

Creating Information Visibility in the Habitat for Humanity Supply Chain

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Abstract

Purpose – The purpose of this study is to begin to define the information technology requirements of an IT system/database for Habitat for Humanity’s supply chain challenges in the areas of planning, sourcing, and delivery of materials to build a home.

Methodology – The methodologies employed in this work are: (1) a comparative assessment of commercial off-the-shelf information technology systems in the supply chain domain, (2) telephone inquiries with Habitat Construction Managers, and (3) an online survey regarding user requirements for supply chain visibility.

Findings – The results identify the most critical features required in the near-term for an information technology system to support Habitat’s supply chain activities. This work provides members of non-profit, house-building businesses with a reference for analyzing functionality priorities for their information technology and supply chain management (SCM) challenges.

Research limitations –The results of this study are telling and inform on the areas of focus (i.e., planning, sourcing, and delivery). However, a broader base of participants must be queried to obtain requirements across the supply chain.

Originality/Value – Through the course of our literature review, we found no research that focused on the Habitat for Humanity supply chain, nor did we find specific supply chain information technology solutions that would immediately serve the Habitat operating environment. The more general area of supply chain management for non-profit home building was also queried, with no relevant literature identified.

Keywords – Habitat for Humanity, information technology, Database Management, Supply Chain Management, Non-profit organization, Requirements Analysis

Paper type – Research

Introduction

With the use of today's sophisticated Information Technology (IT) systems, businesses, more easily done than ever, can stay connected in the supply chain at all times and with all players. Today's supply chain information systems allow for up to the minute data reporting, include supplier relationship management and customer relationship management capabilities, carryout payment scheduling, assist with materials planning and scheduling, and help to facilitate collaboration amongst distributed business partners and customers. With the focus of IT on information integration and management, these systems allow organizations to focus on their specialty and other business practices with better accuracy and preparedness. These together will help to achieve a more visible and well-managed supply chain.

This paper examines IT and Supply Chain Management (SCM) in the context of a non-profit home building organization's supply chain needs, Habitat for Humanity. Demand and their desire to build homes continue to increase year-to-year. However, with growing requests, funds and services continue to be limited and strictly on an "as sponsored" basis, and work continues to be completed on a volunteer basis. Managing the (data) flow of people and materials can be a daunting task, and one that can benefit greatly from increased understanding and visibility. This is especially true when IT is applied to the supply chain. Given Habitat's construction industry and looking into Habitat's business challenges, IT can help eliminate many data and information related issues. IT can also provide them with an infrastructure for a data driven organization that can more easily keep up with managing demanding consumers and partners and rising demand and supply [12].

For Habitat for Humanity, this study aims to investigate the characteristics of an IT system that would effectively create visibility for their most pressing supply chain needs in three specific areas of planning, sourcing, and delivering supplies for building a home. This paper will outline IT strategies to help Habitat for Humanity keep up with and manage their resources. For other readers, this work brings more focus to research in IT and Supply Chain while also looking into non-profit organizations' basic IT needs.

Thus, this work will focus on the improvement to these areas resulting from the integration of an IT system to manage Habitat's data and other information. Specific target areas for improvements include planning, sourcing and gathering materials in order to build a home because these are where their basic needs lie. Further, these three areas include data processing, time constraints, labor and resources and budgeting. This is where Supply Chain Management and IT can play a critical role in managing Habitat's business processes.

In the next chapter of this paper a section reviews current and previous literature in support or disagreement in association with this study. In chapter three we discuss the context of this study; talking about Habitat in subsection III.i., defining Supply Chain Management (SCM) as it relates to the SCOR model, and the three main focuses of this project, planning, sourcing and delivering supplies in subsection III.ii, and finally discussing Databases (DB) and Database Management (DBM) in subsection III.iii. In chapter four a review of the methods for this study will explain the design of the study and how data was collected from Habitat. Chapter five explains the analyses conducted, covering the comparative database assessment in subsections V.i. and the survey results in subsection V.ii. In chapter six the findings and recommendations are presented and finally in chapter seven discusses the limitations and future research.

II. Review of Literature

A review of the literature, both in the fields of Supply Chain Management (SCM) and Information Systems, helps to support this research focused on creating supply chain visibility using information technology. The literature reviewed points out a standard definition of SCM and through comparisons of systems helps to validate methodology in our experimental approach. In the information systems domain, B2B, SCM, and ERP are the primary information system categories of focus. In the supply chain field the primary areas of focus are three of the five major focuses in SCM: plan, source, and deliver. Below you will find initial interpretations of academic articles that span both knowledge domains – information systems and supply chain. This literature review will continue to build in accordance with the content below.

Kapia et al (2006) initially discuss demand data management processes and correlate it to the effects on visibility. Visibility, in this article can be described as the effects of sharing information to further simplify the steps and effects in data management and make the overall supply chain more efficient for its users, an area of direct relevance to the needs of the supply chain challenges at Habitat. Kapia et al (2006) ask and answer questions dealing with the use of information sharing such as "how can we improve supply chain?" They also ask and answer questions on how improved visibility progresses the performance of the supply chain. The article further discusses the implications on the processes discussed for improved supply chain management and concludes with five recommendations for those interested in improving visibility and overall effectiveness of the supply chain.

Kapia et al provide insight some of the data management processes in the supply chain industry that could help to minimize or eliminate costs of supply chain management. They went on to discuss the importance of point of sale (POS) data and how its use may yield much higher accuracy of forecast statements and how it may reduce the bullwhip effect [3]. Kapia et al

contrast POS data with channel data using a case study. The true differences, other than time delays, appear to be access to data and the overall content [3]. Of particular relevance to this work is their finding on vendor-managed inventory (VMI) and how sharing inventory replenishment data helps to decrease costs by up to 40% [3].

Kapia et al offer five recommendations, all of which carry strong relevance to our challenge in this study of identifying the information technology opportunities to create visibility in the Habitat for Humanity supply chain. The five recommendations offered by Kapia et al are:

1. Share only information that helps to improve the supply chain performance- implies the need for efficiency by cutting out redundancy and irrelevant data [3].
2. Simplify, synchronize and stabilize demand-supply planning processes- decrease last minute changes, decrease information delays and processes that help provoke information delays [3].
3. Use a combination of different data demand sources- for optimum efficiency several processes may help to solve alternate issues v
4. Benefit from collaborative relationships with customers- exchanging orders, invoices and order status data help to minimize cost and other inefficiencies [3].
5. Understand suppliers' real need for demand information [3].

The processes described provide key considerations for creating information visibility in a Habitat supply chain.

To create supply chain visibility, effective system implementation is required. Siddharth et al (2006) focus on the implementation and hardships of Supply Chain Management (SCM) in a firm. It goes into describing what SCM is and in doing so talks about the relationship between Logistics and SCM. This portion of the study provided even more perspectives of general and accepted definitions of SCM while also underlining the relationship with Logistics. Siddharth et al assert that Logistics is a subset of SCM dealing with the movement of materials, storage and inventory management [4].

Siddharth et al suggests that in order to implement SCM, evaluation of the current processes must be conducted [4]. Following this suggestion are four approaches to the evaluation of a supply chain, which would be relevant in both SCM systems and relevant to the design of a database for Habitat [4]. The four approaches presented by Siddharth et al are:

Step I: formulation of strategy and description of issue; direction to any program, assessment of capabilities [4].

Step II: identification of areas for improving material flow- this could include improvements in Logistics, outsourcing information technology, etc [4].

Step III: identification of issues [4].

Step IV: performance evaluation of the supply chain [4].

Relevant to our work here in creating supply chain visibility for Habitat for Humanity, study, Siddharth et al provide a useful overview of what goes into effectively putting in place

SCM processes and provide insight into the types of information technology solutions that are geared toward solving supply chain challenges [4].

Worthen (2007) discusses definitions of Supply Chain Management (SCM), what supply chain software should do, the difference between Enterprise Resource Planning (ERP) and SCM, roadblocks to installing supply chain software and some of the emerging technologies that will affect the management of supply chain. Worthen then looks at the five main areas of focus in supply chain, according to the Supply Chain Council, and explains how they fit in with supply chain: plan, source, make, deliver and return. An explanation of these five core areas of supply chain follows:

- Plan – This is where you strategize with a plan how you will go about accomplishing task(s) and meeting the customer’s demand [6].
- Source – Here suppliers are chosen to deliver goods and services needed to create your product [6].
- Make – This is where you will schedule the actual manufacturing of your product [6].
- Deliver – Logistics is what is referred to when discussing delivery. Here you will choose deliverers and setup payment methods [6].
- Return - If your product is defective, here it will undergo the return process, making its way back in your warehouse [6].

Three out of the five –plan, source, and deliver- are the main focus areas for the information technology system to be investigated to serve Habitat’s supply chain visibility requirements.

In the section where Worthen explains what supply chain software can do, he states that not one system is right for every company [6]. The goal of these software packages is to increase supply chain visibility. He focuses on how businesses that use these software tools need to share information with one another in order to increase visibility [6]. However, the players are against sharing the data that is most important to achieve this advantage of supply chain visibility. He gives an example how suppliers would not need to guess how many orders to receive and the manufacturer would not have to order more than needed from suppliers [6]. In turn, retailers would have fewer empty shelves if they all would share this information with one another [6]. Worthen goes on to explain how the Internet is here to help make this all possible.

Additionally, Worthen does state that most companies’ top priorities are tracking demand, tracking supply, tracking manufacturing status, tracking logistics and tracking distribution, which is similar to the functions being investigated for the Habitat supply chain IT system. [6]. Worthen did not specifically address whether or not these implications are the same for profit focused organizations and non-profit organizations such as Habitat, but this does introduce characteristics to look for in an IT supply chain system

Wailgum (2007) discusses ERP systems and their difficulty and inability to centralize tasks in a business. As many companies have discovered, there is an emerging category of third-party, hosted options that successfully blend traditional value added network (VAN) capabilities with on-demand hosted supply chain software and back-office integration services [5]. Companies in this evolving market, such as E2open, GXS, Inovis and Sterling Commerce, offer

a single point of data exchange, whether using Electronic data Interchange (EDI), RosettaNet or XML standards, that acts as a gateway for partner-to-partner, enterprise system integration and collaboration [5]. For companies like Agere, it's now possible to make a single electronic connection to all customers and suppliers if they use E2open. Even better, that task can be taken care of by a third party [5].

Wailgum argues there is another advantage of using an outsourced integration service provider; the hosted front end of an enterprise's supply chain system has the ability to communicate with the different communications protocols found in today's supply chain. Jayaraman says that E2open's ability to translate from one language to another is hugely significant for Hitachi [5]. For example, say a company's systems can communicate only in the "language" of RosettaNet but the company's partners speak in EDI, XML or SAP's iDoc [5]. E2open enables the front-end translation from one language to another and updates the back-end systems as well, which is where current enterprise SCM systems really fall down. As Muller says, "If you're a customer of ours, you can have it your way."

Barker et al (2004) discusses seven "waste spots" that allow for problems in the house building supply chain. They further go onto to discuss what each of these means for the business and then discuss what should be the main focus when finding a solution to these traditional home building problems.

Waste spot #1 consist of poor supplier relations. Communications and relations management technologies would be helpful in the facilitation of business agreements and the overall understanding of the relationships needs from both supplier and house builders [12].

Waste spot #2 deals with the lack of integrating the supply chain. Barker and Naim talk about the information that needs to be shared amongst the supply chain players to keep tasks well managed and communication lines clear and open. The solution here is collaborative based IT systems that allow for agreed planning and delivery [12]. Waste spot #3 includes time compression strategies where, again, miscommunication or no communication amongst the players in the supply chain gives way to crises'. This waste spot's solution is associated with both waste spots #1 and #2 [12].

Waste spot #4 details the inability to rapidly reconfigure the supply chain due to uncertainties. This also plays along with all of the above waste spots [12].

Waste spot #5 and #6 talk about stock issues: excess costs and material wastage. They recommend for improvement in this area consider reduction in stocks and improved processes dealing with stock [12].

Waste spot #7 refers to the "ultimate" symptom of the supply chain – the need for a finishing foreman (snagging) - thus the overall poor quality. Barker and Naim discuss the need for everyone in the organization and in the supply chain to take ownership of quality and how this need should be continually managed, and not so much on a problem

persist basis. Barker et al believes solution to this problem deal with appropriate training and overall accountability [12].

Barker et al outlined preliminary steps to supply chain and information technology solutions. Much discussion was on information technology and how the use of new technologies, such as current and future internet systems, can help to shape the supply chain in a more collaborative better managed chain of business where everyone is kept in the loop and updated on changes and also where real time information can be consistently updated and viewed by players. This is the underlining basis for implementation for the system proposed for Habitat for Humanity.

III. Context of Study

This study is drawn from Supply Chain Management and Information Technology Systems. These disciplines were the focus for creating visibility in Habitat for Humanity's supply chain. Given the versatile domain of study, each of these three arenas (1) Habitat for Humanity, (2) Supply Chain Management, and (3) IT Systems, is described in more detail in subsection III.i, III.ii, and III.iii, respectively.

III.i. About Habitat for Humanity

Habitat for Humanity is a non-profit organization that has been building homes for low-income families since 1976. Although Habitat is exempt from federal income tax, their costs continue to increase every year. In 2006, programs and house building transfers increased by 50% climbing to \$103 million compared to \$70 million in 2005. Donated assets to Habitat dropped from \$18 million in 2006 to \$15 million in 2005 [1, 2]. With the on going cost pressures, improving efficiency and managing expenditures closely is a top priority.

Habitats non-profit environment already challenges them with limited resources and finances but their numerous affiliates are left with even lesser resources and capabilities that include the misuse or non-use of Information Technology. It can be difficult to learn, use and maintain IT system features found in most current supply chain systems [3,4,5]. These system's users are usually big companies and for profit; implementation and training are usually not huge problems. Many times this is not the case for small, medium and even non-profit businesses. By not adopting IT strategies information is scattered and useless and many business processes suffer.

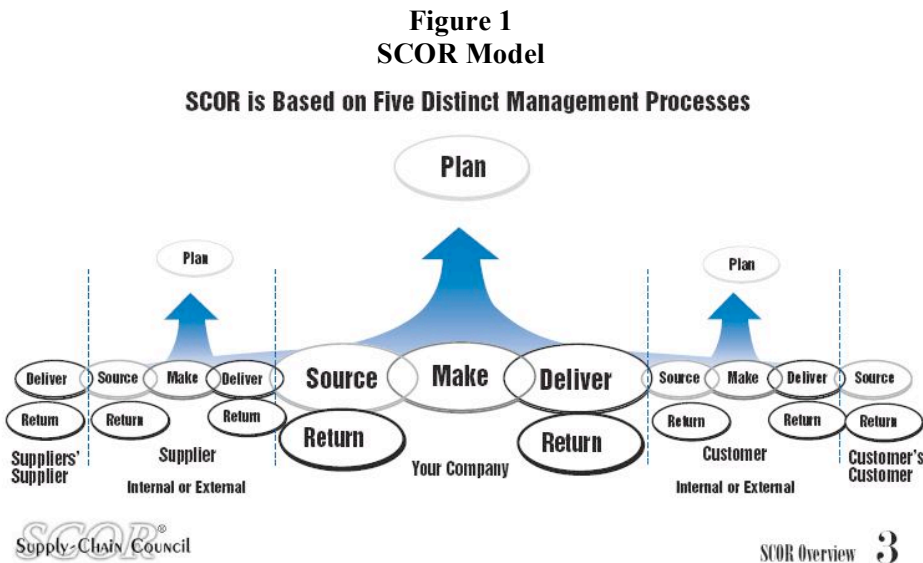
III.ii. What is Supply Chain Management (SCM)?

The Council of Supply Chain Management Professionals (CSCMP) has commissioned a globally excepted definition of Supply Chain Management. This definition can be implied throughout the paper.

“Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology.”

Council of Supply Chain Management

In Figure 1 we visit the Supply Chain Operational Reference (SCOR) model, the primary standard and metric for measuring supply chain performance. It is an industry accepted visual explanation for how each process contributes to the supply chain and the management of it.



www.supplychain-council.org

There are five bases on which SCM concentrates: plan, source, make, deliver and return. Each of the processes plays an important role in the supply chain.

1. Plan - The strategic planning on how to get your product from point A to point B. Key to meeting customer demand [6,7].
2. Source- Planning with partners who will manage the actual delivery of your goods and services including pricing agreements. Processes that help identify data on delivery statistics such as tracking and receiving confirmation are highly important in this area [6,7].
3. Make –Planning and manufacturing your product [6,7].
4. Deliver- Detailing and packing orders, checking out and delivering goods and services [6,7].
5. Return – Receiving returns given a plethora of reasons why [6,7].

Out of the five concentrations, again, this research will only focus on the planning, sourcing and delivery of supplies to build a home. Just to note, when dealing specifically with source and delivery processes, the main focus is on logistics, which is a subset of SCM. Logistics are specific to the delivery of goods from point A to point B and all of the planning in between [4]. Currently, industry has seemed to somewhat agree on the primary differences between Logistic and SCM but most agree on the description stated above [8].

III.iii. What is Database Management (DBM)?

Database Management (DBM) is the maintenance of a database. Database Management Systems (DBMS) are information technology processes that help to control databases, which maintain the organization, storage and retrieval of data. They are essentially IT systems that help to manage databases. They allow users to make a query, requesting some information from the system, and based on parameters of the database it returns data in response to the query. Therefore databases must maintain relationships of much of the data stored in the database in an effective manner. According to the literature there are several accepted definitions of DBMS. The table below outlines more prominent definitions of DBM and DBMS [9].

Table 1-What is DBM and DBMS?

Source	DBM Description
www.ruf.com/mglossary.html	The task of storing, modifying, and retrieving database information to produce reports, answer queries, and record transactions.
www.automationmed.com/glossary.htm	The task of storing data in a database and retrieving that information from that data. This includes: 1) Entering the data 2) Modifying or Updating data 3) Reporting or Manipulating the Data to provide useful information
wordnet.princeton.edu/perl/webwn	Creation and maintenance of a database
Source	DBMS Description
PC Mag	Software that controls the organization, storage, retrieval, security and integrity of data in a database. It accepts requests from the application and instructs the operating system to transfer the appropriate data.
Wikipedia	Computer software designed for the purpose of managing databases.

There are five major features of a DBMS, which include data security, data integrity, interactive querying, and interactive data entry and data independence.

1. Data Security - In DBMS's users are given specific rights to view specific data. Each user is given a username and password, preventing unauthorized users from gaining access to data [10, 11].
2. Data Integrity - This feature allows for only one update (of a record) at a time. It also does not allow duplicate records. For instance, two records containing the same exact name of a manufacturer would not be allowed [10,11].

3. Interactive Query - This feature allows for users to query the database, looking for the system to return valid responses and also gives the ability of analyzing data and managing fields [10,11].
4. Interactive Data Entry and Updating - This feature allows for users to update, edit and delete data in the database(s) within in the system [10,11].
5. Data Independence - Allows for the updating of information without altering the system or other systems that process it [10,11].

Supply Chain Management (SCM) plays an important role in helping to eliminate processes in the supply chain that have little or no importance and that only repeat unnecessary steps in management and control. Database Management Systems (DBMS) also play an important role in helping to organize data in a manner in which it is easy for it's users to update and retrieve while providing a secure means in doing so. The supply chain information system envisioned in this work could prove to be beneficial because of the minimizing of data storage and task reduction, the stability of real time updates and reports, the preciseness of inventory control, a focus on business relations and the elimination of ineffective processes.

IV. Methods

This work employed semi-structured interviews, a comparative assessment of database management systems, and a requirements document. The study began with initial telephone conversations asking Habitat Construction Managers questions dealing with the sort of demand for an information system for their office. This system would be to better manage data, materials and the steps involved in planning, sourcing and delivering supplies to build a home. They were also asked questions as to the different characteristics they would expect in a system if they so chose to implement a new. This conversation was a basis for our next step.

After feedback from the initial communication was assessed, a survey and requirements analysis seemed an appropriate tool to further investigate targeted areas identified in the interviews. Meetings with experts in the SCM field were scheduled and further feedback was provided as to the validity and clarity of the questions on the request document. Finally, a document outlining some of the feedback received from the Construction Managers and industry experts as well as other questions pertaining to their past and current uses with IT was drafted into an online survey document and was sent to 15 of the 39 Habitat affiliates that were contacted. Lastly, during the period of distributing surveys and speaking with Habitat representatives, a comparative assessment of 18 different types of systems that Habitat could use to help with their supply chain and IT challenges was conducted. After the comparisons of potential systems were analyzed and reviewed we further reviewed best practice IT processes and modules for top SCM activities and then compared the final eight systems given the four main modules of focus concluded as best practice modules in SCM (source).

V. Analysis

The comparative assessment and results of the requirements request are reported here in sections V.i and V.ii, respectively.

V.i. Comparative Database Assessment

To create a framework that could successfully capture Habitat for Humanity's supply chain and IT needs a cursory review of high-level functionality of 18 relevant commercial IT systems for similar industries were researched. For each system we looked at characteristics of data management and assessed systems based on key concepts associated with SCM – planning, sourcing and delivering - and IT. More specific SCM ideas include planning management, product optimization, business management, warehousing, and communication management and automation capabilities. In addition, we considered the appropriateness of the system's overall functionality and usability for Habitat's non-technical environment. Table 1 lists the 18 systems for which an initial review was conducted. These 18 systems cover a full range of supply chain management functionality and beyond. Therefore, a subset of the 18 was selected as a basis for capturing the supply chain and IT needs relevant to this study.

Table 1-18 Systems for Supply Chain Management

- | | |
|--|---|
| 1. Enterprise Resource Planning (ERP) | 10. Human Machine Interface (HMI) |
| 2. Business Intelligence (BI) | 11. PC Based Control |
| 3. Manufacturing Intelligence (EMI) | 12. Process Automation Control |
| 4. Customer Relationship Management (CRM) | 13. Procurement/Fulfillment/Payment Systems |
| 5. Product Data Management /Product Lifecycle Management | 14. Supervisory Control Systems |
| 6. Manufacturing Execution Systems (MES) | 15. Enterprise Asset Management /Maintenance Management |
| 7. Supplier Relationship Management | 16. RFID Software |
| 8. CAD/CAM/CAE | 17. Simulation Software |
| 9. Warehouse Management | 18. Machine To Machine |

Source: <http://softwarefinder.mbtmag.com>

Here we conclude the final eight systems that are sufficient for Habitat for Humanities greatest needs in planning, sourcing and delivering. These systems include features as forecasting and inventory, customer and supplier management and shipping and tracking. The eight systems that remain are listed in Table 2.

Table 2 -Best System for Habitat

1. Enterprise Resource Planning (ERP)
2. Business Intelligence (BI)
3. Manufacturing Intelligence (EMI)
4. Product Data Management /Product Lifecycle Management
5. Manufacturing Execution Systems (MES)
6. Warehouse Management
7. Human Machine Interface (HMI)
8. Procurement/Fulfillment/Payment Systems

Source: <http://softwarefinder.mbtmag.com>

These final systems from Table 2 were selected on the basis of needs, goals and usability. Here they are broken down into more detail, as we understand the reason they would be good choices for habitat for Humanity.

Final 8 Best Systems for Habitat for Humanity

Wikipedia.org | Managingautomation.com

V.i.a. Enterprise Resource Planning (ERP) systems

Enterprise Resource Planning (ERP) systems attempt to unify all business processes into one system. The strengths of an ERP system, with respect to Habitat's needs, are that processes communicate with each other that allow for more collaborative and centralized business. The ERP's collaboration capabilities are what landed it a spot in the final eight. Conversely, ERP's are very complicated systems that are not easy to understand and learn. Also they can be very expensive to implement and maintain while customization is limited.

V.i.b. Business Intelligence (BI) Systems

Business intelligence is a business management term, which refers to applications, and technologies, which are used to gather, provide access to, and analyze data and information about company operations. Types of BI tools include digital dashboards and reporting software. Both of these tools are why they were chosen for the final eight. The strengths of a BI system, with respect to Habitat's needs, are the abilities to help companies have a clearer view of the factors affecting their business, which help them to make better decisions. The drawback in employing a BI system at Habitat is their insufficient data, data capacity or data retention.

V.i.c. Manufacturing Intelligence (MI)

Manufacturing Intelligence, is a term which applies to software used to bring a corporation's manufacturing related data together from many sources for the purposes of reporting, analysis, visual summaries, and passing data between enterprise level and plant floor systems. Reporting, analysis and visual summaries are what attracted us to this system for the final list. The strengths of a MI system, with respect to Habitat's needs, are the abilities to aggregate data, making available data from many sources, most often coming from databases and the analysis capabilities, enabling users to analyze data across sources. MI's also have dashboard capabilities. This level of reporting requires data integration from multiple sources, which Habitat does not have and so this is a drawback for them.

V.i.d. Product Data Management /Product Lifecycle Management (PDM)

Product Data Management or Product Lifecycle Management is a computer program used to monitor data related to the life cycle of products. PDM allows its users to manage relationships between data that define a product. The product relationships are then stored in a database. This is why PDM made it in our final eight systems. PDM capabilities include product configurations, product versions and product variations that may not be useful for Habitat since many have little to no variations in products.

V.i.e. Manufacturing Execution Systems (MES)

Manufacturing Execution Systems is a shop floor control system, which includes either manual or automatic labor and production reporting as well as online inquiries and links to tasks that take place on the production floor. Its production-reporting tool caused for its inclusion in the final eight. The strengths of a MI system, with respect to Habitat's needs, are its abilities to track inventory and its use of dashboards and other reporting tools. Not all Habitats have a warehouse or sort of storage and so this tool may not be useful for all.

V.i.f. Warehouse Management

Warehouse Management controls the movement and storage of materials within an operation and processes the associated transactions. The strengths of a MI system, with respect to Habitat's needs, are its abilities to control warehouse information and provide real-time updates. Real-time updates are what attracted us to this system. Also, the system relies on intelligence and does not depend on people's experience or skill. This technology can be expensive and is very advanced as it utilizes automatic ID data capturing such as radio-frequency identification (RFID) and barcode scanners.

V.i.g. Human Machine Interface (HMI)

Human Machine Interface includes 14 types of user interfaces: voice UI, text UI, command line UI, GUI, web based UI, etc. We are interested in the system being web-based and so this system was very attractive.

V.i.h. Procurement/Fulfillment/Payment Systems

Procurement systems are the attainment of goods and/or services at the best possible total cost of ownership, in the right quantity and quality, at the right time, in the right place. Procurement is a great focus in supply chain management and so we knew we had to include this. The strengths of a Procurement System, with respect to Habitat's needs, go in hand with the seven life cycle stages of the system which provide for improved supplier relations management:

- Information Gathering
- Supplier Contact
- Background Review
- Negotiation
- Fulfillment
- Consumption, maintenance and disposal
- Renewal

V.ii. Requirements Results

For the online requirements request documents that was developed we looked at finding answers that would allow us to get a clear understanding of what Habitat did and so what they expected in an IT system that would help deliver efficiency and eliminate many problems they were having. Forty (40%) percent of the participants use a manual system for the planning portion of building a home while another 40% use a database. Sixty (60%) percent of the participants reported they used a manual system for the sourcing of materials to build a home while 20% use a database and 20% use no system. Eighty (80%) of the respondents use a manual system for planning the delivery of supplies to build a home while 20% have no system for this. So, we asked them how they prepared the planning, sourcing and delivery for building a home. Here is a general response:

***Plan:** Look over unit before demolition stage, and evaluate scope of work on each unit draw up plans, and gather all permits on unit.*

***Source:** Have our warehouse manager purchase, order, and also seek out in kind donations as well as inventory current stock.*

***Deliver:** Ordered from local vendors and delivered, also staff and volunteers pull from warehouse and transport to job site.*

Both the conversations with Habitat and the request document focused on questions that asked what aspects made it easier or more difficult to perform these tasks. Here is what some had to say:

<i>Easier for Planning:</i>	<i>Preparation, communication with the construction manager and planned volunteers with experience.</i>
	<i>Having completely thought through every possible issue that could arise during the process. Accurate drawings.</i>
<i>Easier for Sourcing:</i>	<i>Good communication with vendor and on-time ordering.</i>
	<i>Having an accurate account & cost of the items that went into the last unit</i>
<i>Easier for Delivery:</i>	<i>Good communication with the house leaders and construction manager to develop accurate material list for the tasks that week.</i>
	<i>Vendors will deliver.</i>
<i>Difficult for Planning:</i>	<i>Not enough time thinking through what's the next step.</i>
	<i>Poor communications from construction manager.</i>
<i>Difficult for Sourcing:</i>	<i>Not a good inventory system.</i>
	<i>Out of stock situations.</i>
<i>Difficult for Delivery:</i>	<i>inadequate vehicle needs.</i>

We also inquired about their previous and current experiences with IT systems while at Habitat and what they did or did not like about them.

Initial conversations had led us to believe that they need management in inventory, suppliers and transportation. So, for the survey portion of this analysis we asked them to rate system features that they deemed as highly necessary or unnecessary for a functional IT system. In each of the final eight systems, discussed in the previous section, the primary focus was on whether each could provide management in four key areas that encompassed inventory forecasting, supplier and transportation management. These four areas were supported by the survey responses and are also found as conventional features in popular commercial IT system, shown here in Table 1.

Table 1-The Top 4 Features and Their Focus

Feature	Focus on
Demand Management:	<ul style="list-style-type: none"> • Forecasting • Inventory management • Replenishment • Reporting
Supply Chain Optimization:	<ul style="list-style-type: none"> • Inventory management including: Product life cycle, inventory profiles • Transportation management including: Routing, scheduling
Transportation Management:	<ul style="list-style-type: none"> • Planning • Execution • Shipment Tracking
Order Management:	<ul style="list-style-type: none"> • Shipping and outbound management • Sourcing • Inventory management • Visibility

VI. Findings and Recommendations

After the completion of the comparative assessment and analysis of the user requirements gathered through the on-line requirements request survey, four areas of need appeared prominent: (1) inventory management, (2) order management, (3) supplier relations managements and (4) volunteer skills tracking management.

VI.a. Inventory Management

Many of the affiliates reported they sometime had difficulty, using their current system, exactly what they would need for each project and where the supplies were coming from. For those affiliates who do not have a warehouse, it would be useful for them to have a database outlining what supplies will be coming from what suppliers so that they have an idea of what they'll need to provide before the project date. For those affiliates that do have a warehouse, cataloged inventory would be helpful in displaying supplies and materials on hand. Many managers reported it would be helpful to obtain updated reports of inventory before project dates so that they can more efficiently plan for the pick-up and delivery of these supplies and additional supplies and materials if need be. It would also help them to keep a replenishment of particular supplies. For the both, having a warehouse or not having a warehouse, it would be useful for them to maintain a database with all of the suppliers and supplies they ever used for each project which would help project material costs for similar projects.

VI.b. Order Management

For many managers, order management was a huge problem. Specific to the size of the affiliate, depending on suppliers to deliver almost all of the supplies and materials, sourcing and shipping seemed to be quite tedious. For the smaller Habitats, they were very dependent on suppliers to ship materials on time and on site. However, this was not always the case as miscommunications caused orders to sometimes be incomplete while other times delivery times were off schedule. A reporting database outlining the specifics of what materials in what amount will be delivered, from whom, where and at what time would be very helpful in eliminating production delays and unnecessary costs and help track supplies from arrival to site delivery.

VI.c. Supplier Relations Management

Many affiliates emphasized the consequences of poor communication with suppliers about delivery orders, times and so on. Although this third priority could relate closely with order management it still has its focus. Many of the discrepancies that occurred with order management was because of untimely miscommunications or no communications with suppliers and deliverers. If an email client, directory and database of suppliers and the services they provide were included in this proposed system it would help facilitate better communication amongst players and help to reduce costs and stress on the relationships. All together it will help them to display their supplier requirements to their supplier in a more effective manner.

VI.d. Volunteer Skills Tracking Management

Every affiliate has a cost for marketing to volunteers. Some of them have difficulty locating and gathering volunteers while others do not. Even if they receive volunteer workers these volunteers are too often not skilled enough to perform the needed tasks. Unfortunately, most of the affiliates in this study do not keep track of past volunteer information. If they maintained a database with all the volunteers that had ever worked with them, which would include their skill level along with the projects they assisted on, it would be easier on marketing attempts and would give them a greater chance of locating the appropriate skills they need for a project in a timelier manner.

Lastly, we are not looking to integrate and merge all business data or even all affiliates' data but propose a small scale web-based system to include a database addressing the above IT challenges and that which will assist in better overall management and supply chain visibility.

VII. Limitations and Future Research

There were several limitations for this study. This research was studied on a small scale with only 15 participants, ranging staff number and size, so the analysis could become skewed with more participant feedback changing the top four priorities. At any given moment, we never considered the cost of an IT system because the ideas behind the system referred to a simple customizable database that would only tailor to the planning, sourcing and delivery of supplies to build a home and perform basic functions.

In all it was assumed that Habitat needed specific management in each of the three out of five areas of SCM scope that are focused on in this research. For planning, almost all Habitats were looking for an inventory management function. In sourcing, almost all Habitats were looking for better management of an information system to relay their supplier requirements to their suppliers. However, for delivery there were no indicators that they recognize their requirements in this area.

Future research includes going back to Habitat and making sure we understand their needs and have not left out any other important priorities. We would like to go back and expand on the survey and requirements and include more participants to get a more thorough analysis. After their basic top priorities are addressed we can create a prototype encompassing the challenges they reported. If this prototype is on point we may conduct user testing to further revise the program until it is of satisfactory for managing the top priorities of Habitat. Lastly, it is possible to continue the implementation of additional features that address other relevant and important business issues once a design is in completion stage and accepted by Habitat users.

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