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SUPPLY CHAIN MANAGEMENT – ENTERPRISE SYSTEM INTEGRATION AND SUPPLY CHAIN RESOURCE PLANNING

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ABSTRACT

In this study, the systems that constitute the infrastructure for efficient management of the supply chain are examined. Two approaches based on institutional systems are; systems that enable the flow of information between firms through the supply chain add-ons to enterprise systems and supply chain management systems that are independent of enterprise systems but built on this infrastructure . How these systems are integrated is discussed. Apart from these, supply chain resource planning approach, which is not based on enterprise systems, is also mentioned.

***Keywords: Supply Chain** Management, Supply Chain Resource Planning*

***Jel Codes:** M11 – M15 – O32*

TEDARİK ZİNCİRİ YÖNETİMİ – KURUMSAL SİSTEM ENTEGRASYONU VE TEDARİK ZİNCİRİ KAYNAK PLANLAMASI

ÖZ

Bu çalışmada tedarik zincirinin etkin bir şekilde yönetilebilmesinin altyapısını oluşturan sistemler incelenmiştir. Kurumsal sistemleri temel alan iki yaklaşım; kurumsal sistemlere tedarik zinciri eklentileriyle firmalar arası bilgi akışını mümkün kılan sistemler ve kurumsal sistemlerden bağımsız şekilde fakat bu altyapı üzerine inşa edilen tedarik zinciri yönetimi sistemleridir. Bu sistemlerin entegrasyonunun nasıl gerçekleştiği ele alınmıştır. Bunların dışında, kurumsal sistemleri temel almayan tedarik zinciri kaynak planlaması yaklaşımına da değinilmiştir.

***Anahtar Kelimeler**: Tedarik Zinciri Yönetimi, Tedarik Zinciri Kaynak Planlaması*

***Jel Kodu**: M11 – M15 – O32*

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INTRODUCTION

Companies in the 21st century will not compete with each other on their own. A firm will position itself in a competitive supply chain and different supply chains will compete with each other. Return on enterprise system investments and future income and profit increases will be ensured by the company's integration with the entire supply chain. A firm will compete with the total power of the supply chain in the market (Koh et al., 2006, 463).

Firms need strong partnerships and open communication to build an effective supply chain. In the past, enterprise systems were not able to provide successful links with firms outside. System applications were established to improve the effectiveness of transactions within the company. In this way, companies integrate their internal processes and access the desired information instantly. But the transition through e-commerce between firms has made it important to access the information on the systems of suppliers, customers and channel partners. Supply chain management (SCM) systems are more compatible with firms as they allow firms to interact more closely with outside firms (Tarn et al 2002, 32).

1. ENTERPRISE SYSTEMS

Information and communication technologies have become an important part of the competition strategy of many businesses. This strategic importance has made it possible for managers to integrate information and communication technologies across the enterprise and relate all business units to each other. Technology integration throughout the organization makes it possible for those who need to get the necessary information in time and make decisions. A popular approach to the development of an enterprise-wide integrated system is the implementation of an enterprise resource planning (ERP) system or, in other words, an enterprise system (Beheshti 2006, 184).

Many institutions have different systems they have developed over the years to meet their planning and decision-making needs. There is often little or no integration between departments. Applications used by separate departments do not communicate with each other. Data that is entered separately for each department causes data complication and lack of timeliness. The same data is available in a different format that makes it difficult to gather information and produce a coherent picture of what is happening in the business and makes it time consuming. Enterprise systems eliminate the complexity and the redundancy resulting from separate systems. Enterprise systems allow a variety of systems to be grouped together and fed into the system at once. The data is more likely to be valid once it has been entered. When incorrect information is detected, it is corrected at one time instead of going to each department for each change (Beheshti 2006, 186).

An enterprise system is a software that organizes and manages a company's business processes by sharing information among functional areas. Transforms transactional data, such as sales, into useful information that supports company decisions in other departments such as manufacturing, inventory, purchasing, distribution, accounting (Russell and Taylor 2003, 541). Enterprise systems focus on integrating internal processes such as sales, production, and inventory management (Kelle and Akbulut 2005, 41). Enterprise systems are the set of business applications or modules that combine an organization's various business units, such as finance, accounting, manufacturing and human resources, into a single system that is tightly integrated with a common platform for information flow across the enterprise (Beheshti 2006, 184-185). The main purpose of enterprise systems is to consolidate various departments of the organization into a single system application package. On the other hand, it is the basic system that provides the data that is needed by the components of the enterprise by making the flow of the integrated flow of information. How to use this information to gain competitive advantage in this direction is the key to success (Tarn et al., 2002, 27).

Enterprise system modules are integrated with the common definitions array and a common database. When a data comes in, for example a customer order to a point in the business, the effect of this information is reflected in all other departments such as accounting, production planning, procurement and logistics. Along with financial performance, it can be a valuable tool for managers who want to improve operational performance. Long-term financial gains can only be achieved by the

firm reducing the cost of delivering that value simultaneously with an increased customer value (Beheshti 2006, 186).

The forerunner of enterprise systems is a production planning and inventory control system known as material requirements planning (MRP). Later on, MRP was developed and manufacturing resources planning (MRP II) was introduced by adding capacity planning and workshop control modules. In the 1990s, enterprise resource planning (ERP) software was developed that combines all in-house operations, not just those related to manufacturing (Russell and Taylor 2003, 549). Organizations that have developed their internal processes through ERP are looking for ways to improve their processes with customers and suppliers besides ERP and internet. Towards the end of 1990s, software companies have developed new business applications for this purpose by the help of internet on sharing data. Electronic supply chain integration (e-SCM), e-procurement and customer relationship management (CRM), which can be integrated with enterprise systems, are some of them. Extended ERP has been created with the inclusion of modules such as CRM, supply chain planning, integrated e-commerce, sales force automation, decision support and human resources in enterprise systems focusing on internal activities (Burca et al., 2005, 427-428). The extended ERP, also referred to as ERP II, can be used by organizations to integrate the systems of customers and suppliers with their internal systems (Beheshti 2006, 185).

2. SUPPLY CHAIN MANAGEMENT AND ENTERPRISE SYSTEM INTEGRATION

Supply Chain Management (SCM) enables to manage the flow of material and information in a harmonious manner throughout the chain from the source to customers (Boubekri 2001, 394). SCM helps a company to integrate its internal processes so that its functions operate in a harmonious manner and ensures that the entire supply chain is compliant. Moreover, the SCM allows an organization to integrate its business processes with those of its business partners. In other words, when an organization becomes part of a supply chain, its success depends not only on its internal efficiency but also on its business partners. The philosophy of SCM is about the ability of a company to reach the right product, the right place, the right price, the right time and the right way. Accordingly, it is not sufficient for a firm to have a free flow of information within its organizational boundaries, but also to share the right information with the right business partners at the same time. The success of SCM depends on the validity and speed of the information provided by business partners (Tarn et al., 2002, 28).

SCM always tries to ensure the integration of information. The main idea is to ensure that every member involved in the product flow decides on the basis of the latest and valid information from every member, both downstream and upstream. In SCM inventory is tried to be substituted with information. A firm that manages the supply chain provides the shortest time and the lowest cost of getting the product from the source to the point of consumption (Davenport and Brooks 2004, 9).

Older enterprise systems were not primarily focused on the supply chain. Their primary focus was on conducting and integrating internal applications such as finance, accounting, manufacturing, order entry, human resources. But even in the old days there was a connection with the SCM and inventory management. Many firms that integrate their internal activities intend to move to the supply chain with their existing enterprise system (Davenport and Brooks 2004, 8).

Technologically it is stated that enterprise systems are the backbone of TZY. Both are based on very similar frameworks such as intranet, extranet and electronic data interchange. Many enterprise system vendors are strengthening their products with sales force automation, data warehouse, document management and after-sales service and support extensions. And nowadays the most important trend is integrating with SCM. While institutional systems aim to enhance internal effectiveness by integrating different parts of the organization, SCM focuses on external relationships with commercial partners in the supply chain. In fact, the widespread use of enterprise systems has forced firms to overcome natural boundaries and to provide communication and information flow among supply chain members, which makes integration of the enterprise system and SCM a natural and necessary process in strategic and managerial terms (Tarn et al., 2002, 31).

SCM and enterprise system integration focuses on the management of the information flow, and the provides the management of technology and processes to optimize the goods, services and

information flow from supplier to customer. Organizations that want to take advantage of integration, however, must be confident that their enterprise systems are functioning properly. With an enterprise system that does not function properly, this integration can not do more than create up-and-down problems in Internet speed (Burca et al., 2005, 429).

Table 1 compares the ERP systems with the SCM. While enterprise systems focus on the flow of information and physical distribution to integrate processes within a single enterprise, the SCM focuses on the information, physical distribution and cash flow across the entire supply chain to enable interactions with partners in the supply chain while integrating the internal processes of an organization. While enterprise systems do not consider the constraints outside the firm, the SCM arranges business plans according to the availability constraints to the resources (Tarn et al., 2002, 30).

2.1. Integration Methods

Thanks to software developers, SCM is becoming easier. The development of SCM software was predominantly driven by smaller and more focused software providers such as i2 and Manugistics rathet than large enterprise system providers such as SAP and Oracle, While large enterprise system providers are working on in-house systems that support SCM, it has been left to companies with a certain industry experience to create analytical tools that turn all these good data into strategic analyzes and tactical decisions (Davenport and Brooks 2004, 11).

Many enterprise system vendors are strengthening their products to include sales force automation, data warehouse, document management, after-sales service and support, and, most importantly, integration with SCM (Koh et al., 2006, 457). In order to compete against fast-growing SCM application providers, large enterprise system providers are trying to extend their ERP products to include SCM capabilities. But as the ERP deployment grows, the system becomes more costly than before. For this reason, SCM system applications are added as modular strengtheners to existing enterprise system solutions (Tarn et al 2002, 27-31).

Table 1: Comparison of SCM and ERP Systems

	SCM Systems	**ERP Systems**
Objective	Integrating and optimizing internal business proceses of a single organization as well as the interaction ot the organization with its busines partners accross the entire supply chain	Integrating and optimizing internal business processes within the boundary of a single organization
Focus	Optimizing informaion flowphysical distribution flow and cash flow over the entire supply chain	Optimizing information flow and physical distribution flow within a single organization
Goal	Constraint-based tool providing reasonable and feasible business plans based on the availability of the required key resources	Non-constraint-based tools providing business plans without the consideration of the availability of key resources
Function	Manufacturing management, inventory management, logistics management and supply-chain planning	Manufacturing management, financial management and human resource management.

Source: Tarn, J.M.; D.C. Yen; M. Beaumont (2002). Exploring the rationales for ERP and SCM integration, *Industrial Management & Data Systems*, 102(1), 30.

As expressed by Tarn et al. (2002), there are three methods of combining SCM software and enterprise system packages (Table 2). The first is the *conformity* that requires all members of the supply chain to use the same system. In a wide supply chain, this integration seems to be ineffective. Confidence and security considerations also reduce the success chance of this method. The second method, *middleware*, is very practical but expensive. Programmers need to connect between various systems. The benefits are great, but they must bear the costs. The third method, *special integration software*, is the use of specialized integration technologies and software to expand ERP functionality. Different packages in these technologies have been mapped. The software is pre-programmed to integrate the SCM software with the enterprise system package. At this point, the ERP system will become a business-service framework, a central repository of information and a data-delivery scheme.

Table 2: System Integration Methods

Method	Solution
Conformity	Requiring all of the members of the supply chain to embrace the same system
Middleware	Establishing links between various systems via programming
Special integration software	Extending ERP functionality and allowing ERP and other systems to share processes and data

Source: Tarn, J.M.; D.C. Yen; M. Beaumont (2002). Exploring the rationales for ERP and SCM integration, *Industrial Management & Data Systems*, 102(1), 32.

Davenport and Brooks (2004) point out that there are two alternatives for linking the enterprise systems of companies in the supply chain. One is to establish interfaces between the company's enterprise system and its suppliers. This approach is the *middleware software* in Table 2. The other is to establish a common link between the members of an online industry consortium. Both approaches have complexities and are followed by two approaches since they are as complex as many of the company's competitors. Many industry consortia, previously organized as online e-marketplaces, are increasingly becoming centers of connection to enterprise systems.

If it is thought that it will take time for enterprise systems to be linked in a widespread way, firms may go for a third solution: Web services. Web services do not solve the problems of integration of the specified information and processes, but provide common and more flexible applications for the connection. Almost all major software companies have announced that they support this technology and expect to be the standard for future linkages of firms, although they are currently being used by a small percentage of firms (Davenport and Brooks 2004, 16-17).

Another major trend for the integration of enterprise systems and SCM applications is outsourcing. Companies that think the enterprise system will not provide competitive advantage or that it is very difficult to successfully carry out this integration is using outsourcing in their enterprise systems, including the supply chain function (Davenport and Brooks 2004, 16-18).

2.2. Integratıon Challenges

There is no generally accepted and widely used technological structure and application standard in supply chains. Which alternative to choose among XML, middleware, internet, e-marketplaces, and how to make connections between the companies creates difficulties in integration (Tassabehji et al., 2007, 425). In the past, companies that wanted to align their activities would use electronic data interchange (EDI) with specific transactions and information exchanges with their industry. Many companies now communicate directly with their enterprise systems using extensible markup language (XML) over the Internet. But in either EDI or XML, companies must determine how to align their information and business processes with their trading partners, both individually and as an industry group. Neither ERP, XML nor the Internet has made these agreements easier. Even if the two firms have the same enterprise system package, they may have structured their knowledge and processes in many different ways (Davenport and Brooks 2004, 15).

Another difficulty is that companies are persuaded to exchange information. If one of the supply chain partners tries to impose their own optimal policy on another partner, the total cost of the system will be much higher than a coordinated ordering / handling policy. The great cost benefit potential of policy coordination motivates partners to share information that is believed to be confidential (Kelle and Akbulut 2005, 49).

2.3. The Future of SCM and Enterprise Systems

Enterprise system providers have been forced to re-evaluate their own models because of the trend towards e-commerce and SCM between firms. They also have been forced to switch to more flexible systems to meet the need to adapt to changing business cultures. It is thought that the future of enterprise systems will promote supply chain development and promote inter-organizational cooperation. Enterprise systems, which are the set of integrated applications that link back office operations such as manufacturing, finance and distribution, will become a subclass of a larger and broader enterprise business system. Enterprise systems will expand to cover transportation, warehousing, sales force automation, and even engineering through computer aided design and

product data management systems. Trend shows that enterprise systems will continue to exist by adding modular updates to their existing systems and spreading them across small and medium-sized markets. Therefore, integration of enterprise systems with supply chain capabilities is expected to continue strengthening in the near future. (Tarn et al., 2002, 31-33).

3. SUPPLY CHAIN RESOURCE PLANNING

Up tu here enterprise systems (ERP), SCM and their integration, as well as information sharing between internal processes and companies in the supply chain were talked over. On the basis of the enterprise system, the exchange of information between the external system software and the companies in the supply chain takes place instantaneously with the additions made to enterprise systems. According to Kehoe and Boughton (2001) supply chain integration is not based on enterprise system in the concept of supply chain resources planning.

The rapid development of e-commerce in the internet applications of the internet technologies requires a new approach by which all partners in the supply chain can dynamically monitor and manage demand and capacity data in decision systems. The potential for supply chain integration is tremendous, as there are opportunities for a simultaneous decrease in total stock level with an increase in customer service level. It is difficult, if not impossible, to use traditional planning and control approaches to compete against supply chains. To date, many studies suggest that shortening the total cycle time and reducing total cost of inventory will be achieved by optimizing the total supply chain rather than optimizing firms individually. Key business benefits will be derived from supply chain resource planning (Kehoe and Boughton 2001, 519).

The prominence of SCM has been increasing in recent years, the role of planning and control systems in this area is great. Planning and control systems not only coordinate the activities of a firm, but also have an impact on the entire supply chain. It is important to develop a collaborative approach between these areas. In addition, different designs and approaches can be explored by using the developed internet based technologies and the concept of supply chain resource planning (SRP) can be found (Kehoe and Boughton 2001, 517).

In Figure 1-a, planning and control systems are classified, whereas in Figure 1-b, inventory management systems are classified. From this classification it is clear that the SRP will evolve from the BSC / LRP approach rather than the traditional MRP-ERP. SIC and MRP focus on inventory management at a single institutional level. More integrated supply chain approaches to BSC and LRP are (Kehoe and Boughton 2001, 518-519):

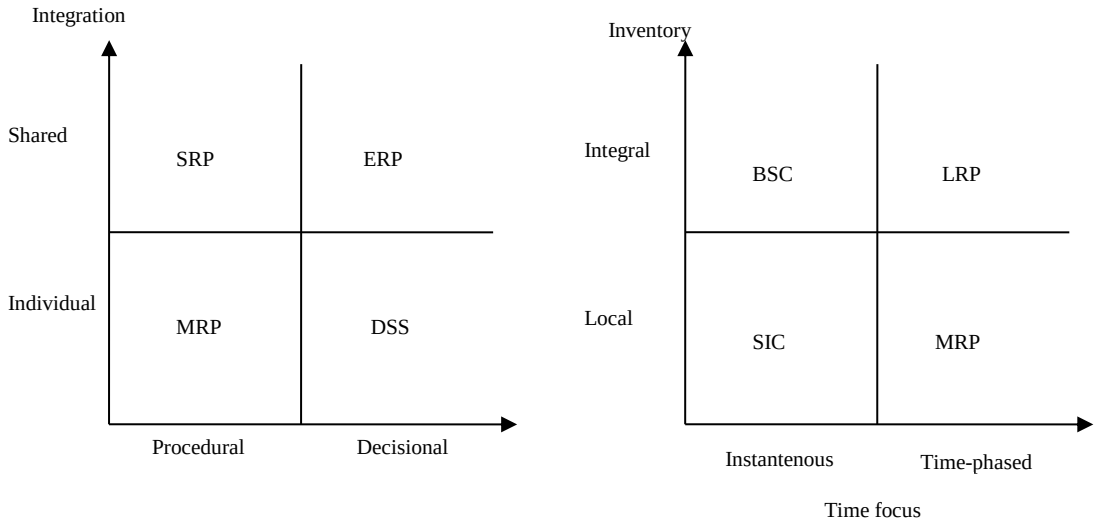

Figure 1:a) Planning and Control System and b) Inventory Management System Classification
SRP: Supply-chain Resource Planning
ERP: Enterprise Resource Planning
MRP: Material Requirements Planning

DSS: Decision Support System
BSC: Base Stock Control
LRP: Line Requirements Planning
SIC: Statistical Inventory Control

Source: Kehoe, D.; N. Boughton (2001). Internet based supply chain management: A classification of approaches to manufacturing planning and control, *International Journal of Operations & Production Management*, 21(4), 518-519.

- BSC systems operate at every stock point in the supply chain, largely based on actual customer demand from the next point in the chain. While managing a local stock level, BSC systems manage the integrated stock level of a stockpile.
- LRP systems also use integrated stock but use time-lag stock levels as in MRP systems. Unlike MRP, LRP moves not only according to expected requirements, but also on stock level information in downward and upward stockpiles.

Burada kastedilen SRP, tedarik zinciri boyunca talep ve stok verisi gereksinimlerinin internet teknolojileriyle karşılandığı entegre stok yönetimi sistemlerinin ortaklaşa bir tanımıdır. SRP yaklaşımının yararlarını tam olarak elde edebilmek için tedarik zincirinin gereksinimlerini planlama ve kontrol sistemleri sınıflandırmasına göre düzenlemek gerekir (Kehoe ve Boughton 2001, 519-520). Tablo 3'te SRP yaklaşımı ile geleneksel ERP yaklaşımının karşılaştırılması görülmektedir.

SRP is a collective definition of integrated inventory management systems where demand and inventory data requirements throughout the supply chain are met by Internet technologies. In order to fully realize the benefits of the SRP approach, the requirements of the supply chain need to be laid out according to the classification of planning and control systems (Kehoe and Boughton 2001, 519-520). Table 3 shows the comparison of the SRP approach with the traditional ERP approach.

Table 3: Comparison of ERP and SRP

Comparative Feature	**ERP approach**	**SRP approach**
Planning methodology	MRP	BSC/LRP
Data management	Data warehouse	Data retailer
Organizational basis	Enterprise based	Supply chain based
Business focus	Multi-site	Multi-business
Technology base	SQL	HTTP/XML

Source: Kehoe, D.; N. Boughton (2001). Internet based supply chain management: A classification of approaches to manufacturing planning and control, *International Journal of Operations & Production Management*, 21(4), 522.

CONCLUSION

Nowadays, the competition is betwen supply chains, not the companies. Although a company has built up its corporate system well, integrated its internal processes, continues its operations efficiently and provides effective information flow, when it becomes part of a supply chain, its success depends not only on itself but also on its partners in the supply chain.

Enterprise systems enable companies to integrate their processes and instantly get the information they need. But with the changing conditions of competition this has remained inadequate. It is also necessary to have instant access to suppliers' and customers' information. This can be accomplished by integrating enterprise systems with SCM. To achieve this integration, all supply chain members have a variety of methods, such as using the same system, linking between different systems, middleware, web services, or outsourcing. However, it is not easy to provide integration between SCM and enterprise systems. because of partners to avoid information sharing and integration problems between different enterprise systems.

Institutional systems are the backbone of the flow of information between partners in the supply chain. A concept called supply chain resource planning, however, advocates the necessity of instant information flow between partners in the supply chain, suggesting that this system is not based on enterprise systems comprising inventory control system of material requirements planning, and based on that basic inventory control and line requirements planning.

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