supply chains and supply chain management outside the traditional manufacturing and retail industries provides for novel applications and interesting research. These non-traditional industries can benefit hugely from the extensive research base that already exists based on the research done in the traditional manufacturing and retail industries. The authors are of opinion that this approach will benefit the charting and mapping industry.

Practical impact:

The SCOR model, which can be seen as an industry standard, provides an accessible tool to map the chart or map production supply chain. The SCOR model also makes provision to measure each process with regards to reliability of the charting or mapping entity to produce products of high quality and standard; the time spent to produce the high quality map; how well the charting or mapping entity is equipped to meet changing demands on its production; the costs involved to produce a chart or map; and how well it utilises its resources. Although the SA Navy Hydrographic Office is a mandated non-profit organisation, it still needs to be conservative about its costs without compromising the high quality and standard of its products.

During the AS IS modelling phase it was discovered that the SCOR model is also ideally suited as a knowledge management tool. The SCOR model allows for the capturing of best practices, required documentation such as IHO standards and chart production rules. The capturing of processes at Level 4 also provides valuable information with regards to the production of charts. When bundled into a report it can be used as a reference tool for new staff members that need to be trained to do the work. This is especially true for organisations where there is a critical shortage of skilled staff to do the chart production. The skills are

especially needed in the area of preparing the charts based information from various suppliers, the quality control thereof as well as getting the charts print ready.

Although it is a lengthy process to capture all the processes and related information with regards to the production of charts supply chain, the authors are of opinion that this approach in using the SCOR model or any other supply chain modelling tool that it will be to the benefit of a charting or mapping organisation.

Keywords: Supply chains, chart production, SCOR, supply chain management

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