

DuPage Habitat for Humanity

Case Study of Lean Principle Implementation to Core Process

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EXECUTIVE SUMMARY

DuPage Habitat for Humanity (DHFH) is in a rapid growth mode. Beginning in 2008, this Chicagoland affiliate had to prepare to more than triple its home building capacity without increasing fixed costs by hiring extra staff. To meet this challenge, they began the implementation of lean management principles into the Core Process of building and rehabbing homes but without the typical series of training sessions and workshops. In a volunteer organization there is a low tolerance for this more traditional approach. Instead, DuPage Habitat leveraged volunteer subject matter expertise to develop a value stream map of the future state. This was developed through extensive one-on-one negotiations with stakeholders. The resulting map was easily agreed to by the DHFH leadership team. From there, deliverables development and implementation was relatively straight forward.

The deliverables included sharpened job descriptions, a Master Construction Schedule tool, a *Build Day Best Practices – User's Manual* to help standardization, a *Home Specification for New Construction*, and Crew Leader Training.

DUPAGE HABITAT FOR HUMANITY

DuPage Habitat for Humanity was founded in 1995 as a nonprofit organization and a local affiliate of Habitat for Humanity® International. DuPage Habitat serves DuPage County in the Chicagoland area. Habitat for Humanity is an ecumenical, Christian movement dedicated to building and selling homes in partnership with limited-income, working families.

Governed by a local volunteer board of directors, DuPage Habitat lowers homebuilding costs by relying on volunteer time to build and renovate homes, to run many of their critical operations and to provide supportive services to their partner families. Since 1995, DuPage Habitat has partnered with the community to build and sell homes to 43 families as of the end of 2009.

PROJECT BACKGROUND

DuPage Habitat for Humanity is currently on a steep growth curve for the number of families it serves per year. This growth has not been steady. In 2006, DuPage Habitat was still in a temporary slump of housing construction with no houses completed that year. In 2007, three houses were completed.

At the end of 2007, DuPage Habitat entered into a commitment to construct a new subdivision called Pioneer Prairie in West Chicago. This commitment would drive the number of houses completed per year into the 5 to 6 range. The business plan for the years 2009 through 2011 require the completion of 18 new and rehab homes, 11 of which are new construction at Pioneer Prairie. Beyond 2011, there are aspirations to further increase capacity to complete 10 or more houses per year.

The business plan for 2008 called for the development of processes and systems to handle 5 to 6 houses per year. However because of unevenness in schedule throughout the year, the affiliate would at times be operating at an annualized rate of

10 houses per year. This rate means building three houses simultaneously. In order to avoid incurring wasteful extra expenses, the project focused on implementing lean management principles, particularly to avoid increasing fixed costs such as hiring additional staff.

Project Objective: Implement a lean Core Process that is capable of 10 houses per year without requiring an increase in the fixed cost of hiring additional staff.

PROJECT METHODOLOGY

At the beginning of 2008, a special task group was established to define the Core Process and to specify ways to improve the performance of the Core Process.

Project Team: The task group was led by a subject matter expert in lean management principle implementation. This task group leader was a volunteer member of the construction committee but in this capacity reported to the Executive Director of DHFH. To develop the content of the project, a six member leadership advisory group was utilized. This DHFH leadership team included the Construction Manager (a paid staff position), the Construction Committee Chair (a volunteer position), the task group leader (a volunteer position) and three other stake holders who were members of the construction committee (all volunteer positions).

Scope of the Core Process: The Core Process starts with a house procured for rehab or new construction scheduled for build start (usually a month before construction actually begins). The Core Process ends when the house is dedicated and the keys are handed over to the new home owner.

Construction days are limited to Thursdays and Saturdays with planning meetings held on Tuesdays. Because of these conditions, there is a natural weekly cycle to the Core Process. Most houses take between 17 to 19 weeks to complete and that applies to new construction as well as rehabs with significant work which is usually the case. This corresponds roughly to 2500 volunteer hours per house.

Supplying the Core Process are several specific components: purchased materials, purchased or donated contractor services, donated materials, permits and inspections, regular volunteers who are members of the construction committee, and visiting volunteers from donor organizations. Development of the value stream map clarified how these components would be scheduled and supplied to the Core Process in a synchronized and lean fashion.

Current State: At the beginning of 2008, DHFH had demonstrated capability to build 3 houses per year. This meant that usually only one house was under construction at a time. Occasionally there would be two houses overlapping at the tail end of the construction process. It was possible to manage this capacity with a relatively ad hoc Core Process. This also meant that most of the processes within the current state Core Process were not standardized and therefore were subject to frequent debate, particularly during the regularly scheduled Tuesday evening planning meetings. This was recognized as non-value added effort.

Consideration was given to measuring the performance of the current state so it could be compared to the lean Core Process after implementation. Unfortunately, there was no meaningful data available and because of limited volunteer time available, no quantitative measurements were attempted. Instead, the task group leader elected to survey the DHFH leadership team for a qualitative evaluation of the implemented lean Core Process 15 months after deliverable implementation began. The results of this survey are discussed in the implementation section of this report.

Future State Requirements: The build plan for 2008-2009 called for the completion of 5 or 6 homes per year. Recognizing that the schedule for building was not always level during the year, it was determined that the Core Process would have to be able to handle 3 homes under construction simultaneously. With a typical house taking 17 weeks to complete, this translated to an annualized rate of 10 houses per year.

VALUE STREAM MAP

The value stream map (VSM) became the first deliverable of the project and served as the backbone for developing other deliverables. It also served as the focal point for defining a process that embodied lean management principles and eliminated waste. Particular attention was paid to eliminating duplication of effort and rework.

In a typical lean implementation, the organization would go through a series of presentations on lean principles and conduct a workshop to develop the VSM. In this situation with a volunteer organization, the tolerance for this approach was determined to be extremely low. Instead, the value stream map was developed by the task group leader with its contents negotiated one-on-one with each member of the DHFH leadership team. By June 2008, the value stream map was approved along with a presentation called *Improve Core Process - How It's Supposed to Work*.

The Core Process VSM is shown in Figure 1. The map has the typical "swim lanes" which made it easy for the leadership team to understand. Each box on the map was rationalized as was each arrow to assure sufficiency while eliminating redundancies and waste. The vast majority of flow represented in the map is information flow as opposed to material flow. This is common for a business process VSM.

The weekly cycle referred to earlier is represented by everything depicted to the right of the first vertical line. These cycles repeat until the house is complete and the house is dedicated. Again, this is typically 17 cycles. The Tuesday evening construction committee planning meeting is represented by the flow represented between the first and third vertical lines.

Once adopted, the value stream map did not change through the duration of the project.

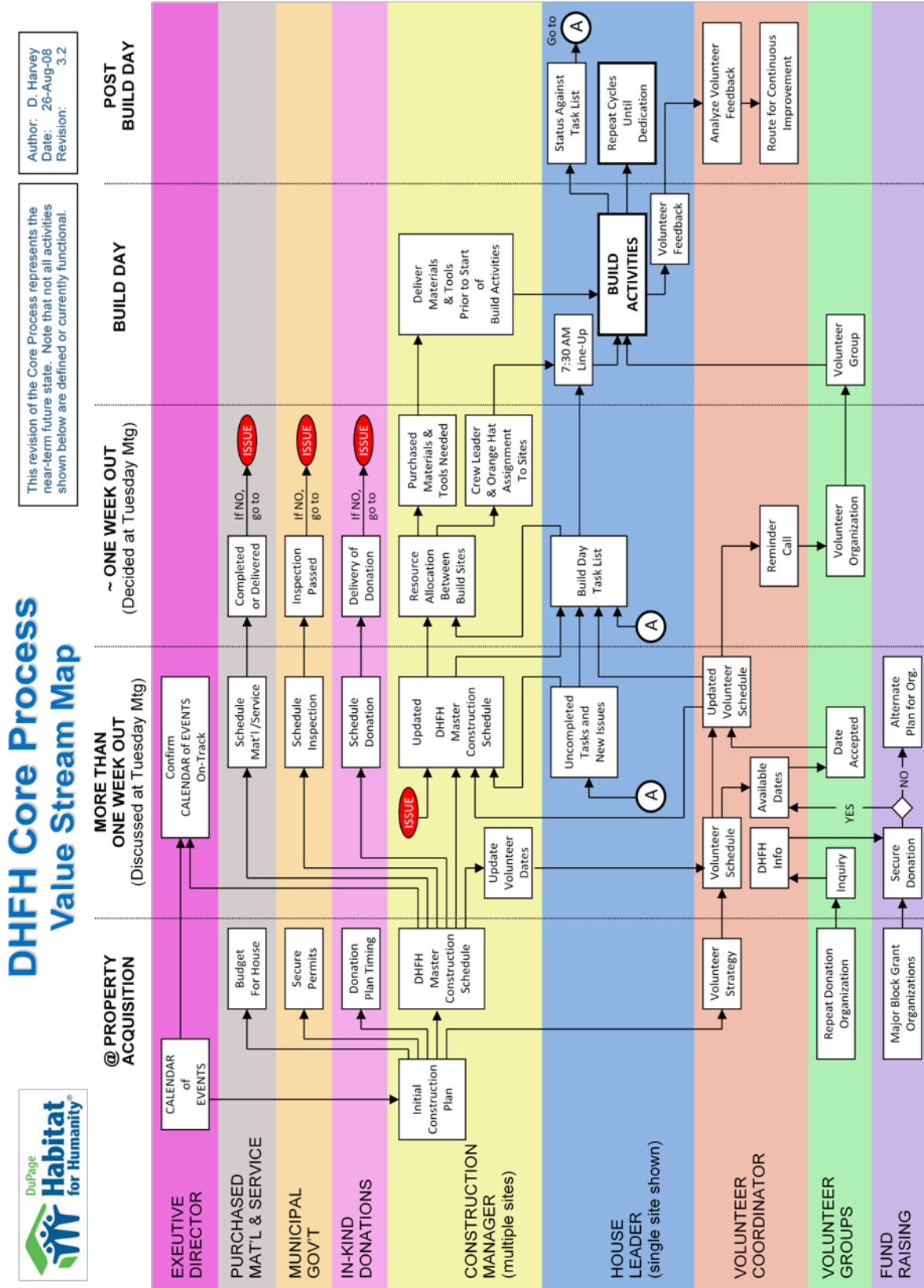


Figure 1. The Core Process value stream map approved by the leadership team.

DELIVERABLES

Once the value stream map was approved, the deliverables that needed to be created became relatively straight forward. They were discussed in the presentation *Improve Core Process – How It’s Supposed to Work*, which was also approved.

The development of the deliverables presented an opportunity to further implement lean management principles such as pull systems, standardized tasks, visual control, grow leaders, develop exceptional people and teams, and become a learning organization.

Job Descriptions: The job descriptions for the Construction Manager, House Leader, Crew Leader and Materials Manager were amended to clarify responsibilities based on the value stream map. This eliminated redundancies.

Master Construction Schedule: Synchronization of Core Process activities emerged as a critical need to effectively run the process. At the center of the process was the Construction Manager who had overall responsibility for construction activities.

A Master Construction Schedule tool was developed using Excel. A filled out example is shown in Figure 2. The tool was streamlined to include only the information needed to fill the requirements of the Core Process as shown in the value stream map.

The tool had the feature of being easily changeable from week to week as changes in priority or circumstances changed. The Construction Manager could put different start and end weeks in the third and fourth column and resort. This feature made the tool responsive to the dynamic nature of the Core Process.

		Start Date	End Date	Type														
Week Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
VOLUNTEERS	THURSDAY		6-Aug	13-Aug	20-Aug	27-Aug	3-Sep	10-Sep	17-Sep	24-Sep	1-Oct	8-Oct	15-Oct	22-Oct	29-Oct	5-Nov	12-Nov	19-Nov
	Visiting Volunteer Plan		10	10	10	10	10	10	10	10	10	10	TBD	10	TBD	TBD	10	TBD
	Visiting Volunteers Scheduled																	
	SATURDAY	1-Aug	8-Aug	15-Aug	22-Aug	29-Aug	5-Sep	12-Sep	19-Sep	26-Sep	3-Oct	10-Oct	17-Oct	24-Oct	31-Oct	7-Nov	14-Nov	21-Nov
	Visiting Volunteer Plan	10	10	10	10	10	TBD	10	10	10	10	10	10	TBD	10	10	10	10
	Volunteers Scheduled																	
	Partner Family Participation																	
Volunteer person-days for week: TOTAL																		
Type	S	E	ACTION		"Type" legend: C=Construction, I=Inspection, and S/M=Service+Mat'l													
1	C	1	1	Install Sill Plate	Done													
2	C	1	1	Build knee walls	Done													
3	C	1	1	Set Steel	Done													
4	C	2	2	Set TJI's		Done												
5	C	2	2	Start Deck		Done												
6	C	2	2	Finish Deck		Done												
7	C	2	2	Start first floor walls		Done												
8	C	3	3	Complete first floor walls			Done											
9	C	3	3	Set roof trusses/ start sheathing			Done											
10	C	4	4	Complete roof sheathing				Done										
11	C	4	4	Install windows/ exterior doors				Done										
12	S/M	4	4	Pour basement slab and garage				Done										
13	S/M	5	5	Rough Plumbing					Done									
14	S/M	5	5	Rough HVAC					Done									
15	I	6	6	Framing inspection						Done								
16	S/M	6	6	Rough Electric						Done								
17	I	7	7	HVAC inspection							Done							
18	I	7	7	Electrical inspection							Done							
19	C	9	9	Install basement stairs								Done						
20	C	9	15	Start siding													Done	
21	C	10	10	Start drywall								Done						
22	S/M	10	10	Install insulation/ continue siding														
23	S/M	11	11	Install garage door									Done					
24	S/M	11	13	Tape drywall										Done				

Figure 2. A Master Construction Schedule for new construction.

Build Day Best Practices – User’s Manual: The DHFH leadership team agreed that standardization of how the affiliate runs build days would have great benefit for eliminating waste and confusion, particularly as the volume of houses increases. This would also enhance the affiliate’s ability to train new House Leaders and Crew Leaders to meet growing capacity requirements and turnover.

The best practices are captured in a single document which is under revision control. The best practices were first reviewed by the construction committee at large. From there, the document was edited and approved. As new best practices are established, they can be incorporated into subsequent revisions of the document.

The *Build Day Best Practices – User’s Manual* contains the following content that is particularly important for lean management principle implementation:

- Preparing for Build Day – Tuesday Evening Meeting
- Construction Safety
- Build Day Task List
- 7:30 AM Line-Up Meeting
- Working with Visiting Volunteer Groups including Feedback Forms

Home Specification for New Construction: This document defines the content and requirements of a DHFH home. It assures that the home will be decent, affordable, and sustainable. Creating this document eliminated considerable non-value added debate during Tuesday evening meetings. It also facilitates the ordering of materials and the soliciting of in-kind donations of materials.

Crew Leader Training: Crew Leader training was developed to standardize the responsibilities of Crew Leaders and to get them up the learning curve quickly. The training is based on the *Build Day Best Practices – User’s Manual*.

Work continues on standardizing the actual construction tasks but this is considered secondary. Each House Leader has responsibility for assuring the Crew Leaders know enough of the construction tasks to make sure they can lead a team of 3-5 visiting volunteers. At present, there are differences between how House Leaders prefer to do specific tasks. So far, these differences have not resulted in problems between build sites.

It is interesting to note that most affiliates focus on teaching Crew Leaders how to do construction tasks where this project focused on how to conduct the Build Day. It is believed that the DHFH approach will result in greater ability to increase capacity and manage turnover of volunteers, particularly House Leaders and Crew Leaders.

IMPLEMENTATION

The lean Core Process has been implemented over the last year and a half as of the writing of this case study. It is important to note that the Core Process gives the organization the capability to build at a rate of 10 houses per year. The affiliate is still challenged with having the necessary number of House Leaders and Crew Leaders to achieve this rate but this is a capacity issue.

During the latter half of 2009, as many as three houses were under construction or rehab at one time. This corresponds to an equivalent rate of 10 houses per year. The process worked effectively but the affiliate was capacity constrained with too few Crew Leaders. Looking forward, bringing on new Crew Leaders should be facilitated by having standardized work and a training program.

To evaluate the effectiveness of the implementation the DHFH leadership team was given a survey. As mentioned earlier, this qualitative analysis was a viable evaluation method considering there were no quantitative measures for the performance of the Core Process prior to the lean implementation. The survey asked the leadership members to rate 18 questions as A,B,C,D, or F. It was unanimous that the overall implementation received a B rating and would have received an A if all the deliverables had been fully implemented. About one third of the deliverables still need additional work to be considered fully implemented. The DHFH leadership team agreed that the value stream map does not need to be changed.

CONTINUOUS IMPROVEMENT OPPORTUNITIES

With a year and a half of experience using the implemented lean Core Process, a number of continuous improvement opportunities emerge.

1. Work continues on the development and implementation of some of the deliverables specified in the value stream map. In particular, these include construction safety, implementation of all Build Day best practices, and the Build Day Task List. As with any change to an organization, leadership must remain committed to the implementation to reap the full benefits.
2. One lesson learned during the implementation of the Core Process was that the role of the Construction Committee Chair was underestimated. It turns out that the Construction Manager delegated some responsibilities; particularly the management of distributing the capacity constrained volunteer resources at the Tuesday evening planning meeting. It might be worth incorporating these delegated responsibilities into the value stream map if they are recognized as a permanent solution. An extra "swim lane" for the Construction Committee Chair could be added.
3. Managing three homes simultaneously is probably the limit of Core Process without adding additional steps to help balance limited resources between multiple build sites. It is believed that this addition will not undo anything already defined in the value stream map. This additive feature of the VSM was put in by design. Build requirements for the years 2012 and beyond will likely require this addition to be developed and tested over the next two years.
4. The leadership team has agreed to work on standardizing the construction tasks which up to this point have not been tackled in a systematic way. The intent is to have a manual and training available for Crew Leaders and House Leaders to implement this standardization.