

ERP SYSTEMS AND WAREHOUSE MANAGEMENT BY WMS

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This article presents differences between Enterprise Resource Planning Systems and Warehouse Management Systems. Management of warehouse processes and hardware requires specialized functionality, not present in ERP, functionality that only WMS can provide. Using separate systems enforces their integration. Different approaches to integration and risks connected to implementation are discussed and summarized.

Keywords: WMS, ERP, logistics, warehouse

1. Introduction

Logistics is one of those sectors which couldn't effectively function without information technology support. The aim of the paper is analysis of integration issues among WMS and ERP systems in terms of costs and technology. Growing importance of competition in logistics market and continuous pressure on raising enterprises operations efficiency results in searching for new solutions and technologies, and increases importance of modern IT systems. The problem appears with choosing the right kind of solution that provides required level of efficiency for a reasonable costs. The necessity of choosing proper solutions is apparent on every stage of informatics investment. Implementing of such systems enables to improve enterprise financial condition, improve efficiency of functioning simultaneously in various areas, enables acquire full control over enterprise, and promises perspective of undisturbed development. By undertaking

implementation of integrated information system the company gets unique opportunity to make significant organizational changes. These operations may result in raising efficiency not only everyday work organization, but magnitude of results depends on scale and range of changes [1].

2. Enterprise Resource Planning systems

Enterprise Resource Planning (ERP) system is a package used for planning enterprise resources, composed of integrated modules which manage all of the core business processes of the organization. Main objective of the system is to seamlessly incorporate business processes within and across the functional and technical boundaries in the organization with improved workflow, standardization of business practice and access to up-to-date real time information. The basis of the ERP system is database layer, DBMS common for all the modules, that manages the operational and business data throughout the whole enterprise. The core functionalities include logistics management, manufacturing, sales and distribution, financial management, controlling, human resource management, project management, inventory management, service and maintenance, and management reporting.

ERP systems are very flexible and tailorabile, allowing easily adaptation to specific requirements of different organizations because business functionalities are designed as independent components, which can function separately. Privileges system allows to define user access for individual employees only to resources that are related to their job's responsibilities.

Basic functional modules of ERP system including logistics management consist of:

- Sales and Distribution – part of large logistics area , supports customer relationship from offer through the purchase order up to invoice. This module is closely integrated with inventory management and production planning.
- Materials Management – this module is responsible for the coordination of planning, sourcing, purchasing, moving, storing and controlling materials
- Production Planning - manages the lifecycle of product manufacturing process according to customer requirements
- Quality Management – module manages planning and controlling product quality, collects quality data of raw materials, manufactured goods and finished products.
- Plant Maintenance module for managing inspections, determining current technical condition of equipment, preventive maintenance and keeping technical equipment in perfect condition [2].

3. Main areas of risk by implementing ERP system

Every company which plans to implement ERP system have to take into consideration specific risk level. The number of analysed risk areas should be restricted to areas that have main impact on results of the implementation.

First is risk of not launching ERP system at all. This area describes a situation when as a result of different external reasons on side of IT system provider implementation was cancelled or not completed with a fully operational and commissioned deployment. Essentials of this risk area are expenses paid by the company for implementation ERP system. This cost should include not only initial offer cost but also expenses on engaging company employees in the implementation, or purchasing of servers and other IT hardware.

Another risk area connected with implementing ERP system in company is budget overrun. It is most common arising implementation risk, regardless of the class of integrated IT system. It is very hard to avoid this course of events. In a situation when a project is highly advanced the management rarely decides not to allocate additional resource for full system implementation. That's why IT systems providers often underestimate implementation costs in theirs offer or omit important expensive elements of the system, like future users' training or project administration, counting on adjudicate additional funding after process of IT system implementation will start.

Next area of risk in implementing an ERP class system is situation when company doesn't achieve planned benefits from implementing ERP system. During making decision of implementing an ERP system, main and decisive factor is range of benefits for the company from an implementation of ERP system, That why this risk area should be considered as the most important amongst different risk areas. Probability of reaching planned business goals depends on functional sophistication advance of the system, which manifests inability to meet business requirements.

The last area of risk associated with implementing ERP informational system is delay In implementation. This risk area resembles risk of no achieving planned benefits from implementation of ERP system. It refers to situation when system ERP was fully implemented, assumed business profits was achieved, but with a considerable delay e.g. 3-6 months. Factors which influence this risk area are quality of project management in implementing company.[3].

4. WMS System

Warehouse Management System (WMS) is an informational system dedicated to manage entire high-volume warehouse operation in a real-time mode. These systems are made to optimize supervision on handling and storage of products.

Nowadays it is hard to imagine an efficient realization of logistics processes without IT tools that support them. The WMS program makes possible to quick receipt and pick up goods at the warehouse, defines an external supplier or specifies interior origin. It controls goods in terms of quality and quantity and automatically chooses storing location. The system specifies the shipping zone for orders marked for delivery, and analyses orders.

The consequences of using these system functions are increase in company turnover. Using such software makes possible to optimize tasks and realization of operations according to established priorities. As a result of implementing WMS system enterprise is supported in scopes of organization, supervision and control of processes related to movement and storage of goods and materials.

WMS have a number of specific features that accurately describe their behaviour. There will be

- optimization of storage space usage
- reduction of time for ordering and delivery of goods
- increasing of stock and assets turnover
- improving quality of services provided by manufacturers
- reduction amount of possible errors, due to advanced control and quick problems resolution between manufacturers and merchants
- high flexibility and mobility in exchanging data with the system
- easier data access
- full control of orders
- management of warehouse traffic
- assistance in preparation of dispatch documentation and automation of dispatch process
- automation of inventory process [4].

5. Differences between ERP Warehouse module versus Best-of-Breed WMS

Both large and medium size manufacturing and distribution companies are aware of the fact that functioning without WMS system is difficult in competitive market. As far as ERP systems become standard in enterprise management, WMS system also becoming more important.

Understanding the difference between WMS and ERP is very important for functioning of entire enterprise. Storage is last step during realization of customer's order and determines the level of satisfaction from collaboration with product supplier.

WMS are system specialized to support realization of warehouse processes and warehouse management. They possess advanced functionalities, but also have high cost and long implementation time. Respondents who marked using of this

kind of solution were asked what was lacking in EPR warehouse modules implemented in theirs' companies, that they decided to invest in separate WMS system. First they paid attention to greater flexibility of the WMS systems, possibility to dynamically manage pick locations and more efficient work with radio terminals. Surprisingly opinions of IT professionals and logistics have been different. Logistics most frequently pointed out more flexibility and dynamism of WMS systems, while the IT specialists opinions were more diverged and 40% had problem with answering this question and choose "hard to say" option.[5].

DISADVANTAGES OF ERP WAREHOUSE MODULE COMPARING TO WMS

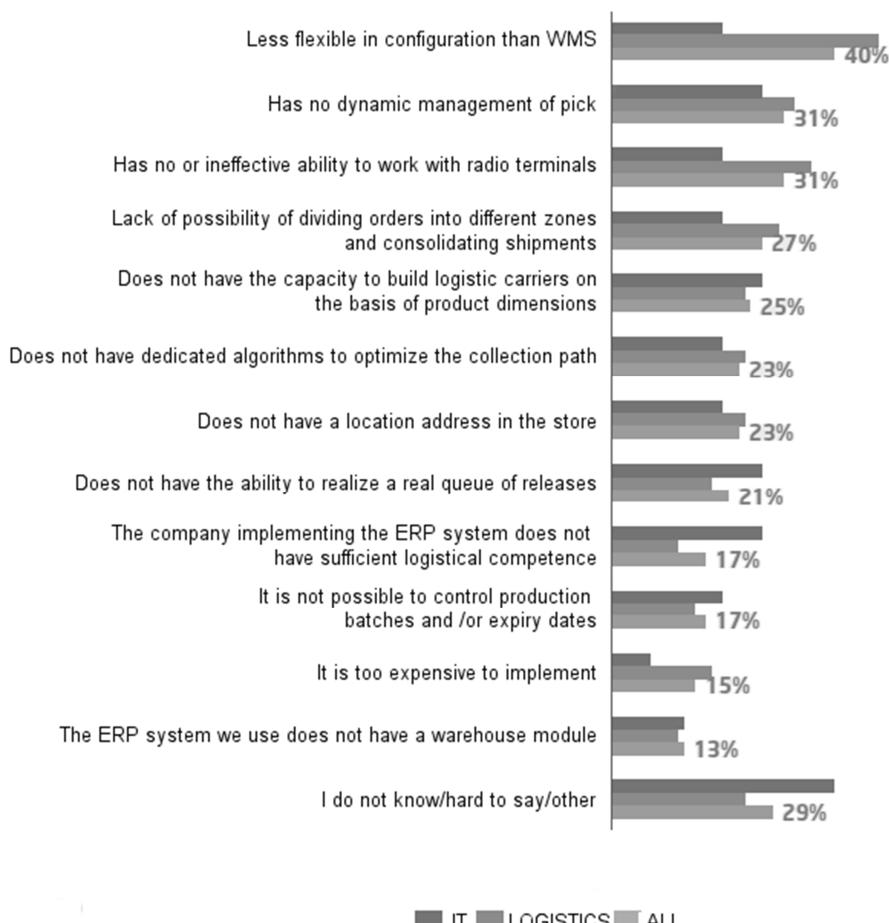


Figure1. ERP warehouse module comparing to WMS
Source: Systemy informatyczne w polskich magazynach, Raport 2014

WMS during receiving goods uses advanced algorithms to optimize the place, time, and way to depositing goods, which is not supported by ERP. Logistics processes are accomplished by creating task queues that include various interleaving operations, minimizing the empty cycles of forklift trucks. ERP systems doesn't work on queues, only on documents, which doesn't contribute to increasing efficiency of work. [6][9].

Table 1. Use cases of ERP and WMS

WMS	<ul style="list-style-type: none"> • if the company offers value-added services, such as kitting and assembly. It will need a specialized module for tracking this kind of work. • if the company clients are demanding greater visibility into inventory levels. Web portals that allow clients to view their inventory levels using a standard browser are still the province of best-of-breed solutions.
ERP	<ul style="list-style-type: none"> • If you need to improve reporting and accounting along with warehousing operations. ERP suites offer an enterprise-wide perspective on warehousing and supply chain operations.

Source: own preparation based on <https://www.softwareadvice.com/resources/wms-scm-erp-which-is-best-for-3pls/>

6. WMS and ERP integration

Warehouse management does not exist in isolation. WMS often include integration with hardware: barcode scanners, printers, labelling systems with external shipping companies or integration with an internal ERP software.

Many warehouse operations, especially those with high-volume pick, pack and ship requirements, include sophisticated automatic material handling equipment which include conveyors, sorters, carousels, A-frame picking systems, pick-to-light systems. Most WMS solution offers extensive integrating with these devices.

Most manufactures have a need for integrated item information, customer orders, inventory, shipment and visibility of incoming product. The degree to which integration is necessary will vary depending on business needs. Integration with ERP implies that most software programs use a common database and most information is updated in real time. While there are many examples of ERP and WMS software systems that are truly integrated, most third-party WMS products are interfaced instead. Interfaced usually means the ERP system and WMS run on separate databases, and perhaps on separate servers. In this case, duplication of a

certain amount of business data is unavoidable, as well as additional implementation costs. Interfaces are usually accomplished with batch export and import programs that physically transfer data between systems, or a middleware product designed for this purpose. Even if these programs are included with the WMS or ERP package, during implementation may occur interface complexities and the need for custom interface development or interface issues that negatively impact the business.



Figure 2. The industrial barcode scanner.

Source: <http://www.barcodedatalink.com/pages/warehouse.php>

Making decision about purchasing separate WMS and ERP systems, different integration scenarios were considered. Purchase the WMS package offered by ERP vendor that was originally acquired from a third-party vendor and is now offered as an optional bolt-on to the ERP package. This is a very common situation since, over the years, many ERP vendors have rushed to provide a WMS solution to fill this void. In order to make the WMS more compelling to potential customers, it is likely the new vendor spent plenty of time integrating or interfacing the system with its own ERP.

Purchase a best-of-breed WMS from a third-party vendor. Because it needs higher-end software capabilities, this may be the only valid option for many companies. However, the software will likely cost more to purchase and definitely

involves more custom interface expense. Also, using a middleware product to link the systems together will likely be a separate purchase [7].

Risk area connected with failed integration means that there will be significant amount of manual processing needed to keep data synchronized. So the easiness of integration, time and costs to integrate should be taken into consideration when choosing the WMS system

7. Using applications programming interfaces for integration

ERP and WMS manufactures are aware of the fact that their systems will be connected with other software. They offer different methods to extract and update data, including low-level programming languages in their software packages, providing Application Programming Interfaces (APIs), and documentation for database schemas. The most popular high level communication method is SOAP based web service.

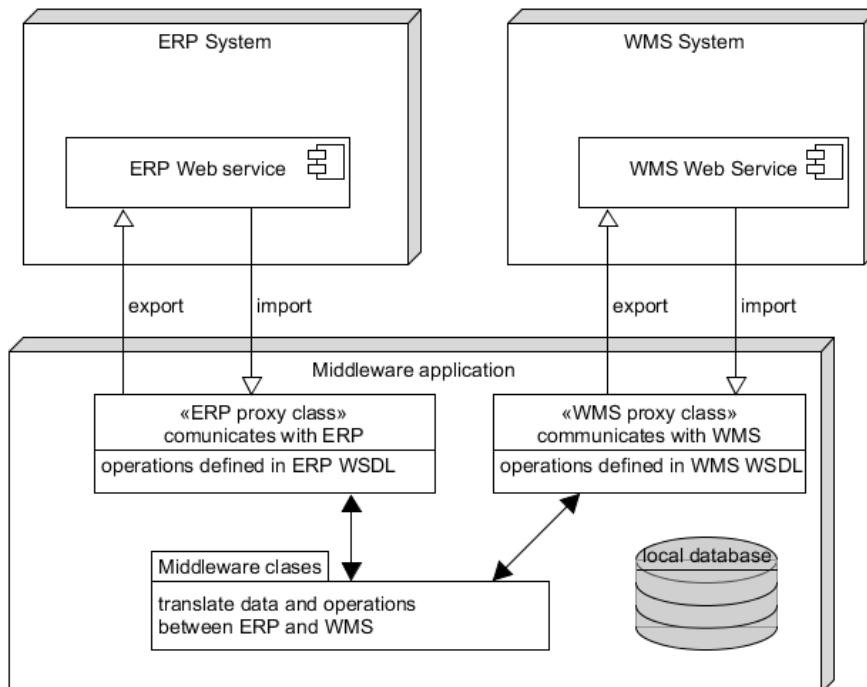


Figure 3. UML diagram of basic middleware application

Web services use standardized XML messaging system to receive or send requests over the internet. Web services are platform independent, they are using standard protocols, can be implemented in any programming language. Definitions of specified service are published using WSDL (Web Services Description Language), an XML file which exposes service interface, interaction patterns and protocol mapping. WSDL can be easily interpreted by other applications, but it is hard to read by humans.

```
<operation name="add">
    <input name="addRequest" message="tns:addRequest" />
    <output name="addResponse" message="tns:addResponse" />
    <fault name="InsufficientPermissionFault"
message="tns:InsufficientPermissionFault" />
    <fault name="InvalidSessionFault"
message="tns:InvalidSessionFault" />
    <fault name="InvalidCredentialsFault"
message="tns:InvalidCredentialsFault" />
    <fault name="ExceededConcurrentRequestLimitFault"
message="tns:ExceededConcurrentRequestLimitFault" />
    <fault name="ExceededRequestLimitFault"
message="tns:ExceededRequestLimitFault" />
    <fault name="ExceededUsageLimitFault"
message="tns:ExceededUsageLimitFault" />
    <fault name="ExceededRecordCountFault"
message="tns:ExceededRecordCountFault" />
    <fault name="ExceededRequestSizeFault"
message="tns:ExceededRequestSizeFault" />
    <fault name="UnexpectedErrorFault"
message="tns:UnexpectedErrorFault" />
</operation>
```

Extract from SuiteTalk WSDL, defining web service for Oracle NetSuite

Source: https://webservices.netsuite.com/wsdl/v2017_1_0/netsuite.wsdl

That's why many programming platforms offers assistants, which can read WSDL file and create ready to use methods and classes. For instance Microsoft Visual studio enables adding "Web Reference" to project, automatically creates classes and methods using definitions from WSDL file.

Middleware applications use these automatically created classes to translate data received from one system to format required by other system, using predefined values for missing data where complexity of ERP system far exceeds range of information received from WMS system. Calling web service methods may fail, as a result of mismatched parameters, or unpredictable network problem, so all operation should be logged in local database.

8. Summary

WMS systems have considerably changed with regard to technology as well as amount of supported warehouse processes. For many years between the users of this systems classical approach prevailed – application should support typical processes for instance magazine's registers. During the years users' requirements grew. Companies wanted support in loading, picking, releasing, scanning, labelling and monitoring workers activities. Today we have to deal with situation when system have to be closely adjusted to clients requirements. Often it has to cooperate with industrial automation systems, because companies tend to fully automate their warehouses. Also grows importance of integration with data warehouses, carrier attendance applications, communications with subcontractors and stock management. More frequently WMS is becoming a part of the ERP system. Today integration of WMS solutions with advanced IT systems is relatively simple. ERP and WMS systems are becoming more flexible. Task that were impossible or very difficult few years ago, for instance implementing advanced ERP system in small company became common practice. At development of WMS system great influence has had mobile revolution, thank to which systems became easier to use – colourful application enables work with touch screen. Electronic information exchange in supply chain, mobile data update, integration with transport and warehouse automation have become standards.

The role of WMS also changes, it has to not only support warehouse management but also enable to create more intelligent forms of management. From this point of view WMS has to support more and more processes, it's duties include scheduling tasks, allocating resources, managing transport automation and optimizing storage space. Today the role of the system is full automation of magazine's work, including adaptation to external conditions. More important is mathematical support, for instance by using optimization algorithms. Of course, we have to remember that ERP never can replace WMS, just like ERP will not replace ERP system. There are two different solutions. ERP supports a number of business processes, including supply chain. WMS only manages the warehouse. They supplement each other, and their integration brings the enterprise most profit [8].

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