

4 THE EAM SC MODEL

4.1 THE EVOLUTION OF PRODUCTION MODELS

The last two decades have seen a shift in favour of the end user in the manufacturing industry. What a company manufactured and presented to the customer twenty years ago was what the end user bought. Competition changed this and the end user has become a sophisticated and selective buyer. This changed the way business looked at the market for their products and it has now become a case of the fittest will survive. The ability to respond more quickly to changing market conditions than your competitors may be the difference between survival and extinction.

Figure 9 [DNA SC] shows how businesses then, "PUSHED" their product down the customer channel. Each step in the process added increasing costs and lengthened responsiveness to product demand.

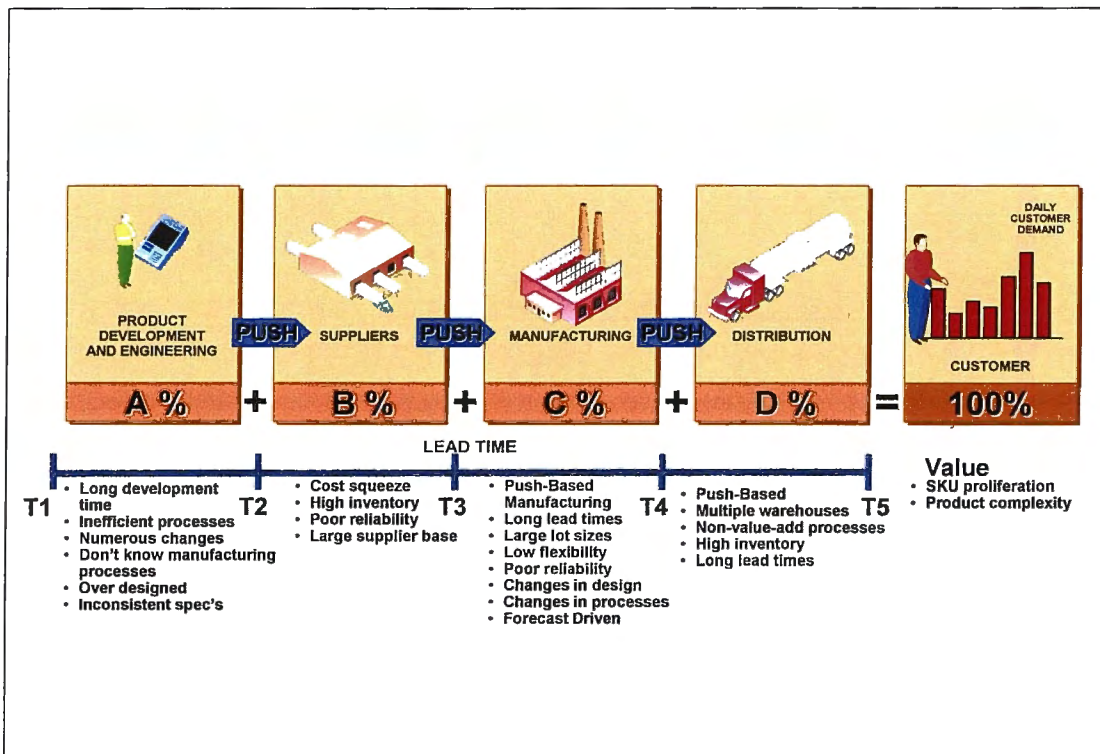


Figure 9: The "PUSH" Production Model

This outdated business model relied on a customer (e.g. retail outlet) that was eager and willing to pass on any product to the end user; and the end user accepted it. The customer allowed the manufacture to dictate product type and specification. An idea for a product starts on the drawing board in the development and engineering phase. The result is a concept product that is usually over designed with poor specifications and a yet to be determined manufacturing process. The end user has no idea that

the product is on its way and once received by the market, will go through numerous modifications to increase user acceptance. This, and the fact that the product is pushed from the manufacturer, is an inefficient process with long development times. A new product's requirement for materials always catches suppliers off guard and they develop a reputation of being unreliable. Suppliers counter the push effect by increasing inventory items and levels, which in return increases operational costs and squeezes profits. If a supplier cannot immediately provide materials they are sourced on the open market and results in a large supplier base. The manufacturer is next in line. This is the first time that the manufacturer provides input to the product design process. Manufacturing limitations; be it in the production process or assets, can change the design of a product. Retooling and establishing an inbound supply chain means low flexibility, poor reliability and long lead times before manufacturing can start.

Distribution to the customer is tricky. Not knowing exactly who and where the end user is, requires a larger distribution network and higher inventories to deal with unexpected demands for a product. The customer sells the product to the end user who can accept or reject the product outright. Usually acceptance falls is conditional on certain changes and to increase acceptance requires a process of product modification. This vicious cycle starts again at the product development and engineering phase and ends with a very similar product issued as a product version. The knock on effect sees a proliferation in the number of products, product complexity, support, items or Stock Keeping Units (SKU's), inventory, etc.

Successful businesses have significantly changed their production models. Manufacturers are moving towards a "PULL" environment where products and production is geared toward making only what the end user expects [Lapide, 1998 and Cohen, Cull, Lee, Willen, 2000]. This makes understanding current and future consumer demand extremely important and has seen a resurgence of interest in demand forecasting, planning processes and technologies, and Customer Relationship Management (CRM).

Best practice companies are looking beyond themselves to identify opportunities to improve business performance through the entire value chain. They have extended the business model to include the end user. The "PUSH" for a product that originated from the development and engineering phase now comes from the end user who "PULLS" his requirement all the way through to design and engineering. This is illustrated in figure 10 [DNA SC].

When design and engineering knows what the end user wants, it means that a product can now reach the market far quicker as less time is spent on design. The risk of a product failure due to rejection by the end user is considerably less. There is cost saving opportunities due to a lower risk associated with product failure and lower design costs. During design, engineers now take into account factors such as the supplier base and materials commercially available, the manufacturing processes with their complexities, method of distribution, etc. The reason why this now happens is because suppliers all the

way through to end users are exerting their influence or positive pressure on designers to take into consideration what is happening upstream and to include this knowledge in the product designed.

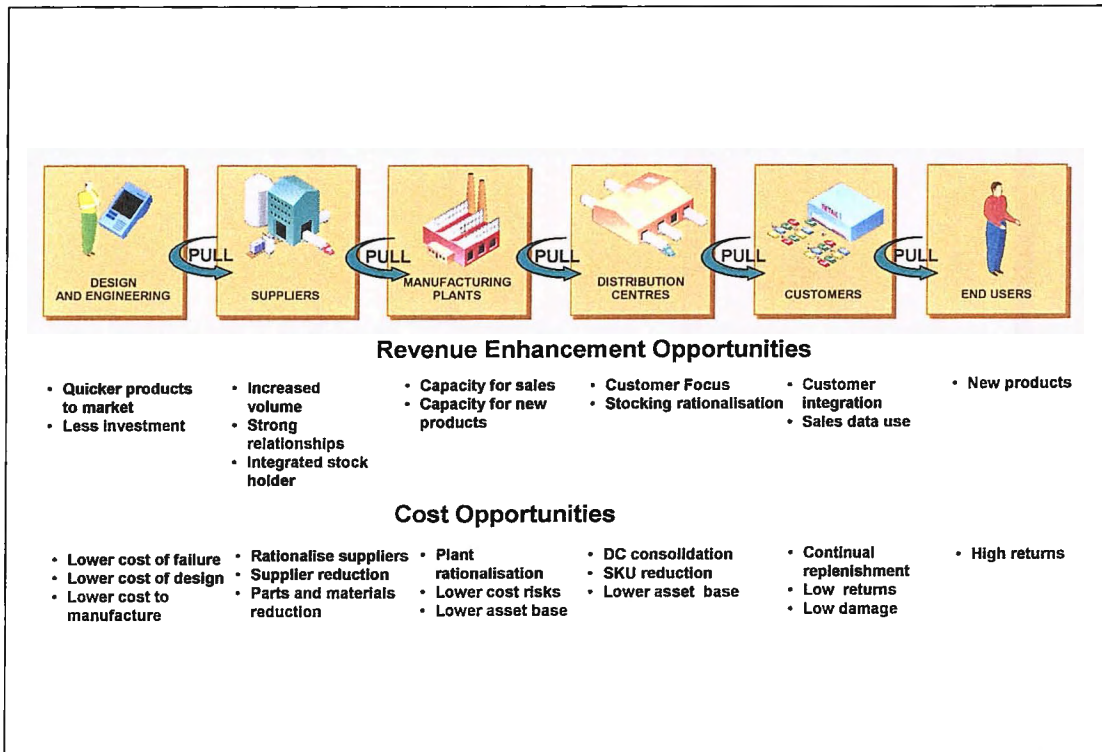


Figure 10: The "PULL" Production Model

Knowing the supplier market and the parts and materials commercially available means that there is cost saving opportunities through the reduction in the supplier base or items needed to assemble a product.

The pull from manufacturers through to suppliers provides the opportunity to influence the way business is done. Better designs result in less product versions and better forecasting data puts a manufacturer in a position to rationalise his plant and create capacity for sales and / or new products. Strong forecasting and a reduced supplier base makes it possible to concentrate material volumes with approved / selected suppliers. The manufacturer / supplier relationship may improve to such an extent that the supplier becomes part and parcel of the product manufacturing process. A good example is when suppliers integrate stock holding with manufacturers.

Distribution of finished goods is significantly simplified due to known end user locality and consumption. Distribution now becomes customer focused through fulfilment. Cost saving opportunities exist by consolidating Distribution Centres (DC), the reduced number of product versions, and a lower asset base needed to distribute finished goods.

For the customer (i.e. retail outlet) it opens up the opportunity to gain a captured end user. Using a continuous replenishment process to service a known demand the customer gets lower returns of goods as less stock is held in anticipation of sales.

4.2 THE DEMAND SIGNAL

What impact has the pull-production environment had on supply chain management? To achieve more profitable and revenue enhancing supply chain operations, companies are moving towards integrated supply and demand planning. The integrated supply planning process yields great benefits since it ensures all operational plans are synchronised to a single set of demand forecasts [Lapide, 1998]. In turn this ensures consistent accountability and commitment among supply chain partners.

In process manufacturing, operational plans equal production output. An operational plan can only work if:

- the plant operates according to its intended design and
- raw materials are available to process.

The pull-production model provides a demand signal to purchase raw materials and a production schedule for the plant to operate to. Herein lies the problem! At best the model works with a 100% plant availability and reliability. At its worst the pull-production model is null and void if the plant suffers from poor availability and reliability. Lapide stresses that the greatest benefits of an integrated supply planning solution is achieved with a single set of demand forecasts. He however did not elaborate on the different types of demand forecasts.

It is clear that demand forecasting within a process-manufacturing environment is not simply a case of setting up a production schedule in response to an accurate end user demand signal. There is a further need to attend to the additional and different demands generated by plant assets for maintenance, repair and operating materials. If this demand is not met a plant cannot perform according to its intended design.

Figure 11 [DNA EAM] demonstrates the importance of a demand signal in a product-manufacturing environment. The demand signal initiates the procurement (buy), followed by logistics (move), and warehousing (store) of materials. Chapter 3 described the relationship between process manufacturing, asset density, asset management and maintenance. We now understand that the pull-production model provides a production schedule but relies on asset availability and reliability. In an asset intensive manufacturing company a single demand forecast for materials, required for integration with the supply chain, therefore becomes the sum of two demand signals. They are the:

- production demand signal
- asset demand signal

The production demand signal is responsible for the identification of the correct raw materials in their right quantities for production. The asset demand signal in turn addresses the maintenance, repair and operating materials or popularly referred to as MRO materials required by an asset. The difference between raw materials and MRO materials is the following: MRO materials are materials that are consumed by a company rather than forming part of its output; raw materials form part of the output usually in the form of a finished product. At any given time both demand signals are influenced by:

- The rate of consumption of raw, maintenance, repair and operating materials.
- Stock on hand.
- Production cycles based on history (e.g. cyclical cycles due to seasonality).
- Production plans.
- Maintenance requirements of assets.
- Strategic direction set by management.

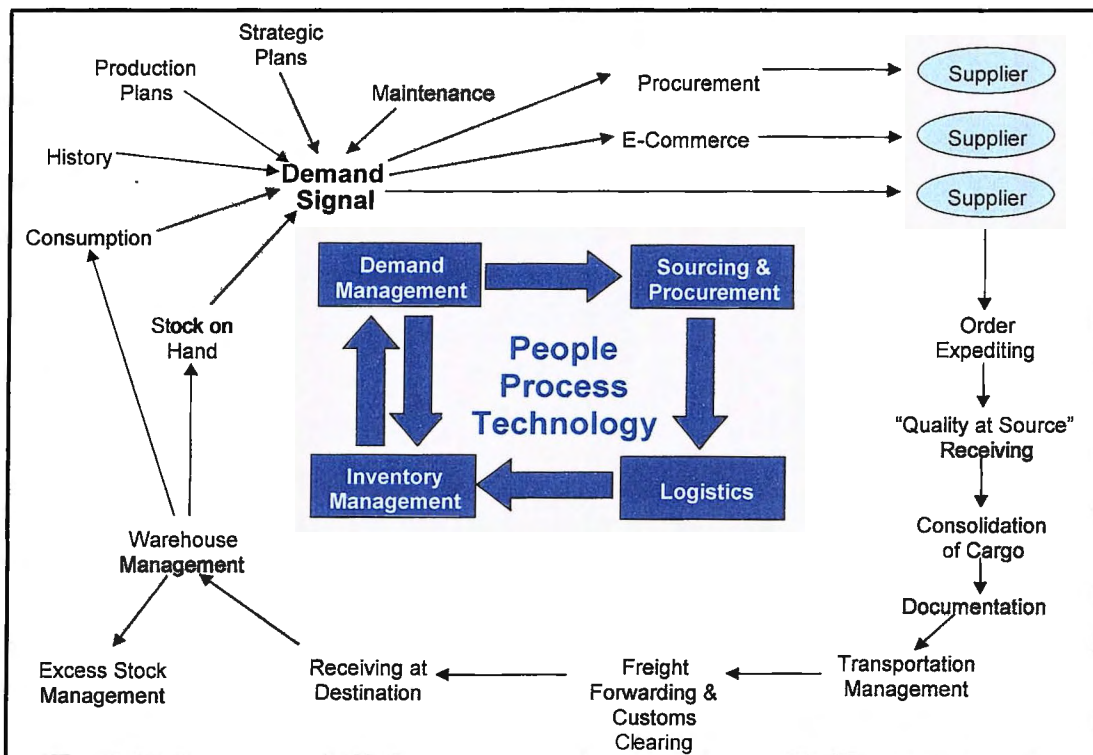


Figure 11: Understanding the Demand Signal

4.3 INTEGRATING EAM AND SC USING THE M&R DEMAND SIGNAL

If you ask plant engineers what role supply chain management (SCM) plays in enterprises asset management (EAM) you'd stand a good chance of hearing this retort. "SCM has nothing to do with EAM." The engineer might admit that, as a procurer of equipment and MRO inventory, asset management is an end link in a supply chain. There aren't many engineers willing to concede that SCM significantly impacts the way they do business [Singer, 2000]. Why have they taken up this position and how have they derived at this conclusion. It has to do with:

- Organisational structures that continue to operate in "silos" or responsibility verticals. It results in a culture of ownership / responsibility per silo to the detriment of the business requirement.
- A lack of knowledge and understanding how things fit together due to the complexity and isolation of business functions (silos).
- The lack of an integrated EAM SC process.

Is integrating enterprise asset management and supply chain management even desirable? Chapter 2 concluded that SCM is a vital aspect for companies to improve their competitive edge and profitability and has become the number one strategy priority with management. Chapter 3 dealt with enterprise asset management and the benefits of optimisation in each life cycle. The previous paragraphs addressed the changing production environment and the dependency on asset availability and reliability, and an efficient supply chain. We now understand the interdependency between EAM, SCM and Production and can only conclude that an integrated EAM SC model is not only desirable but also essential.

What has changed to make integration possible? Profit margins, competition, customer satisfaction to name but a few add impetus for business to do things better, but the introduction of the concepts of EAM and SCM makes it possible to integrate. Both EAM and SCM are low-level integration concepts / techniques on their own. EAM integrates the business functions of Plan, Acquire, Install, Operate, Maintain and Dispose to manage and optimise assets. SCM integrates the business functions of Buy, Move, Store, Make and Sell in a product or service value chain. This simplifies and orders the way an organisation does business and makes it possible to integrate on the next level. In this case the next level is EAM and SCM. Both have broadened the business solution to cross company boundaries and break down the internal silo structures. What EAM and SCM do is provide a different business perspective or angle. One cannot emphasise this enough as you cannot solve a problem with the same approach that created it in the first place.

The first step in integrating EAM with SCM is to admit the limitations of the current supply chain model. It is production focused with a limited application for MRO materials. The term "supply chain" is in itself problematic as it implies linearity. The market has stopped thinking of the supply chain as a sequence of simplified series of events. It's actually a highly complex network of related supply chains required to manufacture a finished product [Hoffman and Sarwar, 2001].

DNA EAM investigated the MRO supply chain requirements and found commonalities with the production supply chain. The commonalities are:

- Similar supply chain functions of Buy, Move, and Store in the inbound supply chain.
- A demand signal that initiates a supply chain service, in this case the MRO and raw material supply chain.

The MRO demand signal can only be activated during the manufacture (Make) of a product when assets operate and its function degenerates to such a point where it cannot sustain the necessary product quality or worse, fails and stops the manufacturing process. DNA EAM found the MRO demand signal to be amongst others a function of:

- The inherent maintenance requirements due to its design.
- The process that it participates in.
- Operating environment.
- The product manufactured.

The demand signal initiates the supply chain to buy, move and store MRO material so that the assets can be maintained and its function restored to its original state. With the investigation DNA EAM came to realise that a second supply chain exists for asset management. It exists within the "Make" function of the production supply chain and shares the three existing functions of Buy, Move, and Store and two new functions of Operate and Maintain. The asset management supply chain for MRO material is shown in figure 12 [DNA EAM]. DNA EAM calls the asset management supply chain the INDIRECT supply chain and the Production supply chain the DIRECT supply chain.

With the indirect supply chain, EAM is integrated with SCM. The golden thread is the MRO demand signal that ties asset management in with the supply chain. Through integration the benefits of SCM become apparent to asset managers. Asset managers should realise that the supply chain has always been part of asset management but new and broader concepts now afford asset managers the opportunity to approach business in a different way and accomplish results that the out-of-date business models could not achieve. The new look concept of enterprise asset management after integration is represented in figure 13 [DNA EAM].

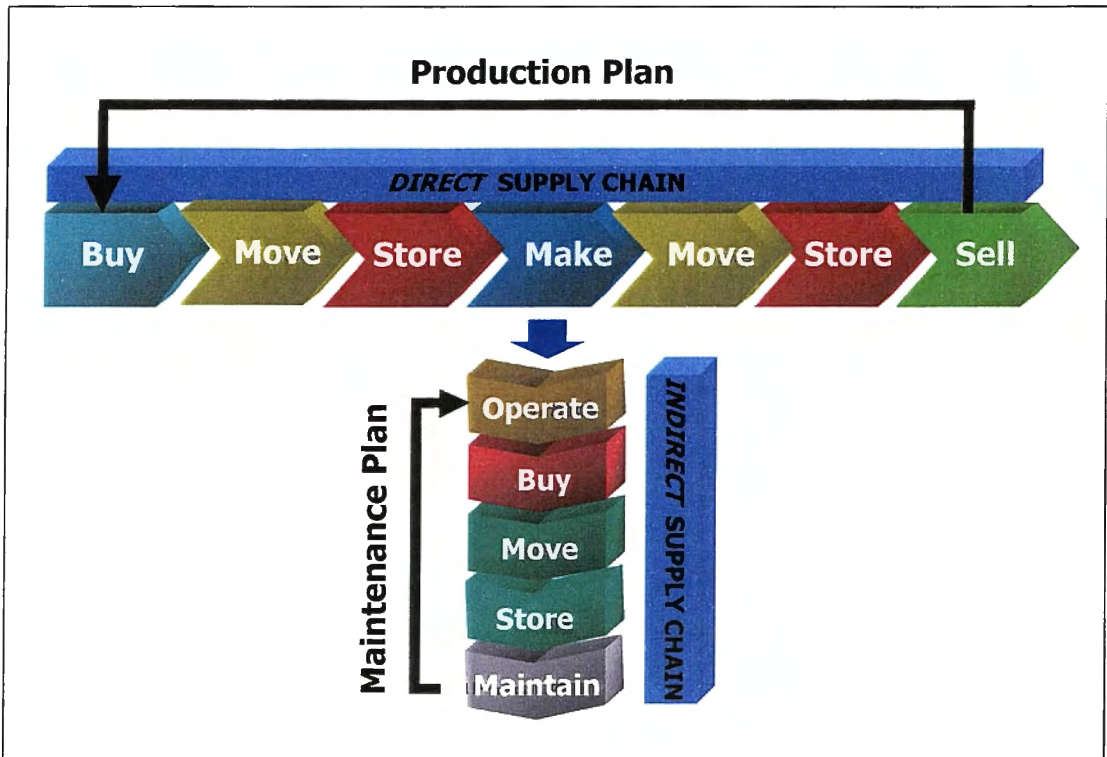


Figure 12: The Integrated EAM SC Model

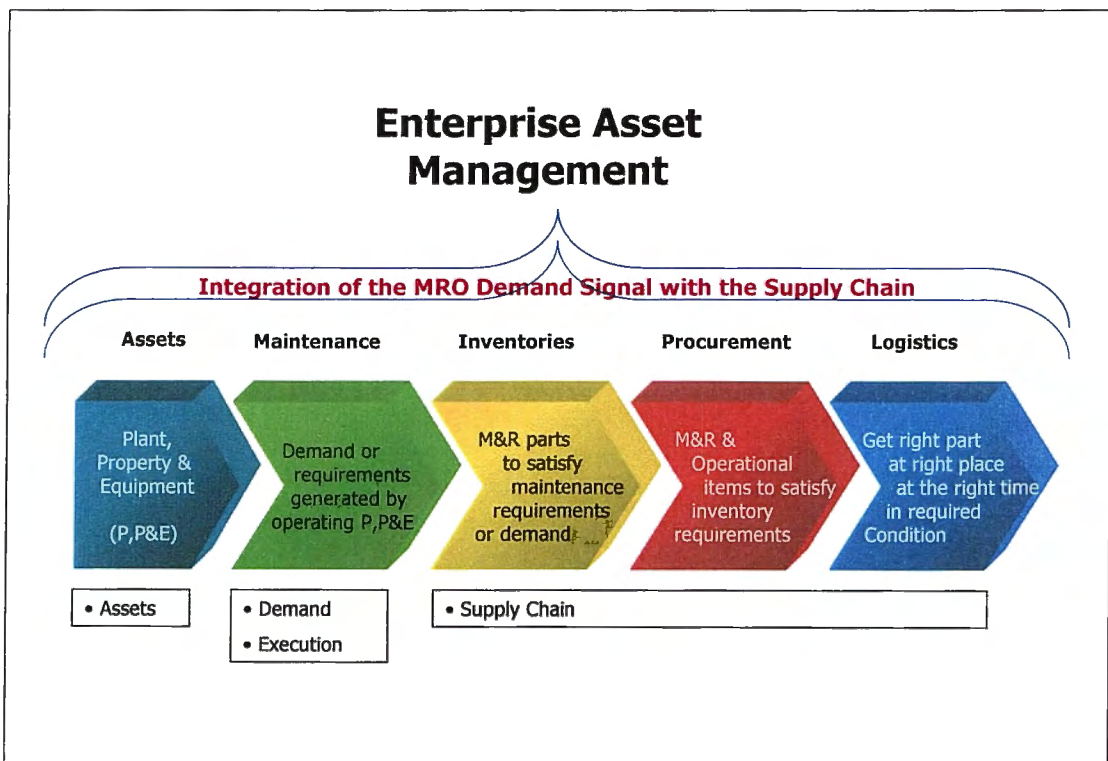


Figure 13: Scope of Enterprise Asset Management

4.4 CONCLUSION

To achieve more profitable supply chain operations, companies are moving towards integrated supply and demand planning. In a process-manufacturing environment it is simply not a case of setting up a production schedule in response to an accurate end user demand signal but includes the demand set by plant assets for maintenance, repair and operating materials.

If you ask plant engineers what role supply chain management (SCM) plays in enterprises asset management (EAM) one would stand a good chance of hearing this reply! "SCM has nothing to do with EAM." This is due to a lack of understanding how things fit together and an integrated EAM SC model. There is a definite interdependency between EAM and SCM and to integrate the two is not only desirable but also essential.

The market has stopped thinking of the supply chain as a sequence of simplified series of events. It's actually a highly complex network of related supply chains required to manufacture a finished product. DNA EAM came to realise this in its drive to optimise asset management. DNA EAM investigated the MRO supply chain and found commonalities with the production (traditional) supply chain. In both cases a demand signal initiates a supply chain service but for asset management this only happens when the plant is in use. The MRO supply chain exists within the Make function of the production supply chain and shares the three existing functions of Buy, Move, and Store and two new functions of Operate and Maintain. DNA EAM calls the asset management supply chain the INDIRECT supply chain and the Production supply chain the DIRECT supply chain.

The golden thread that makes integration possible is the MRO demand signal. Through integration the benefits of SCM are available to asset managers. Although the EAM SC model resides within the "Make" function of the production supply chain, its focus is on asset management. It provides asset managers with a different view of how they do business and may change their approach and responsibilities with regards to asset management.