Facets in Warehouse Management Systems (WMS) Implementations in Logistics and Supply Chain

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ABSTRACT
Logistics and Supply Chain become very vital to any business that has the nature of the business complexity and dynamically ever-changing customer requirements. Since organizations have realized that in the last decade or so, there are investing in their IT systems to bring the complexity into simplicity in managing their business processes. Being Warehouse Management Systems (WMS) is one of the key Logistics and Supply Chain IT systems, it helps the businesses greatly in managing the inventory and providing supply chain visibility to all the business partners in the Supply chain. This research article explains the key facets in implementing the WMS in Logistics and Supply Chain industry in an attempt to leverage this expertise to this industry. This article also details the latest developments in the WMS Implementation arena and how this WMS is helping their Logistics and Supply Chain businesses by conducting a case study in a leading 3PL provider.

Keywords
Logistics, Supply Chain, Warehouse Management System, WMS, Systems Integration

1. INTRODUCTION
Supply Chain is a concept at an enterprise level to manage all the business entities in a single framework to provide better visibility of any business function to any stake holder at any time. There are many business functions or processes within the Supply Chain and it is the business or organizational decision to determine in choosing the modules or functions that need to be on the Supply Chain as it provides the greater flexibility. And, there are leaders now in the market in the IT applications in providing the seamless sservice to their customers on their Supply Chain portfolio.

Logistics is the business of making the product flow from Origin to the Destination. This business does primarily perform managing the Inbound and Outbound transportation, Warehousing, Materials management, Inventory management, Supply and Demand planning and Value Added Services as necessary.

Fig 1. A Supply Chain

2. LITERATURE REVIEW
Warehouse Management System (WMS) is a computer application system developed to manage the inventory at the Distribution Center and fulfill the customer requirements better, faster and cheaper thus providing the Operational benefits and better customer service. WMS can be categorized such as Tier-1, 2 and 3 depends upon the capabilities of the product and Implementing the right WMS would offer greater benefits to this business. Marzenna Cichosz emphasizes the criticality of having the IT solution implemented in the Logistics industry [1].

WMS benefits the Logistics business in many different ways and some of the key are; Reducing Operating Expenses, Increasing Inventory Visibility, Increased Security and importantly Increased Customer service and the business partners' relationship. Helo, P., & Szekely iterates the benefits that the Supply Chain industry could yield with the help of the Supply Chain systems [2].

And, when a business model involves managing multiple parts or items, different locations and a number of business partners, the role of WMS in the Logistics business becomes very vital due to the nature of the business complexity and to manage the customers' expectations. As per WEF [3], the Digitalization helps the industry to alleviate a majority of them if not all. Ramaa.A et all [4] details the impact of the IT systems in the Supply Chain industry in a very detailer manner.

When it comes to WMS implementations, there are many facets to it starting from standalone implementation, integration and configuration etc and some of the key facets are attempted to be detailed out in this article.

3. A METHODICAL APPROACH IN WMS IMPLEMENTATION
Based on the real-time experiences on the WMS

implementation area, it is highly recommended to use the waterfall methodology as shown below. Each phase has its own activities and dependencies on others which should be completed as expected and also to be monitored very closely.

Fig 2. Phases in WMS Implementations

The activities that are being performed on each of the phase are listed out below and managing these activities closely by all the stakeholders ensures the successful WMS implementations.

1. Initiate:
   - To kick off the project
   - To identify the stakeholders
   - Contract sign off and project plan established
2. Plan:
   - Understanding the customer / business requirements
   - Designing the Warehouse processes & flows
   - Designing the IT solutions (WMS, EDI, Reporting, Billing etc)
3. Execute:
   - Configuration of IT WMS solutions
   - Development of EDI interfaces, Reporting, customer compliance requirements if any
   - Unit testing, Customer testing, Operations testing and Production Smoke testing
   - Migration of WMS and other IT solutions into Production system
4. Monitor:
   - Ensuring that the Production system is performing as expected
   - Fixing the production issues if any and engage the support group at go-live period
5. Hand-Off:
   - Preparing the project documentation and handing this off to the support group
   - Train the support group on the IT WMS solutions and processes
6. Close:
   - Close the project and Dissolve the project team

4. APPLICATION OF EXTERNAL PARCEL SOLUTIONS IN WMS IMPELMENTATIONS

As we know, the Logistics & Supply Chain systems help businesses by providing the visibility of the supply chain and manage the inventory accurately. And, Warehouse Management Systems (WMS) is one of the Logistics systems that processes the TL/LTL (Truck Load / Less Than Truck Load) and Parcel shipments per customer requirements for the effective delivery of goods to the customers.

The TL / LTL shipments are tracked at the shipment level where as the Parcel shipments are tracked at the package level. The TL / LTL shipments are mostly delivered to the stores where as the Parcel shipment are mostly delivered to the end customers.

While some of the Warehouse Management systems are capable of handling the Parcel solutions within the Logistics systems, some of the others provide the External Parcel Integrated solutions to manage the Parcel shipping seamless and very cost effective. This provides the Parcel service providers to work with different Parcel carriers to get the real time rate shopping thus providing better customer experience and greater cost savings.

The objective of this is to understand the impact of having the external Parcel solution implemented and integrated with WMS. And, it is based on implementing the Tier-1 WMS solutions with the Tier-1 external parcel solutions implemented thru a third party vendor.

When a Third party logistics service provider is inclined towards having the External parcel solutions implemented, there are many factors / areas to be considered and evaluated for integrating it with the Warehouse Management System and some of the key factors are detailed out below to make a better and informed decision for successful WMS implementation.

i) Response Time
   - The response time of the external Parcel manifesting system for all the Parcel transactions are vital and should be validated against the product benchmark studies and results. And, this also should be based on the current system resources and capacity.
   - The integration requirements and validation of WMS with the external parcel system should be acceptable to the business requirements.
   - The transactions volume testing should also be conducted between these two systems based on the business volume and profile.

ii) Product Expertise
   - In the scenario of Parcel in-built WMS solution, the WMS resources are able to handle the Parcel configuration, certification and testing with no involvement from the external resources as opposed to work very closely and simultaneously with the external parcel service providers for the other for the successful implementation.
   - Since, the external parcel service is managed by a third party software provider, the WMS implementation resources are not required to have any expertise on the parcel product and this greatly reduces the implementation cost and the timeline.

iii) Dependability
   - Since this External Parcel solutions is provided by a third party solution provider, it creates high dependability for the customer on the parcel service provider for any solution design, implementation and support.
   - And, eventually this will impact the customer experience and should be evaluated appropriately.
   - Any design change to the Parcel system might have direct impact on

WMS solution.

iv) Flexibility

- The external parcel system might provide more flexibility than the in-built solution in case the business needs to switch from one carrier to another and also one parcel service to another.
- When a WMS solution is built for the external parcel, it has the impact on the other ancillary services for the initial implementations such as EDI (Electronic Data Interchange), Reporting etc and this might potentially costs the company additional effort on the development and testing cycle.

v) Implementation Lead Time

- Since the external parcel system is managed by a third party provider who gets certified with the parcel carriers, the Logistics and Supply chain service provider is not required to do any certification for any services with the Parcel carriers. The responsibility of having these certifications reside with the external Parcel solution providers.
- This is very likely to reduce the WMS implementation efforts as it eliminates the WMS configuration related to Parcel carriers and Parcel certification heavily too in the project.

vi) Customer Service

- The external parcel system provides great benefits in working with the various parcel carriers real time and provide the best rate shopping experience for the customers thus eventually provides better cost savings.

The external parcel solution might appear to provide greater benefits in WMS implementations but a thorough study should still be conducted by the Logistics service provider to choose the right product for their business and customer requirements.

5. EDI INTEGRATION ON WMS IMPLEMENTATIONS

As we have discussed earlier, Warehouse Management System (WMS) is a computer application which is used to manage the customer inventory as per business and customer requirements. And, the successful integration of WMS with the Customer Host system or any other external systems has become very crucial for the Logistics and Supply Chain Providers to gain competitive advantage.

Fig 3. Systems Integration

EDI integration is helping organizations to integrate the customer Host systems and/or any other external system with the WMS applications as needed for the seamless and real time data communication between them. But, there are some key factors that are contributing to the successful EDI integration on the WMS implementations and they are listed below;

1. Maintaining the EDI standards –
   - There are standards in EDI in specific to an EDI format and version that both the parties should agree to use. X12 version 4010 is one of the commonly used format and version used in the industry and predominantly used in this organization too as part of the standardization being used in the EDI.

2. Ability to exchange the necessary/required data –
   - Both the parties, the Customer and the Logistics service provider, should be able to use some latest technologies to cope-up with the very dynamic market condition and behavior.
   - Mode of communication such as AS2, FTP etc should be agreed upon based on the system capacity / capability on both sides.

3. Business Partners and their Service levels –
   - Identifying all the business partners involved for the electronic data exchange.
   - Determining the frequency and timings of the data exchange amongst all the partners.

4. System performance –
   - The EDI system should be capable of handling the volume and performance that is expected for the business.
   - System should be able to support the business with no or very minimal interruption.

5. System Expertise (EDI, WMS etc at different levels) -
   - It is very crucial to have the right expertise at all levels while designing and developing these interfaces, not only from EDI perspective but also from WMS / Host system and business perspective.

6. Commitment from all the Stakeholders –
   - A strong commitment from all the stakeholders involved in the business is needed for the successful system implementation.
   - Transparency is key for all the Stakeholders to understand the deliverables and make a better decision for the business.

7. Monitor for pro-active measures –
   - EDI monitor to report the EDI failures at the Integration systems, primarily reporting the non-EDI compliance.
   - WMS monitor to report the EDI failures at the WMS applications, primarily reporting the master data issues.

8. End to End testing (with end customers) –
   - While it is important to test all the

communication and interfaces with the customer for all the possible and exceptional scenarios and it is also very important to do the same with the end customer (customer's customer) to ensure the successful end-to-end loop.

- Multiple rounds of testing such as Interface Unit testing, System Integrated testing, Volume testing and Production Smoke testing are helping to bring the integration a huge success.

9. Impact of EDI on other ancillary systems / applications (Reporting, Billing etc) –
    - It is crucial to design and develop the EDI integration to meet the requirements from other ancillary applications such as Reporting, Dashboard and Billing etc.

6. A CASE STUDY ON RECENT DEVELOPMENTS IN WMS IMPLEMENTATIONS

A case study has been conducted in a leading third party logistics and supply chain provider to understand the latest and greatest developments in WMS implementations. And, as per this provider, a specific warehousing and distribution facility has been selected for this research as this facility is a Million Sq.Ft facility serving one of their leading Technology Companies with Tier-1 WMS being implemented with heavy automation and the WMS is integrated with multiple external systems such as Enterprise Resource Planning (ERP) System, Transportation Management System (TMS) and Labor Management System (LMS).

These results are based on the real-time project experiences and learnings, documentations and interviews with various operational leads at the specific site chosen for this research. This facility is serving domestic and international customers, primarily eCom business about 85% and 15% for domestic retailers.

Integration Technology

- This facility is using the latest integration technology API (Application Programming Interface) where WMS is integrated with the external system; Customer Host system for seamless communication.
- Based on the analysis, it is found that there is an improvement of 32% in response in EDI volume transactions compared to the previous legacy Integration technology.

Rolling out the Template

- Building the industry specific template benefits the business for faster implementation cycles. And, the necessary features will be added as add-ons to the template.
- This facility had implemented the WMS template that was built for the technology sector and this has reduced the implementation period by 41% compared against the same size deployment that did not have the WMS template. All other sizing factors remain the same between those two implementations.

Voice Picking

- Voice directed picking is seen as a greatest implementation growth in the current and future state at this provider.
- This company at this facility is seen 35% improvements in speed and accuracy in picking after the Voice picking has been implemented.

Flexibility

- This facility has implemented the model called ANY. It means this facility can have WMS run on Any device, Any platform and Any location. This concept helps this business to operate in a much more flexible manner to be able to use any smart device which can run on any platform and the user can work anywhere in the world with no interruption.

External Parcel System

- This tier-1 WMS has the functionality to manifest the Parcel shipments within the WMS as the WMS product has the necessary functionality. But, based on the past experiences, in particular to the eCom business environment, the 3PL has integrated the WMS with an External Tier-1 third party parcel manifesting system for processing all parcel shipments.
- This has helped the company to completely eliminate the necessary parcel certification process with the necessary parcel carriers and comply with their requirements.
- After this deployment, the facility has seen 27% improvements in speed in communication with the Parcel carriers and exchanging the data between them.

Cloud technology

- This 3PL provider has been implementing WMS with on-premise IT infrastructures but wanted to move to Cloud for different reasons such as Cost savings, easy maintenance with no downtime.
- A leading Cloud technology provider has been providing the service for this logistics facility and the provider has started seeing cost savings about 12% per annum with no downtime.

7. CONCLUSION

It is evident from this research that there are many facets in WMS implementations and some of the key such as; Methodical approach, External parcel system and EDI integration in WMS implementation are detailed out in this article with its features and benefits. This would help the logistics and supply chain providers to understand them and evaluate them for their future implementations. Also, the results of a case study conducted in a leading 3PL have been published. It is no surprise that WMS offers great benefits to the business based on this study. Despite of having many technologies, methodologies and products evolve every day in the industry, it is necessary for the service provider to evaluate them and implement the right one for their business to gain the competitive advantage in the market.

This research has been focused on the some of the key facets in WMS implementations and also conducted a case study in a facility that has Tier-1 WMS, heavy automation and multiple systems integration. This research can be extended to some of the other facets in WMS implementations and also extending this to multi-site research, multi-tier WMS solutions and with its different combinations to understand the impact of WMS implementations on the business.

8. REFERENCES

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