

# Shed Project Final Paper

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Team E2FG

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## **Introduction**

The Home Depot is widely renowned for quality products and reasonable prices. Team E2FG is excited to propose our strategy for producing a new line of garden sheds which we are positive will uphold the legacy which proceeds your company. This proposal will outline the specifics behind the shed's design along with how we plan on executing the project, with the goal of eliminating any doubts that might arise over the feasibility of a task of this magnitude. We are confident that the meticulous planning performed by E2FG has enabled us to far surpass the criteria described in the SOW, giving you the confidence to choose us to be part of your Home Depot team.

## **Phase One Work Breakdown Structure & Network Diagram**

The beginning of phase one involves work put in by our CEO, including tasks such as designing the organizational structure, determining the facility requirements, and building a team to carry out the project. This allows us to build a schedule and finalize the budget. From here, we get into the bread and butter of the project, the shed design. Every part of the shed, i.e. walls, roof and flooring, needs a rough draft and then a precise CAD design. From the detailed design, the needed pieces can be procured and processed. The top assembly involves everything surrounding pulling the separate parts together into one complete shed, and also involves steps such as design, procurements and manufacturing.

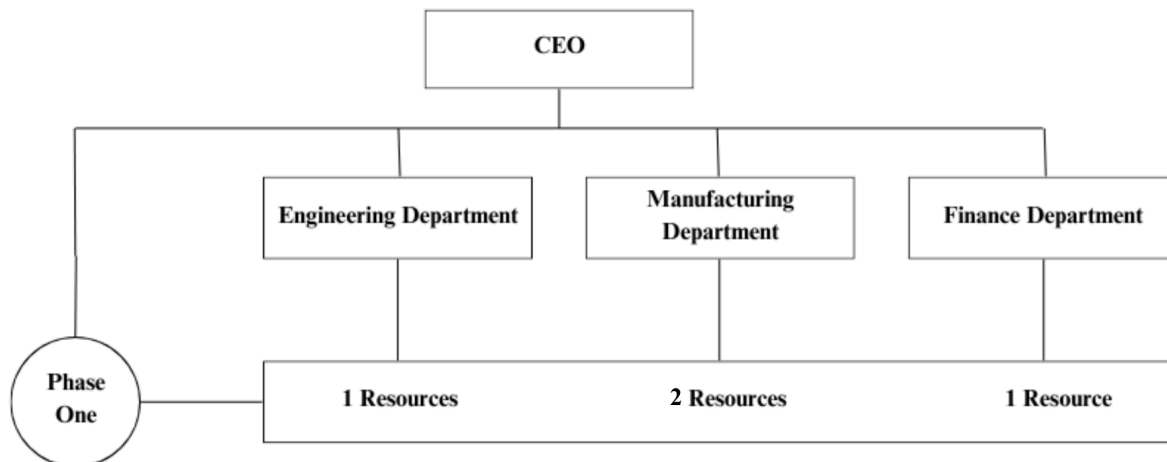
Phase one explicitly requires the timely delivery of the first five sheds, however the contract does not directly indicate how imperative it is to establish a framework for mass manufacturing. Our team identifies this necessity and for this reason, there are several work packages installed which focus on developing the procedures and documentation covering how the sheds should be constructed. This is done with the intent of streamlining shed production for phase two, so that once it comes time to produce, our team can hit the ground running. A detailed work breakdown structure and corresponding network diagram can be seen below.



## Phase One Management

For successful completion of this project, we need expertise in the fields of engineering, manufacturing and finance. Phase one will be largely focused on the design of the shed and the development of the procedures which will be used to produce the sheds in phase two. This design and development phase will require collaboration across all departments. The goal is to develop a product that balances an innovative design, feasibility of production, and a cost effective final product. To achieve the phase one requirements, E2FG decided that a matrix organizational structure will be the most appropriate to facilitate work. This structure will permit communication across departments, furthering the interconnectedness between the design, money and production.

Phase one resources consist of the core manager-level employees, one in the engineering department, one in manufacturing, and one in finance. Manufacturing will also have an additional hand from a laborer to help expedite the phase one production. All divisions can report to the CEO to help resolve any discrepancies. A visual representation of the organizational structure can be seen below.



*Figure 3: Phase One Organizational Structure*

## Phase One Scheduling

Using the information established in the WBS and the network diagram, an integrated master schedule was created. This schedule covers everything from the initial team assembly to the completion of the final shed. While creating the schedule, we realized that working 8 hour days was slightly overkill for completing phase one requirements. In order to throttle the speed of the project while simultaneously saving money, all employees are scheduled to work Monday through Friday, but only for 3 hour days. Using these ground rules and also building a week in as a buffer, we plan to start phase one April 21. From here, the first shed would be delivered the week of July 7th, the second on the week of July 28th, third August 19th. The fourth and fifth will follow on similar three week intervals. This schedule obeys the requirements established in the SOW, and can be seen in detail below.

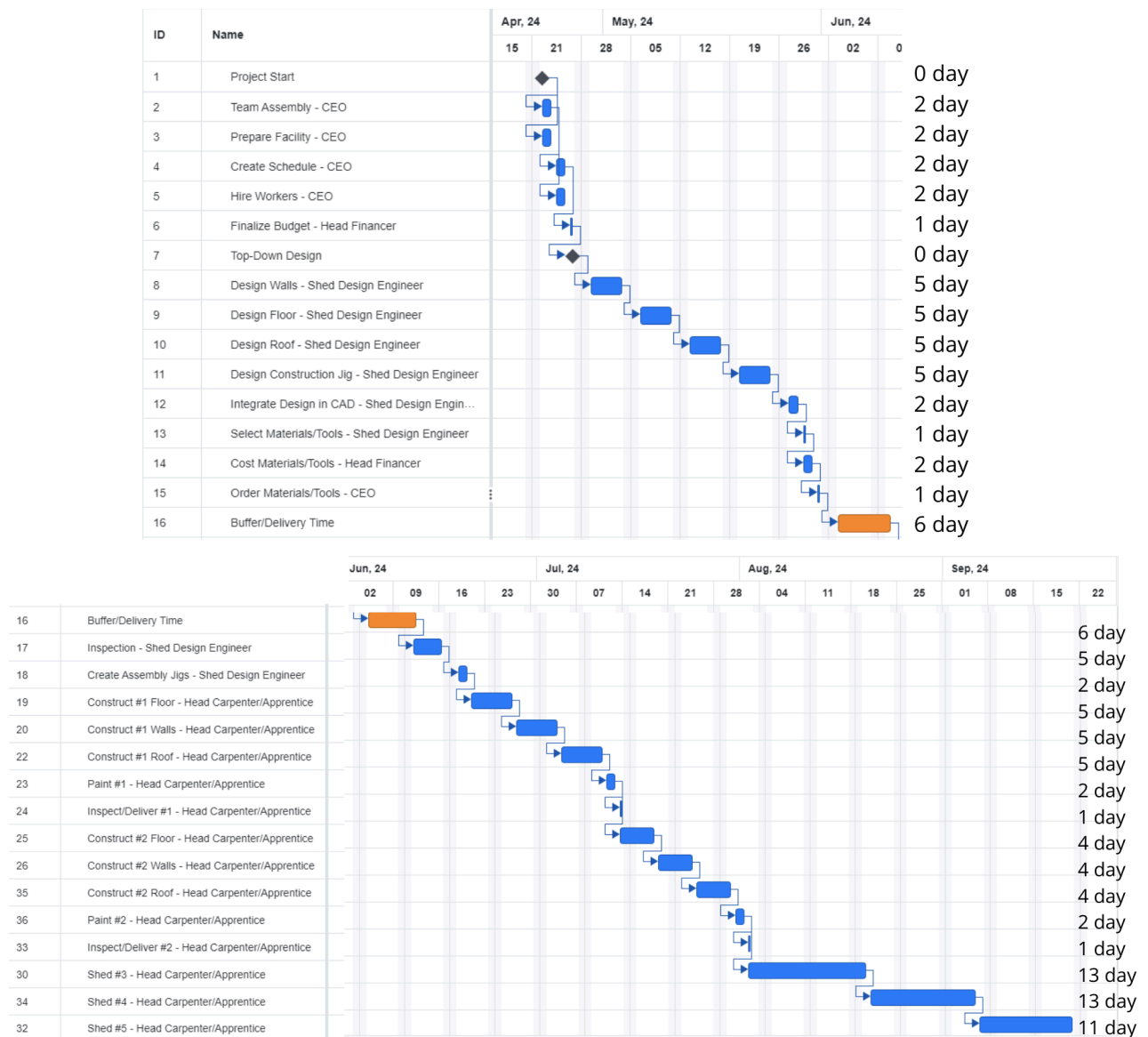


Figure 4: Phase One Integrated Master Schedule

## Shed Design



*Figure 5: Final Shed CAD*

Our shed has been designed extensively by our highly qualified engineer. Emphasis is placed in the quality of the final product, while simultaneously minimizing the material costs and production time. With an 8' x 8' footprint and a barn-style sloped roof, the shed is designed with quality materials, all directly selected from the Home Depot catalog. A full breakdown can be seen below.

<b>2x4</b>	Length (inch)	Quantity	96-X (leftover)	
	96	23	0	
	89	4	7	
	78.347	2	17.653	
	69.625	4	26.375	
	52.827	12	43.173	
	28.125	4	67.875	
Price Per	Total	49		
\$3.36	Total Needed:	45	Total Cost:	\$151.20
<b>4x4</b>	Length (inch)	Quantity	96-X (leftover)	
Price Per	96	3	0	
\$10.33	Total Needed:	3	Total Cost:	\$30.99
<b>48x96x19/32</b>	Length (inch)	Quantity	% of Full	
	96x48	10		
	48x24 Triangle	4	0.5	
	5.666x96 Rect	1	0.05902770833	
	96x1.5	4	0.015625	
Price Per	Total Unrounded	10.57465271		
\$33.98		10.75	Total Cost:	\$365.29
<b>Door Hinge</b>		Quantity		
Price Per		4		
\$7.93	Total Needed:	4	Total Cost:	\$31.72
<b>Corner Molding</b>	Length (inch)	Quantity		
Price Per	96	4		
\$10.94	Total Needed:	4	Total Cost:	\$43.76
<b>Metal Drip Edges</b>	Length (inch)	Quantity	120-X (leftover)	Price
	96	2	24	
Price Per	55.6666	4	64.3334	
\$4.98	Total Needed:	4	Total Cost:	\$19.92
<b>Latch</b>		Quantity		
Price Per		1		
\$6.27	Total Needed:	1	Total Cost:	\$6.27
<b>Vent</b>		Quantity		
Price Per		1		
\$7.57	Total Needed:	1	Total Cost:	\$7.57
<b>Paint (Grey)</b>	Area (ft^2)	Quantity (gal)	350 ft^2/gal	
Price Per 5 gal	343.5555547	0.981587299		
\$104.00				
PP gal				
\$20.80	Total Needed:	0.981587299	Total Cost:	\$20.42
<b>Paint (White)</b>	Area (ft^2)	Quantity (gal)	350 ft^2/gal	
Price Per 5 gal	27	0.07714285714		
\$104.00				
PP gal				
\$20.80	Total Needed:	0.07714285714	Total Cost:	\$1.60
<b>Shingles</b>	Area (ft^2)	Quantity (bnd)	33.33 ft^2/bundle	
Price Per Bundle	71.55555467	2.146881328		
\$36.42	Total Needed:	2.146881328	Total Cost:	\$78.19
<b>Leak Barrier</b>	Area (ft^2)	Quantity (roll)	150 ft^2/roll	
Price Per Roll	71.55555467	0.4770370311		
\$64.76	Total Needed:	0.4770370311	Total Cost:	\$30.89
<b>Paving Stones</b>	Area (ft^2)	Quantity (Stn)	1 ft^2/stone	
Price Per	64	64		
\$1.78	Total Needed:	64	Total Cost:	\$113.92
<b>Blue Stone</b>	Area (ft^3)	Quantity (bags)	0.5 ft^3/bag	
Price Per	16	32		
\$9.43	Total Needed:	32	Total Cost:	\$301.76
<b>Sand</b>	Area (ft^3)	Quantity (bags)	0.5 ft^3/bag	
Price Per	16	32		
\$4.93	Total Needed:	32	Total Cost:	\$157.76
<b>Estimation of Additional Supplies</b>				\$100.00
<b>Total Cost</b>				\$1,461.26

Figure 6: Final Parts List (One Shed)



The shed is designed in a fashion that reuses the same piece of lumber for multiple parts. This can be seen in the fact that there are 49 pieces in the shed that require 2” x 4” premium kiln dried studs, however we can cut that number down to 45 per shed by simply accounting for leftover materials during processing. Using this ideology throughout the project has saved us thousands of dollars. The shed design in phase one is anticipated to be identical to that in phase two, unless room for improvement is discovered during manufacturing.

In addition to the cost of the raw materials for building the sheds, we also need to account for the cost of tools that need to be purchased. Thanks to our extensive planning, we know how many staff will need to have tools in phase one along with in phase two. The tools will be purchased in phase one and be reused in phase two, therefore there is no need to repeat this purchase for the second phase. We brainstormed all the tools needed to construct a shed, as well as implemented a \$1000 buffer to account for any tools forgotten or any type of manufacturing fixture that we would want to construct. The price breakdown of all the tools is attached below.

Tool x(Quantity)	Price
Table Saw x1	\$330.00
Drills x5 + Batteries	\$600.00
Tape Measures x5	\$60.00
Rafter Squares x5	\$70.00
Hard Hat x5	\$125.00
Safety Glasses x12	\$17.50
48" Level x2	\$82.00
Electric Sander x2	\$40.00
Budget for DIY Tools	\$1,000.00
TOTAL	\$2,324.50

*Figure 7: Final Tool List*

## Facility Layout

Team E2FG knows that what makes us stand out will be our ability to manufacture the sheds quickly and consistently. For this reason, we decided to allocate a slightly larger budget on the facility, in order to have more real estate for construction. To be specific, the final dimensions came out to be 32' x 56', which yields a \$2986.666 per month rent charge.

Our facility is diligently designed for workflow, and includes space allotted for desk work and the square footage to store a week's worth of raw materials. The raw materials move from material processing, into walls and flooring and progress through paint and finishing. Similar to the shed design, we do not plan on altering the facility layout between phase one and two unless deemed necessary during actualization. The layout can be seen below and a simulated use case of our proposed warehouse can be seen in the 'Phase One Assembly Sequence' section.

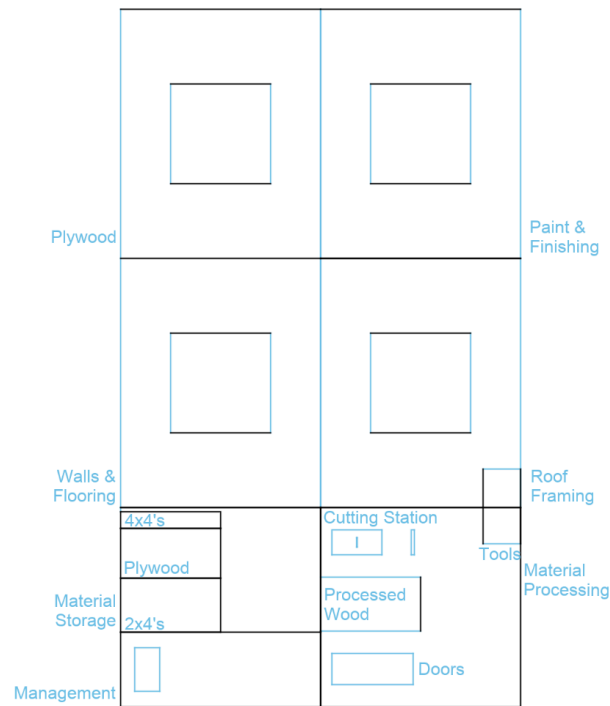
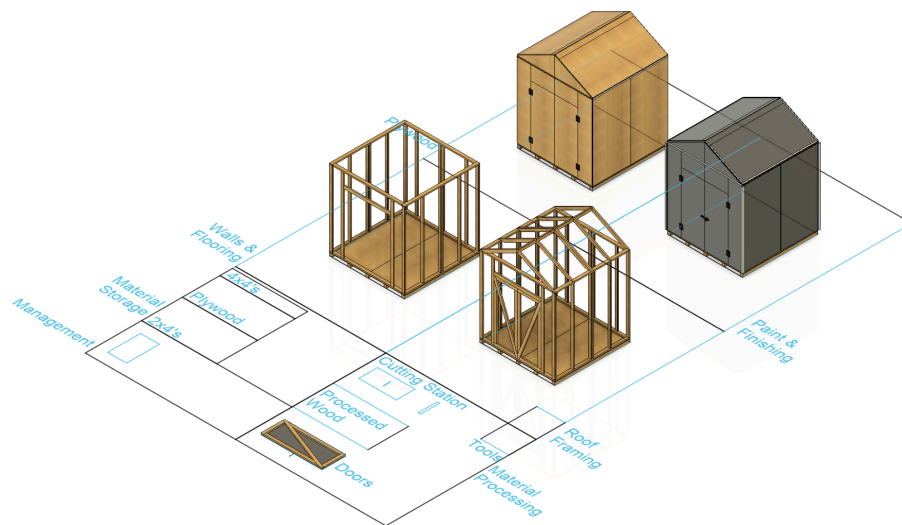


Figure 8: Facility Layout

## Phase One Assembly Sequence

As stated previously, the end goal of phase one is not only to deliver the 5 sheds in accordance with the schedule, but additionally develop the procedure to make phase two as efficient as possible. The task of the engineer, after the shed design, is to develop and revise the manufacturing process. By the end of phase one, we will have clear documentation on each step of the construction process, enabling us to hire cheaper labor and still receive quality results. It is believed that separating the shed building process into a four-step sequence will yield the best balance of efficiency to space. The engineer will work alongside the carpenters, continuously developing and documenting the optimal procedure through the entirety of phase one.



*Figure 9: Facility Simulated Use Case*

## Phase One Cost

Knowing everything that we know now, we are able to calculate the total cost of phase one. The price breakdown can be seen below.

5 Shed Cost: \$7,306.30

Total Overhead: \$2,324.50

Total Labor: \$10,218.75

Rent for 5 Months: \$14,933.33

Insurance for 5 Months: \$625

TOTAL: \$35,407.88

## Phase Two Work Breakdown Structure & Network Diagram

After a successful phase one, all of the shed and manufacturing design will have been completed. Phase two is when the rubber hits the road and mass manufacturing begins. This stage starts with re-evaluation and hiring of all the phase two labor resources, along with the assessment of the schedule and ground rules. The documents surrounding the processes for shed construction are also under continuous evaluation, with the hope of further improvements on efficiency. The labor flow in phase two is the same as in phase one, with the materials moving from station to station, eventually ending up with a finished product. This cycle of production and refinement will repeat until 100 sheds have been completed. The WBS and network diagram for phase two are attached below.

2 Phase Two					
<b>2.01</b>	<b>Project Management</b>	<b>2.02</b>	<b>Walls</b>	<b>2.03</b>	<b>Roof</b>
2.01.01	Determine Required Roles	2.02.03	Manufacturing	2.03.03	Manufacturing
2.01.01.01	Re-evaluate Labor Needs for Phase Two	2.02.03.01	Wood Processing	2.03.03.01	Wood Processing
2.01.01.02	Time Phased Labor Plan	2.02.04	Assembly	2.03.04	Assembly
2.01.01.03	Hire Phase Two Labor	2.02.04.01	Verify Assembly Procedure	2.03.04.01	Design Assembly Procedure
2.01.02	Examine requirements	2.02.04.02	Verify Tooling to Aid in Construction	2.03.04.02	Design Tooling to Aid in Construction
2.01.02.01	Verify Project Against SOW	2.02.04.03	Verify Doc. Describing Procedure	2.03.04.03	Create Doc. Describing Procedure
2.01.02.02	Verify Project Against WBS	2.02.04.04	Assemble Walls	2.03.04.04	Assemble Roof
2.01.02.03	Verify Project Against Network Diagram	2.02.04.05	Continuous Evaluation of Procedure	2.03.04.05	Continuous Evaluation of Procedure
2.01.03	Verify Ground Rules				
2.01.03.1	Verify Project Against IMS				

<b>2.04</b>	<b>Flooring</b>	<b>2.05</b>	<b>Top Assembly</b>
2.04.03	Manufacturing	2.05.01	Top Assembly
2.04.03.01	Wood Processing	2.05.01.01	Verify Integration Processing
2.04.04	Assembly	2.05.01.02	Verify Work Space Layout
2.04.04.01	Design Assembly Procedure	2.05.03	Manufacturing
2.04.04.02	Design Tooling to Aid in Construction	2.05.03.01	Verify Assembly Documentation
2.04.04.03	Create Doc. Describing Procedure	2.05.03.02	Prepare All Pieces for Assembly
2.04.04.04	Assemble Floor	2.05.04	Assembly
2.04.04.05	Continuous Evaluation of Procedure	2.05.04.01	Verify Assembly Procedure
		2.05.04.02	Verify Tooling and Fixturing
		2.05.04.03	Verify Doc. Describing Procedure
		2.05.04.04	Three Sheds per Week
		2.05.04.05	Five Sheds per Week
		2.05.04.06	Continuous Evaluation of Procedure

Figure 10: Phase Two Work Breakdown Structure

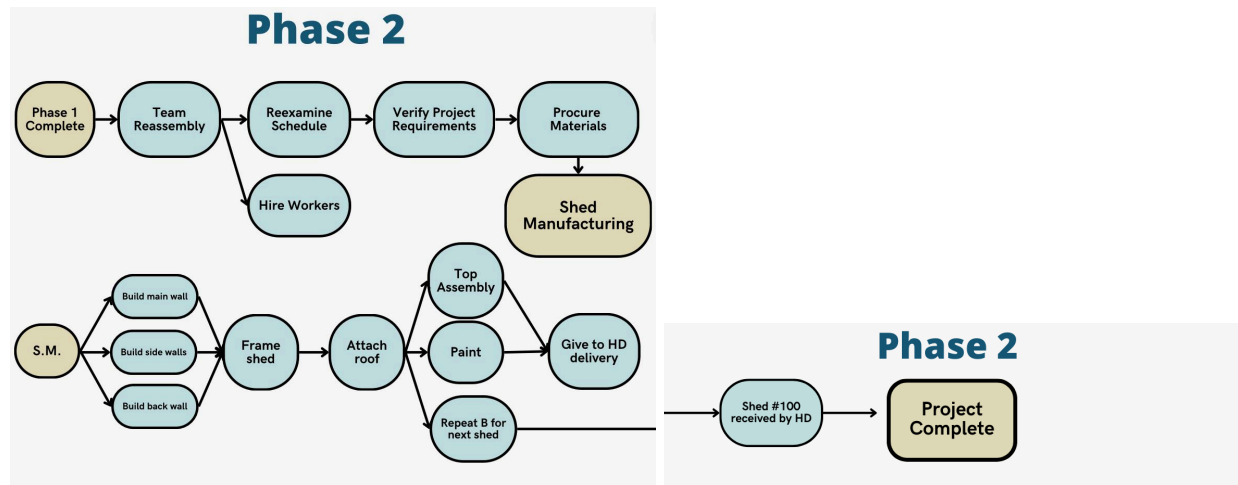
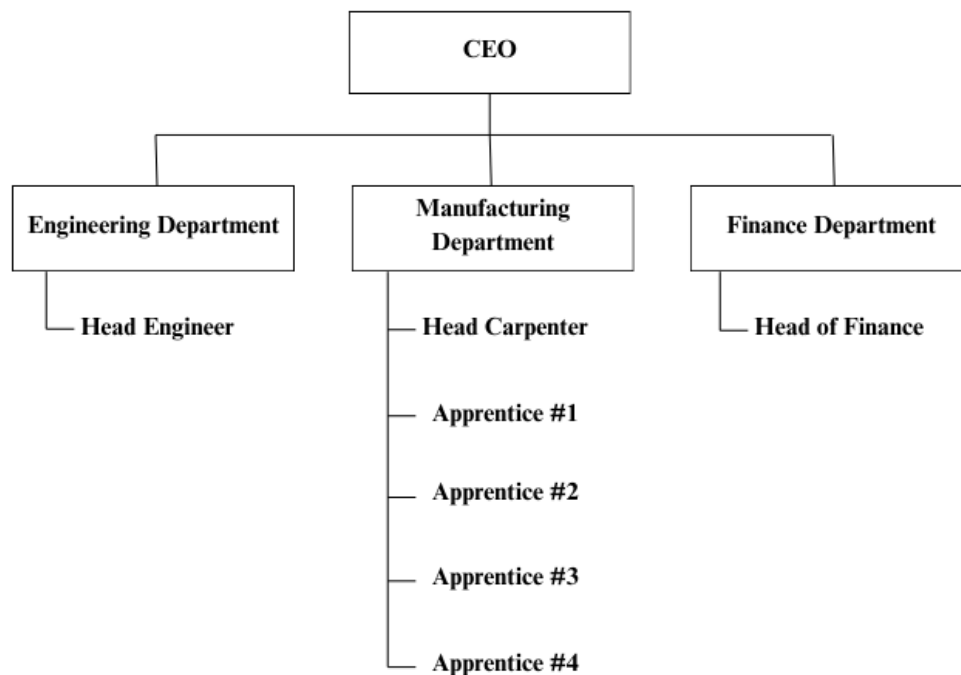


Figure 11: Phase Two Network Diagram

## Phase Two Management

The team goes into phase two with all the design work completed, all that is left to do is production. Compared to phase one, there is much less cross-department collaboration required. For this reason, in phase two the company will shift to a functional organizational structure. We will continue to hire the same core employees as in phase one, the one engineer, the two carpenters in manufacturing, and one worker in finance. The difference in phase two is that each station will be manned with its full-time assigned laborer. To cover this resource requirement, the team will hire four additional laborers, leaving the head of manufacturing and one extra laborer free to roam and assist where needed. The CEO will still be in reach if discrepancies arise. The organizational chart is visualized below.



*Figure 12: Phase Two Organizational Structure*

## Phase Two Scheduling

The first week of phase two is reserved for establishing all the organizational needs for phase two, such as team assembly and reevaluation of strategies. Week two begins production. The goal is to build five sheds a week off the bat, which we will be more than ready to achieve, considering the extensive planning leading up to this point. All phase two employees will work 8 hour days 5 days a week until all the work is finished. At a rate of five sheds per week, 100 sheds should be completed in 20 weeks, which is within the project specifications. The IMS for phase 2 can be seen below.

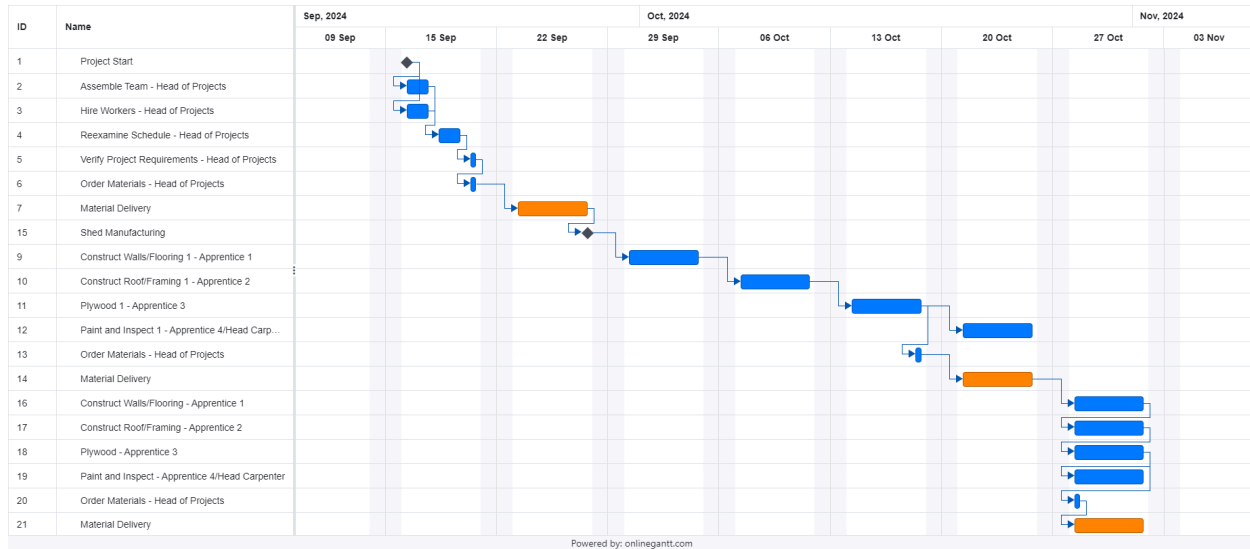


Figure 13: Phase Two Integrated Master Schedule

## Phase Two Assembly Sequence

The assembly in phase two will be determined by the testing in phase one, but will follow a set structure. The framing of the walls on the first shed will start at the beginning of the week, and when that station finishes, it progresses onto the following [roof framing] station. A new set of walls will start immediately in the first station. This progression will repeat, moving sheds sequentially through the stations until the final of the week's five sheds passes through the finishing station. This strategy minimizes the free time of the employees, ensuring that there is always work to be done. In addition to the four laborers designated to their specific stations, there is a spare laborer floating, ready to assist where needed. The head carpenter is the manager for the laborers and is also responsible for quality control. The engineer still works on optimizing the workflow and the finance worker still finances.

## Phase Two Costs

With the given information, we are able to calculate the total cost of phase two. The price breakdown can be seen below.

100 Sheds: \$146,126.00

Overhead: \$22,500.00

Labor: \$90,000.00

Rent for 5 Months = \$14,933.33

Insurance for 5 Months = \$625.00

TOTAL: \$274,184.33

## Conclusion

In conclusion, Team E2FG is eager to embark on the journey of producing a new line of garden sheds for Home Depot. Through meticulous planning and collaboration across departments, we have developed a comprehensive strategy, with a final cost for both phases summing up to \$309,592.21. Our project not only meets the requirements outlined in the statement of work but also exceeds expectations. From the detailed shed design to the streamlined manufacturing process, we are confident in our ability to deliver high-quality sheds that uphold Home Depot's legacy of quality and affordability. With a clear roadmap for both phase one and phase two, we are ready to hit the ground running and contribute to the success of Home Depot's product offerings. We look forward to the opportunity to collaborate and contribute to the growth and success of Home Depot's garden shed product line.

## References

- Palacio, Eduardo. *Project Management: EST 393*, Stony Brook University, Stony Brook, 2024.
- Pinto, Jeffrey K. *Project Management: Achieving Competitive Advantage*. Pearson, 2020.