

Pod Car Life Cycle Cost Estimation

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05/15/2019



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Problem, Scope, and Limitations



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Problem: Estimating the financial cost for the life-cycle of a pod car is going to be difficult since we neither have a physical full-scale prototype of the Pod Car nor the project has been developed yet

Scope: Life-cycle cost analysis which include material extraction, material processing, and manufacturing

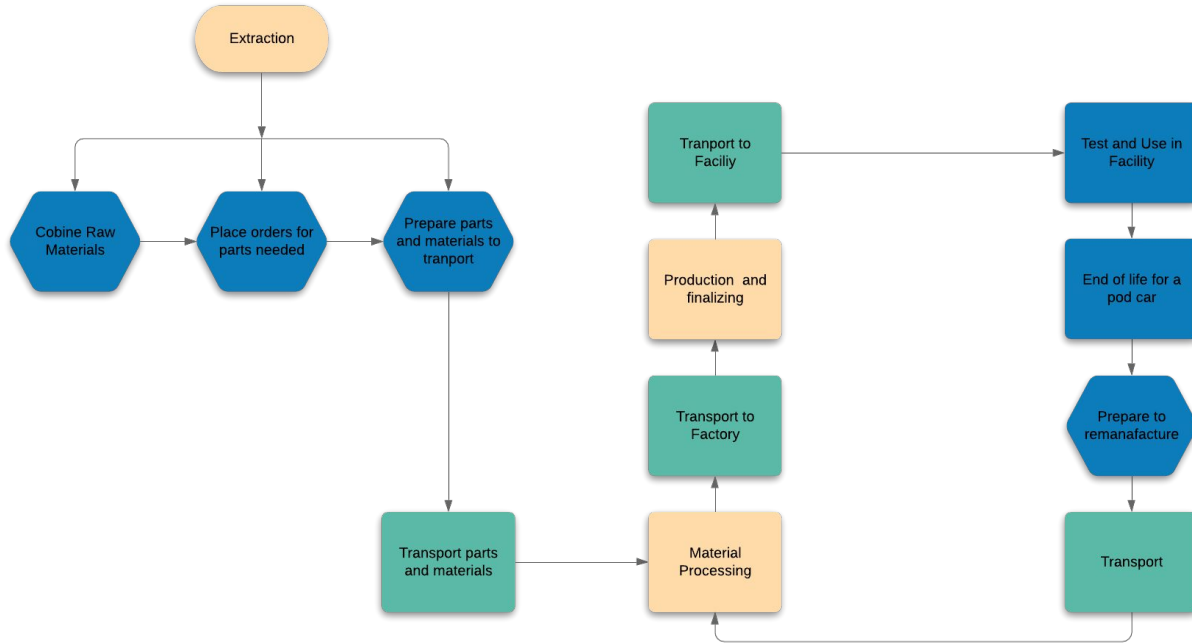
Limitations: The undertaken of this project has some limitation which include:

- The availability of cost as some will be estimated
- Adapting of new public transportation will likely present unforeseen challenges and cost

Life-Cycle Flowchart and 3 Wastes Identification



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Wastes:

- Overproduction
- Motion
- Defects

Similar Personal Rapid Transit (PRT) Systems Analysed



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	Metric	ULTra	Portland	West Virginia	Average	S.D.	Median	Range
Material Extraction	Material Cost	\$60,000	\$80,000	\$72,000	\$70,667	\$10,066	\$72,000	\$20,000
Material Processing	Annual Machine Maintenance Cost	\$30,000	\$20,000	\$20,000	\$23,333	\$5,774	\$20,000	\$10,000
	Annual Labor Cost per Worker	\$33,280	\$48,200	\$38,360	\$39,947	\$7,585	\$38,360	\$14,920
	Annual Machine Operation Cost	\$1,000,000	\$820,000	\$880,000	\$900,000	\$91,652	\$880,000	\$180,000
	Production Waste Management Cost	\$37,000	\$27,000	\$40,000	\$34,667	\$6,807	\$37,000	\$13,000
Manufacturing	Annual Maintenance Cost	\$200,000	\$124,000	\$90,000	\$138,000	\$56,321	\$124,000	\$110,000
	Transportaion Cost	\$180,000	\$210,000	\$169,000	\$186,333	\$21,221	\$180,000	\$41,000
	Annual Labor Cost	\$240,000	\$290,000	\$220,000	\$250,000	\$36,056	\$240,000	\$70,000
	Annual Operation Cost	\$200,000	\$230,000	\$180,000	\$203,333	\$25,166	\$200,000	\$50,000
	Product Waste Management Cost	\$180,000	\$270,000	\$175,000	\$208,333	\$53,463	\$180,000	\$95,000
	Total	\$2,576,888.00	\$4,873,200.00	\$2,259,660.00				

Three Recommendations to Propose



- Bill of materials (BOM)
 - Inventory of the raw material, assemblies, and parts as well as the quantity of each
- Labor cost
 - Manufacturing overhead, direct, and indirect labor
- Overhead cost
 - Indirect costs that does not generate revenue

Overhead Costs



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	Low Cost Estimate	High Cost Estimate	Average	\$ / Pod Car
Electricity, natural gas, water, and sewer for operating the manufacturing facilities and equipment.	\$ 200,000.00	\$ 270,000.00	\$ 235,000.00	\$ 7,833.00
Computer and communication systems for the manufacturing function.	\$ 15,000.00	\$ 30,000.00	\$ 22,500.00	\$ 750.00
Repair parts for the manufacturing equipment and facilities.	\$ 25,000.00	\$ 65,000.00	\$ 45,000.00	\$ 1,500.00
Supplies for operating the manufacturing process.	\$ 7,500.00	\$ 20,000.00	\$ 13,750.00	\$ 458.00
Depreciation on the manufacturing equipment and facilities.	\$ 10,000.00	\$ 70,000.00	\$ 40,000.00	\$ 1,333.00
Insurance and property taxes on the manufacturing equipment and facilities.	\$ 100,000.00	\$ 400,000.00	\$ 250,000.00	\$ 8,333.00
Safety and environmental costs.	\$ 250,000.00	\$ 400,000.00	\$ 325,000.00	\$ 10,833.00
Total	\$ 607,500.00	\$ 1,255,000.00	\$ 931,250.00	\$ 31,040.00

Overhead Costs Compared



	Spartan Superway / PodCar	ULTRA / Pod Car	Portland / Pod Car	West Virginia / Pod Car
Electricity, natural gas, water, and sewer for operating the manufacturing facilities and equipment.	\$ 7,833	\$ 15,368	\$ 14,308	\$ 13,072
Computer and communication systems for the manufacturing function.	\$ 750	\$ 1,471	\$ 1,370	\$ 1,252
Repair parts for the manufacturing equipment and facilities.	\$ 1,500	\$ 2,943	\$ 2,740	\$ 2,503
Supplies for operating the manufacturing process.	\$ 458	\$ 899	\$ 837	\$ 765
Depreciation on the manufacturing equipment and facilities.	\$ 1,333	\$ 2,616	\$ 2,435	\$ 2,225
Insurance and property taxes on the manufacturing equipment and facilities.	\$ 8,333	\$ 16,349	\$ 15,221	\$ 13,906
Safety and environmental costs.	\$ 10,833	\$ 21,254	\$ 19,788	\$ 18,078
Total	\$ 31,040	\$ 60,900	\$ 56,700	\$ 51,800

- ULTra is 2x
- Portland is 1.8x
- WV is 1.8x

Overhead Costs Compared After Being Scaled Down



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	\$ / Pod Car	ULTRA Shrunked / Pod Car	Portland Shrunked / Pod Car	West Virginia Shrunked / Pod Car
Electricity, natural gas, water, and sewer for operating the manufacturing facilities and equipment.	\$ 7,833	\$ 7,684	\$ 7,949	\$ 7,262
Computer and communication systems for the manufacturing function.	\$ 750	\$ 736	\$ 761	\$ 695
Repair parts for the manufacturing equipment and facilities.	\$ 1,500	\$ 1,471	\$ 1,522	\$ 1,391
Supplies for operating the manufacturing process.	\$ 458	\$ 450	\$ 465	\$ 425
Depreciation on the manufacturing equipment and facilities.	\$ 1,333	\$ 1,308	\$ 1,353	\$ 1,236
Insurance and property taxes on the manufacturing equipment and facilities.	\$ 8,333	\$ 8,174	\$ 8,456	\$ 7,726
Safety and environmental costs.	\$ 10,833	\$ 10,627	\$ 10,993	\$ 10,043
Total	\$ 31,040	\$ 30,450	\$ 31,500	\$ 28,778

- P = 0.0347
- Costs are feasible

Labor Roles



Roles	Salary /year	Number of Workers	Total cost of all workers
Project Manager	\$90,000	1	\$90,000
HR Manager	\$96,000	1	\$96,000
Electrician	\$67,648	3	\$202,944
Mechanic	\$51,997	5	\$259,985
Operating machinery	\$54,000	2	\$108,000
Quality Conrtol Manufacturing Eng	\$82,126	1	\$82,126
factory workers	\$38,000	9	\$342,000
Health and Safety	\$78,000	1	\$78,000
Technician	\$42,000	5	\$210,000
Total Labor Cost	\$1,469,055		Total Cost
Total Cost/Pod Car	\$48,968.50	Manufacturing overhead labor	\$462,929
		Direct labor	\$820,126
		Indirect labor	\$186,000

- Direct Labor is the highest amongst all three
- Manufacturing overhead had only two roles

Labor Costs Compared



	Spartan SuperWay	Ultra	Portland	WVM
Manufacturing overhead labor	\$462,929	\$298,000	\$492,000	\$418,000
Direct Labor	\$820,126	\$639,000	\$612,000	\$647,000
Indirect labor	\$186,000	\$95,000	\$159,000	\$167,000
Total Labor Cost	\$1,469,055	\$1,032,000	\$1,263,000	\$1,232,000
Total Cost/Pod Car	\$48,968	\$34,400	\$42,100	\$41,066

- Ultra had the lowest cost per PodCar
- Spartan Superway was the highest

BOM Cost



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Part Name	Quantity	Description	Cost
Wheel	4	Iron	\$400
Chassis bar	4	Every corner.	\$400
Sensor	1	Electronic	\$700.00
Sliding Doors	2	Fiber Glass. Need to be order specifcly for the	\$800.00
Battery	1	Supercapacitor	\$1,600.00
Motor	1	EM2332T 10HP, 1180RPM, 3PH, 60HZ, 256T, 0960M, TEFC, F1	\$1,750
Cabin Parts	6	Fiber Glass, and Glass (inside the cabin) Incuding floor, sides, top.	\$1,600.00
Headset	kit	In order to make any announcement	\$500.00
Seat	6	Plastic Type	\$250.00
Boday Parts	4	Fiber Glass. Need to be order specifcly for the	\$5,000.00
Lights	4	Front lights back lights. (outside)	\$4,000.00
Lights(inside)	kit	Inside lights (inside)	\$1,000
AC	1	Air Condition	\$1,200.00
Windows	8	Including doors window, windshield, side windows and back windows.	\$8,000.00
Total			\$27,200.00

- BOM of Spartan Superway that shows the quantity of each item, and is used to analyze the cost of the product.

BOM Compared



	Spartan Superway	ULTra	West Virginia	Portland
BOM Total Cost	\$27,000.00	\$60,000.00	\$72,000.00	\$80,000.00

- Portland is 3x bigger than Spartan Superway
- WV used more material than Spartan Superway

BOM After Scale Down



	Spartan Superway	ULtra	West Virginia	Portland
BOM Total Cost	\$27,000.00	\$30,000.00	\$28,800.00	\$25,806.00

- Portland is 3x bigger than Spartan Superway
- ULtra expenses are 2x more than Spartan Superway
- West Virginia used more material than Spartan Superway

Pod Car Lifecycle Costs



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Thank You!

- **Dr. Burford Furman**
- **Ron Swenson**
- **Dr. Baruch Saeed**



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**CHARLES W. DAVIDSON
COLLEGE OF ENGINEERING**