Team Project: DEVELOPMENT OF EDIBLE WATER BOTTLE

Course Title: Project Management
Course Number: ETM 545/645
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PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

Objective: To develop Nutritious Edible Water Bottle.

Overview: Our aim is to develop an Edible Water Bottle. This is a business idea to generate revenue for our start-up company and also contribute a bit for the environment and its green future. It is estimated that in US alone every year, 17million barrels of oil is used up to make 50 billion plastic bottle cans per year. And out of this only 23% is recycled resulting in a loss of over $1 million. On the flipside it can add value to people's life, athletes, trekkers, hikers, mountain climbers, sailors, air passengers, astronauts can carry this Edible Water bottle with them, as it quenches their thirst and gives them nutrition at same time, also minimizing their back pack or storage sizes. None the less, it's a challenge for us to take up this project as it's one of a kind and never been done before!

Scope: To synthesise Edible Water bottle, Proto type produce it, test it and get approval from FDA (US. Food and Drug Approval) and hand over it to Manufacturing for mass production.

Estimated Budget: Company has assigned a budget of$500,000 for this Project. To justify we came up with this number after a bottom up analysis of our deliverables and work break down structure (WBS).

Resources: This project will be conducted in a "Functional" type of Organization. We came up with these resource personnel count after a bottom up analysis of our deliverables and work break down structure (WBS).

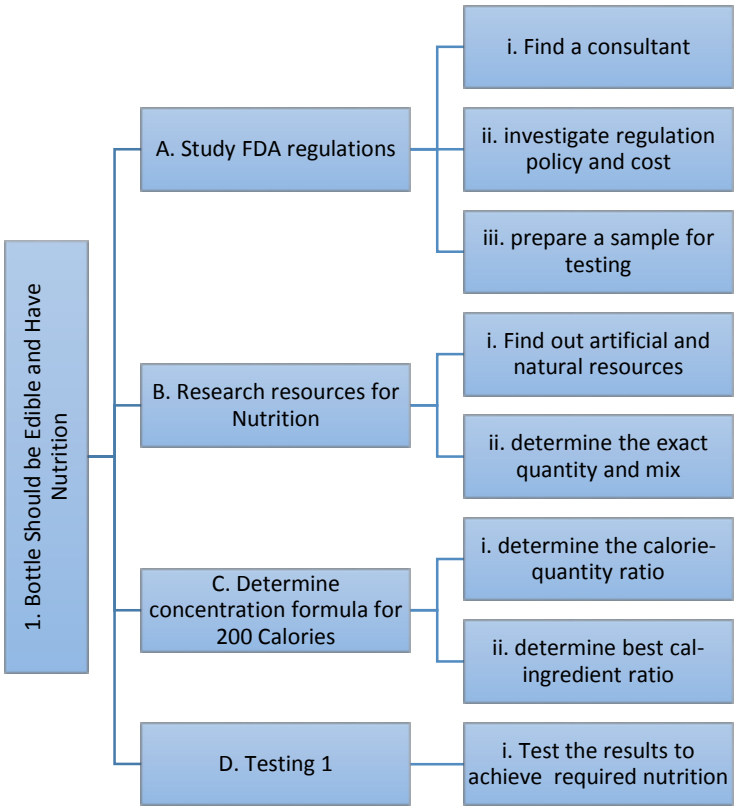
- Nutrition Scientists – 2
- Chemical/Polymer Scientists – 2
- Lab Technicians – 4
- Analytical Data Scientist – 1
- FDA consultant – 1
- R&D Manager – 1

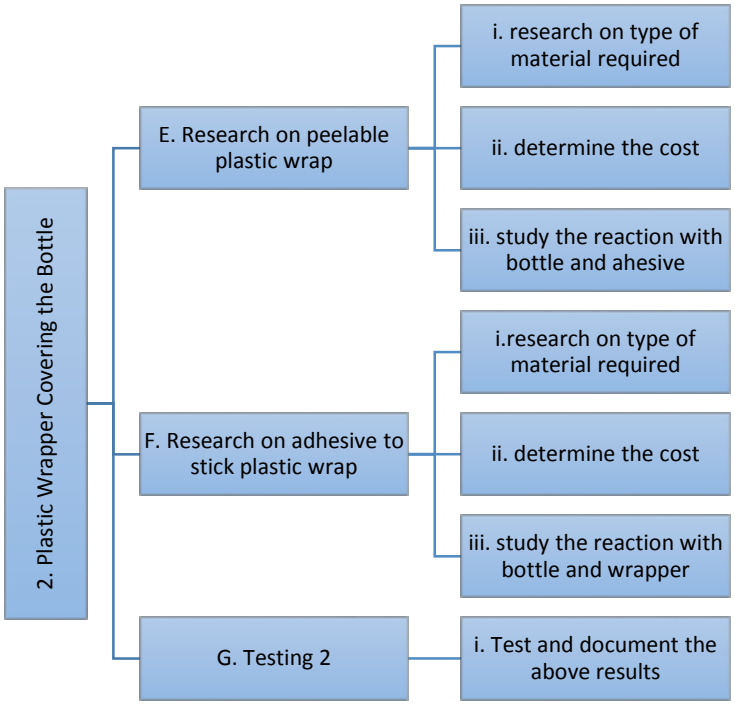
Deliverables: The project can be split up in to the following main deliverables, which has to be monitored.

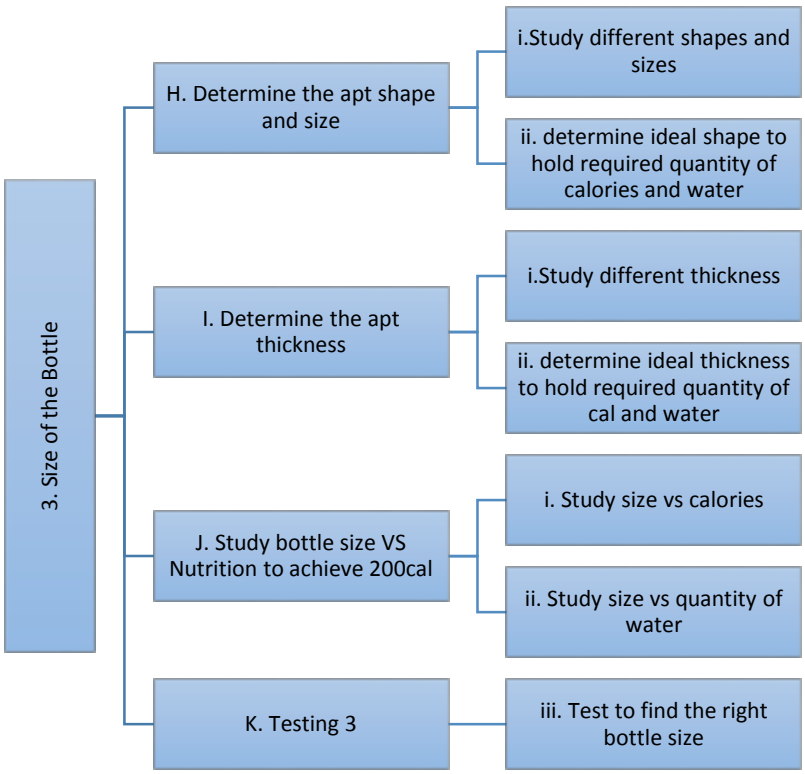
1. Bottle should be Edible and Have Nutrition – One bottle after consumption should give 200 calories along with other nutrition like Vitamins and Minerals and be approved by the FDA, to be certified as safe for consumption.
2. Plastic Wrapper Covering the Bottle - this must easily peel able.
3. Size of the Bottle - should be such that it should hold a minimum of 3ooml of water.
4. Shelf Life – The water bottles must have a storage life of 6 months.
5. Taste of Water – Just because the bottle is edible, it shouldn't dissolve or change water taste
6. Bottle Flavour and Colour – The bottle could have colours and flavours to make it attractive.
7. FDA Approval – set up lab and proto test and co operate

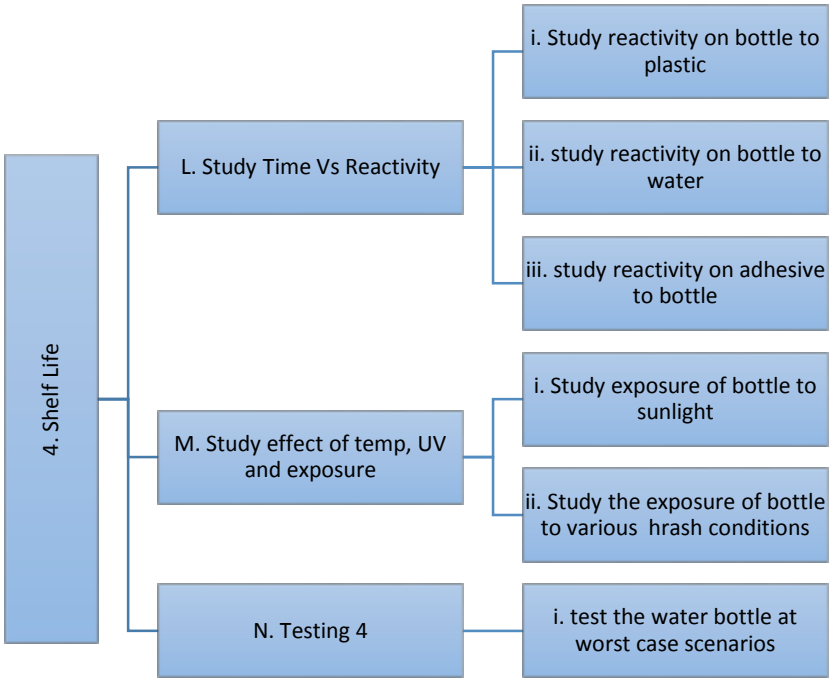
APPENDIX A:

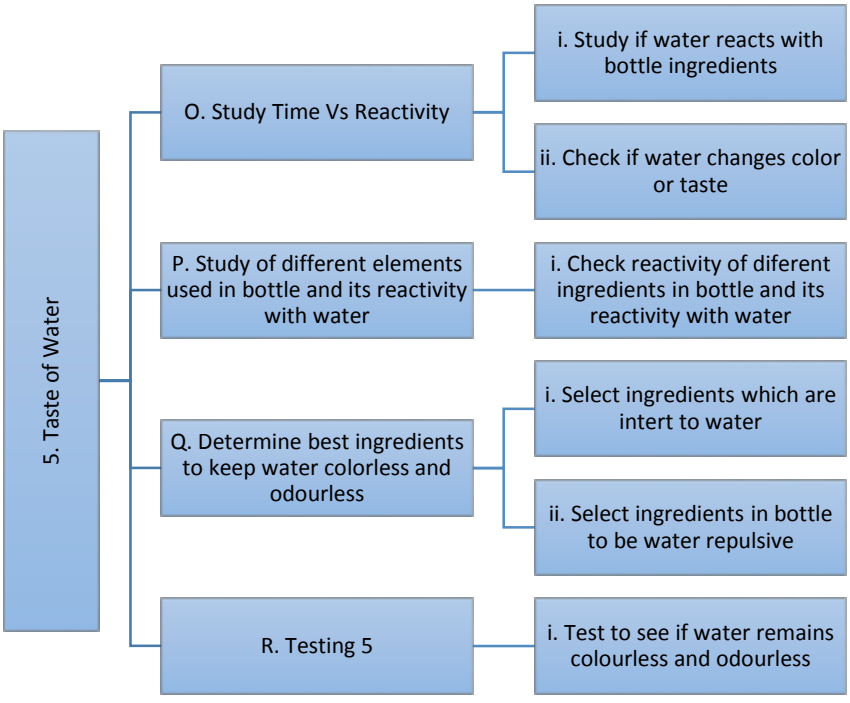
Work Break down Structure (WBS): The above deliverables can be further broken down in to following WBS to get the work done in a systematic way.

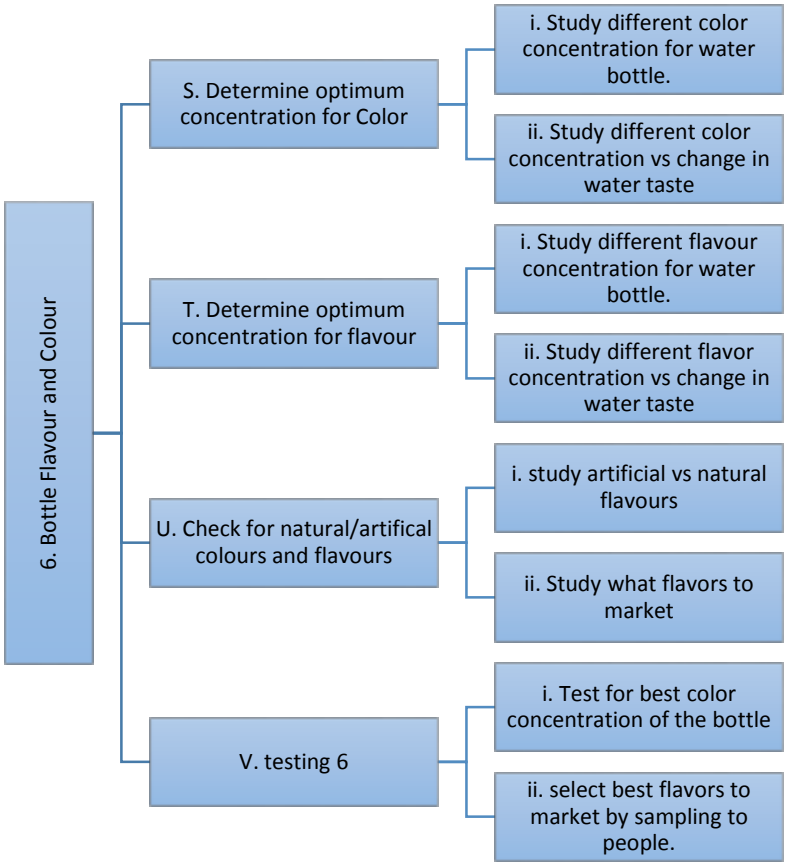


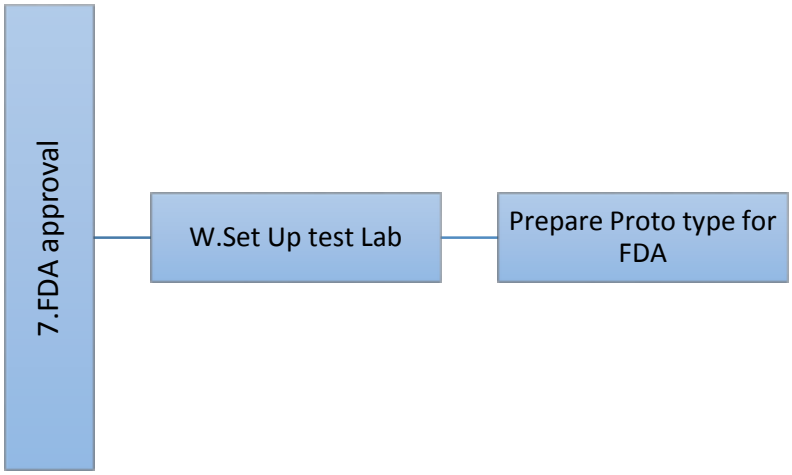

2. Plastic Wrapper Covering the Bottle
E. Research on peelable plastic wrap
i. research on type of material required
ii. determine the cost
iii. study the reaction with bottle and ahesive
F. Research on adhesive to stick plastic wrap
i.research on type of material required
ii. determine the cost
iii. study the reaction with bottle and wrapper
G. Testing 2
i. Test and document the above results


3. Size of the Bottle
H. Determine the apt shape and size
i.Study different shapes and sizes
ii. determine ideal shape to hold required quantity of calories and water
I. Determine the apt thickness
i.Study different thickness
ii. determine ideal thickness to hold required quantity of cal and water
J. Study bottle size VS Nutrition to achieve 200cal
i. Study size vs calories
ii. Study size vs quantity of water
K. Testing 3
iii. Test to find the right bottle size


4. Shelf Life
L. Study Time Vs Reactivity
i. Study reactivity on bottle to plastic
ii. study reactivity on bottle to water
iii. study reactivity on adhesive to bottle
M. Study effect of temp, UV and exposure
i. Study exposure of bottle to sunlight
ii. Study the exposure of bottle to various hrash conditions
N. Testing 4
i. test the water bottle at worst case scenarios


5. Taste of Water
O. Study Time Vs Reactivity
i. Study if water reacts with bottle ingredients
ii. Check if water changes color or taste
P. Study of different elements used in bottle and its reactivity with water
i. Check reactivity of diferent ingredients in bottle and its reactivity with water
Q. Determine best ingredients to keep water colorless and odourless
i. Select ingredients which are intert to water
ii. Select ingredients in bottle to be water repulsive
R. Testing 5
i. Test to see if water remains colourless and odourless





APPENDIX B:

RACI Matrix:

The resources are allocated with the tasks as follows:

PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

1 Actual Responsibility
2 General supervision
3 Must be consulted
4 May be consulted
5 Must be notified
6 Final approval

Number	Deliverable and Tasks	RESOURCES										
		R&D Manager	Neutrition scientist# 1	Neutrition scientist # 2	Polymer scientist # 1	Polymer scientist # 2	Lab Tech# 1	Lab Tech # 2	Lab Tech #3	Lab Tech #4	Analytical scientist 1	FDA consultant
# 1	Bottle should be eddible and have neutritions											
A	Study FDA Regulation	1	3	3								1
B	Research Resources for	4	1	1			1	1				
C	Determine Concentration Formula for 200 Calories	3	2	2			1	1				
D	Testing 1	5	5	5			1				1	6
# 2	Plastic wrapper covering bottle											
E	wrap	5	4	4	1	3			1			
F	wrap	5			3	1				1		
G	Testing				5	5				1	1	
# 3	Size of bottle											
H	Determine the shape and size of bottle	6	4	4	1		1					
I	Determine the thickness of bottle		5	1	1	5		1	1			4
J	Study bottle size vs Nutrition to achive 200 calories		1	5	5	1	1			1		4
k	Testing 2		4	5	5	5	5			1	1	
# 4	Shelf life											
L	Study Time Vs Reactivity	5	1	4			1					
M	Study effect of temp, UV and	5		1	4	4		1				
N	Testing 3			4						1	1	4
# 5	Taste of water											
O	Study Time Vs Reactivity	5	1	4	1	4	1	4			4	
P	Study different elements in water bottle and reactivity with	5	4	1	4	1	4	1			4	
Q	Determine best ingredients to keep water colorless and		1	1	4	4		1	1			
R	Testing											
# 6	bottle flavor and color											
S	Determine Optimum concentration of color	4	1	5			1	1				5
T	Determine optimum concentration for flavour		5	1	4	4	1					5
U	Check for natural/artificial colors and flavorurs		1	4	4		1					
V	Testing 4		1	1			1	1			1	5
#7	FDA approval											
W	Set up Lab and Sample	5	5	5	5	5						1

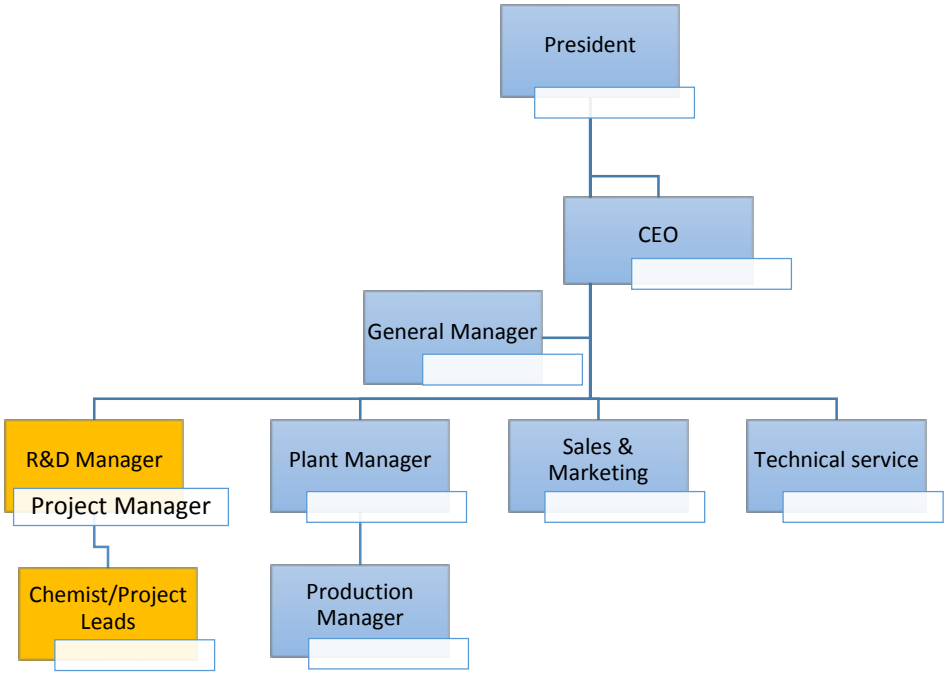
PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

APPENDIX C:

The Project we have chosen takes place in a "**Functional Organization**" Where experts can be temporarily assigned to a project, make required contributions and immediately reassigned to their normal work.

The Project takes place in the R&D department and The Project is headed by the R&D Manger who also acts as a Project Manager for the "Development of Edible Water Bottle Project"

A figure of the positioning of your project relative to the rest of the organization is as below: (Marked in orange)



APPENDIX D and G: Open calculations for clear view: Group Project caluclations_latest.xlsx

GANT CHART and a summary/aggregate baseline schedule, including milestones/phase gates is as below:

1. Planned Completion
2. Actual completion
3. Report/status date
4. Mile stone planned
5. Mile stone achieved
6. Planned progress
7. Actual progress

PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

number	Tasks and Subtasks	Est. Duration weeks	task	Predecessor	Wk1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20	Wk 21	Wk 22	Wk 23	Wk 24	Wk 25	Wk 26	Wk 27	Wk 28	Wk 29	Wk 30	Wk 31	Wk 32	Wk 33	Wk 34	Wk 35	Wk 36	Wk 37	Wk 38	Wk 39	Wk 40	Wk 41	Wk 42	Wk 43	Wk 44	Wk 45	Wk 46	Wk 47	Wk 48	Wk 49	Wk 50	Wk 51	Wk 52
A	Study FDA Regulation	5	A						4																																												
1.1	•Find a consultant	1																																																			
1.2	•. investigate regulation policy and cost	2																																																		
1.3	•prepare a sample for testing	2																																																		
B	Research resources for Nutrition	2	B	a						4																																											
1.4	•. Find out artificial and natural resources	1																																																		
1.5	•determine the exact quantity and mix	1																																																		
C	Determine concentration formula for 200 Calories	3	C	a,b																																																	
1.6	•determine the calorie-quantity ratio	1.5																																																		
1.7	•determine best cal-ingredient ratio	1.5																																																		
D	Testing	2	D	c																																																	
1.8	•Test the results to achieve required nutrition	2																																																		
E	Research on Peelable Plastic wrap	2	E	a																																																	
2.1	•research on type of material required	1																																																			
2.2	•determine the cost	0.5																																																		
2.3	•determine the cost	0.5																																																		
F	Research on adhesive for plastic wrap	1	F	e																																																	
2.4	•research on type of material required	0.25																																																		
2.5	•determine the cost	0.25																																																		
2.6	•study the reaction with bottle and wrapper	0.5																																																		
G	Testing	2	G	f																																																	
2.7	Testing	2																																																		
H	Determine the shape and size of bottle	4	H	a																																																	
3.1	•Study different shapes and sizes	2																																																		
3.2	•determine ideal shape to hold required quantity of	2																																																	
I	Determine the thickness of bottle	6	I	h																																																	
3.3	•Study different thickness	2																																																		
3.4	•determine ideal thickness to hold required quantity of	4																																																	
J	Study bottle size vs Nutrition to achive 200 calories	5	J	i																																																
3.5	•Study size vs calories	2																																																		
3.6	•Study size vs quantity of water	3																																																	
k	Testing	2	K	j																																																
3.7	Testing	2																																																	
L	Study Time Vs Reactivity	2	L	j,u,																																																
4.1	•Study reactivity on bottle to plastic	0.5																																																	
4.2	•study reactivity on bottle to water	0.5																																																	
4.3	•study reactivity on adhesive to bottle	1																																																	
M	Study effect of temp, UV and exposure	6	M	j																																																
4.4	•Study exposure of bottle to sunlight	2																																																	
4.5	•Study the exposure of bottle to various hrash conditions	4																																																	
N	Testing 3	2	N	m																																																
4.6	•test the water bottle at worst case scenarios	2																																																	
O	Study Time Vs Reactivity	2	O	d																																																
5.1	•Study if water reacts with bottle ingredients	1																																																
5.2	•Check if water changes color or taste	1																																																
P	Study different elements in water bottle and reactivity	4	P	d																																																
5.3	•Check reactivity of different ingredients in bottle and its	4																																																
Q	Determine best ingredients to keep water colorless and	3	Q	o,p																																															
5.4	•Select ingredients which are intert to water	1																																																
5.5	•Select ingredients in bottle to be water repulsive	2																																																
R	Testing	1	R	q																																																
5.6	•Test to see if water remains colourless and odourless	1																																																
S	Determine Optimum concentration of color	1	S	j																																																
6.1	•Study different color concentration for water bottle.	0.5																																																
6.2	•Study different color concentration vs change in water	0.5																																																
T	Determine optimum concentration for flavour	6	T	j																																																
6.3	•Study different flavour concentration for water bottle.	2																																																
6.4	taste	4																																																	
U	Check for natural /artificial colors and flavorurs	8	U	t																																															
6.5	•study artificial vs natural flavours	5																																																
6.6	•Study what flavors to market	3																																																
V	Testing 4	8	V	u																																															
6.7	•Test for best color concentration of the bottle	3																																																
6.8	•select best flavors to market by sampling to people.	5																																																
W	Get the approval	10	W	v																																														
7.1	FDA approval	10																																																1

PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

Appendix E: open excel calculations for clear view: Group Project caluclations latest.xlsx

Bottom up Time phased Project budget:

Deliverables		Tasks & Subtasks	Est. Duration weeks	Est. Duration in Hours	Optimistic	Most Likely Calculated Duration	Pessimistic	Three point Estimation	Resources	Effort (hours)	Cost/week	Cost/task
Bottle should be edible and nutrituious	A	Study FDA Regulation	5	200	190	200	250	206.67	2	16.00	1200	6000.00
	1.1	•Find a consultant	1	40	38	40	50.00	41.33				1200.00
	1.2	•. investigate regulation policy and cost	2	80	76	80	100.00	82.67				2400.00
	1.3	•prepare a sample for testing	2	80	76	80	100.00	82.67				2400.00
	B	Research resources for Nutrition	2	80	76	80	100	82.67	4	80.00	6000	12000.00
	1.4	•. Find out artificial and natural resources	1	40	38	40	50.00	41.33		0.00	0	6000.00
	1.5	•determine the exact quantity and mix	1	40	38	40	50.00	41.33		0.00	0	6000.00
	C	Determine concentration formula for 200 Calories	3	120	114	120	150	124.00	2	26.67	2000	6000.00
	1.6	•determine the calorie-quantity ratio	1.5	60	57	60	75.00	62.00		0.00	0	3000.00
	1.7	•determine best cal-ingredient ratio	1.5	60	57	60	75.00	62.00		0.00	0	3000.00
	D	Testing 1	2	80	76	80	100	82.67	2	40.00	3000	6000.00
	1.8	•Test the results to achieve required nutrition	2	80	76	80	100.00	82.67		0.00	0	6000.00
Plastic wrapper covering bottle	E	Research on Peelable Plastic wrap	2	80	76	80	100	82.67	2	40.00	3000	6000.00
	2.1	•research on type of material required	1	40	38	40	50.00	41.33		0.00	0	3000.00
	2.2	•determine the cost	0.5	20	19	20	25.00	20.67		0.00	0	1500.00
	2.3	•determine the cost	0.5	20	19	20	25.00	20.67		0.00	0	1500.00
	F	Research on adhesive for plastic wrap	1	40	38	40	50	41.33	2	80.00	6000	6000.00
	2.4	•research on type of material required	0.25	10	9.5	10	12.50	10.33		0.00	0	1500.00
	2.5	•determine the cost	0.25	10	9.5	10	12.50	10.33		0.00	0	1500.00
	2.6	•study the reaction with bottle and wrapper	0.5	20	19	20	25.00	20.67		0.00	0	3000.00
	G	Testing 2	2	80	76	80	100	82.67	2	40.00	3000	6000.00
	2.7	Testing	2	80	76	80	100.00	82.67		0.00	0	6000.00
Size of bottle	H	Determine the shape and size of bottle	4	160	152	160	200	165.33	2	20.00	1500	6000.00
	3.1	•Study different shapes and sizes	2	80	76	80	100.00	82.67		0.00	0	3000.00
	3.2	•determine ideal shape to hold required quantity of calories and water	2	80	76	80	100.00	82.67		0.00	0	3000.00
	I	Determine the thickness of bottle	6	240	228	240	300	248.00	4	26.67	2000	12000.00
	3.3	•Study different thickness	2	80	76	80	100.00	82.67		0.00	0	4000.00
	3.4	•determine ideal thickness to hold required quantity of cal and water	4	160	152	160	200.00	165.33		0.00	0	8000.00
	J	Study bottle size vs Nutrition to achive 200 calories	5	200	190	200	250	206.67	4	32.00	2400	12000.00
	3.5	•Study size vs calories	2	80	76	80	100.00	82.67		0.00	0	4800.00
	3.6	•Study size vs quantity of water	3	120	114	120	150.00	124.00		0.00	0	7200.00
	k	Testing 3	2	80	76	80	100	82.67	2	40.00	3000	6000.00
	3.7	Testing	2	80	76	80	100.00	82.67		0.00	0	6000.00
Shelf life	L	Study Time Vs Reactivity	2	80	76	80	100	82.67	2	40.00	3000	6000.00
	4.1	•Study reactivity on bottle to plastic	0.5	20	19	20	25.00	20.67		0.00	0	1500.00
	4.2	•study reactivity on bottle to water	0.5	20	19	20	25.00	20.67		0.00	0	1500.00
	4.3	•study reactivity on adhesive to bottle	1	40	38	40	50.00	41.33		0.00	0	3000.00
	M	Study effect of temp, UV and exposure	6	240	228	240	300	248.00	2	13.33	1000	6000.00
	4.4	•Study exposure of bottle to sunlight	2	80	76	80	100.00	82.67		0.00	0	2000.00
	4.5	•Study the exposure of bottle to various hrash conditions	4	160	152	160	200.00	165.33		0.00	0	4000.00
	N	Testing 4	2	80	76	80	100	82.67	2	40.00	3000	6000.00
	4.6	•test the water bottle at worst case scenarios	2	80	76	80	100.00	82.67		0.00	0	6000.00
Taste of water	O	Study Time Vs Reactivity	2	80	76	80	100	82.67	3	60.00	4500	9000.00
	5.1	•Study if water reacts with bottle ingredients	1	40	38	40	50.00	41.33		0.00	0	4500.00
	5.2	•Check if water changes color or taste	1	40	38	40	50.00	41.33		0.00	0	4500.00
	P	Study different elements in water bottle and reactivity with water	4	160	152	160	200	165.33	3	30.00	2250	9000.00
	5.3	•Check reactivity of diferent ingredients in bottle and its reactivity with water	4	160	152	160	200.00	165.33		0.00	0	9000.00
	Q	Determine best ingredients to keep water colorless and Odorless	3	120	114	120	150	124.00	4	53.33	4000	12000.00
	5.4	•Select ingredients which are intert to water	1	40	38	40	50.00	41.33		0.00	0	4000.00
	5.5	•Select ingredients in bottle to be water repulsive	2	80	76	80	100.00	82.67		0.00	0	8000.00
	R	Testing 5	1	40	38	40	50	41.33	4	160.00	12000	12000.00
	5.6	•Test to see if water remains colourless and odourless	1	40	38	40	50.00	41.33		0.00	0	12000.00
bottle flavor and color	S	Determine Optimum concentration of color	1	40	38	40	50	41.33	3	120.00	9000	9000.00
	6.1	•Study different color concentration for water bottle.	0.5	20	19	20	25.00	20.67		0.00	0	4500.00
	6.2	•Study different color concentration vs change in water taste	0.5	20	19	20	25.00	20.67		0.00	0	0.00
	T	Determine optimum concentration for flavour	6	240	228	240	300	248.00	2	13.33	1000	6000.00
	6.3	•Study different flavour concentration for water bottle.	2	80	76	80	100.00	82.67		0.00	0	2000.00
	6.4	•Study different flavor concentration vs change in water taste	4	160	152	160	200.00	165.33		0.00	0	0.00
	U	Check for natural/artificial colors and flavorurs	8	320	304	320	400	330.67	2	10.00	750	6000.00
	6.5	•study artificial vs natural flavours	5	200	190	200	250.00	206.67		0.00	0	3750.00
	6.6	•Study what flavors to market	3	120	114	120	150.00	124.00		0.00	0	2250.00
Final Testing	V	Testing 6	8	320	304	320	400	330.67	5	25.00	1875	15000.00
	6.7	•Test for best color concentration of the bottle	3	120	114	120	150.00	124.00		0.00	0	5625.00
	6.8	•select best flavors to market by sampling to people.	5	200	190	200	250.00	206.67		0.00	0	9375.00
FDAapproval	W	Set up proto Lab	10	400	380	400	500	413.33	1	4.00	300	3000.00
	7.1	FDA approval	10	400	380	400	500.00	413.33		0.00	0	3000.00

PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

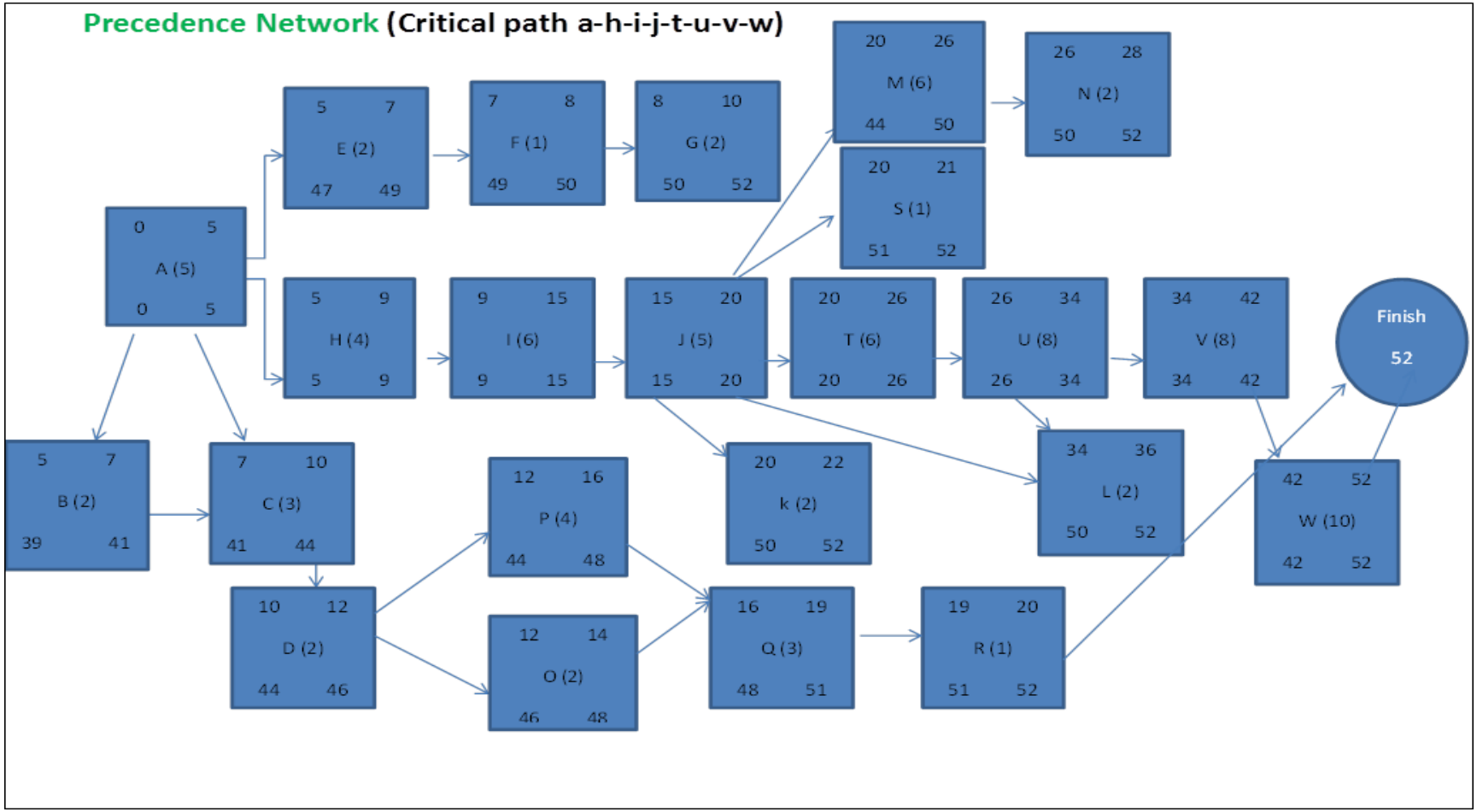
APPENDIX F and I: open excel calculations for clear view: [Group Project caluclations latest.xlsx]

A table with all tasks and variances with Optimistic, Pessimistic and Most likely calculations with Probability Confidence factor: 80%

	Tasks and Sub tasks	Est. Duration weeks	Estimated in hours	Optimistic	Most Likely Calculated	Pessimistic	TE	Variance	Variance (Days)	σ	Probability Confidence Factor
A	Study FDA Regulation	5	200	190	200	250.00	206.67	100.00	4.17	2.041	97%
1.1	•Find a consultant	1	40	38	40	50.00	41.33	4.00	0.17	0.408	68%
1.2	•. investigate regulation policy and cost	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
1.3	•prepare a sample for testing	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
B	Research resources for Nutrition	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
1.4	•. Find out artificial and natural resources	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
1.5	•determine the exact quantity and mix	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
C	Determine concentration formula for 200 Calories	3	120	114	120	150.00	124.00	36.00	1.50	1.225	89%
1.6	•determine the calorie-quantity ratio	1.5	60	57	60	75.00	62.00	9.00	0.38	0.612	61%
1.7	•determine best cal-ingredient ratio	1.5	60	57	60	75.00	62.00	9.00	0.38	0.612	61%
D	Testing 1	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
1.8	•Test the results to achieve required nutrition	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
E	Research on Peelable Plastic wrap	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
2.1	•research on type of material required	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
2.2	•determine the cost	0.5	20	19	20	25.00	20.67	1.00	0.04	0.204	59%
2.3	•determine the cost	0.5	20	19	20	25.00	20.67	1.00	0.04	0.204	59%
F	Research on adhesive for plastic wrap	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
2.4	•research on type of material required	0.25	10	9.5	10	12.50	10.33	0.25	0.01	0.102	54%
2.5	•determine the cost	0.25	10	9.5	10	12.50	10.33	0.25	0.01	0.102	54%
2.6	•study the reaction with bottle and wrapper	0.5	20	19	20	25.00	20.67	1.00	0.04	0.204	59%
G	Testing2	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
2.7	Testing	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
H	Determine the shape and size of bottle	4	160	152	160	200.00	165.33	64.00	2.67	1.633	95%
3.1	•Study different shapes and sizes	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
3.2	•determine ideal shape to hold required quantity of calories and water	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
I	Determine the thickness of bottle	6	240	228	240	300.00	248.00	144.00	6.00	2.449	99%
3.3	•Study different thickness	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
3.4	•determine ideal thickness to hold required quantity of cal and water	4	160	152	160	200.00	165.33	64.00	2.67	1.633	95%
J	Study bottle size vs Nutrition to achive 200 calories	5	200	190	200	250.00	206.67	100.00	4.17	2.041	98%
3.5	•Study size vs calories	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
3.6	•Study size vs quantity of water	3	120	114	120	150.00	124.00	36.00	1.50	1.225	89%
k	Testing3	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
3.7	Testing	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
L	Study Time Vs Reactivity	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
4.1	•Study reactivity on bottle to plastic	0.5	20	19	20	25.00	20.67	1.00	0.04	0.204	59%
4.2	•study reactivity on bottle to water	0.5	20	19	20	25.00	20.67	1.00	0.04	0.204	59%
4.3	•study reactivity on adhesive to bottle	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
M	Study effect of temp, UV and exposure	6	240	228	240	300.00	248.00	144.00	6.00	2.449	99%
4.4	•Study exposure of bottle to sunlight	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
4.5	•Study the exposure of bottle to various hrash conditions	4	160	152	160	200.00	165.33	64.00	2.67	1.633	95%
N	Testing 4	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
4.6	•test the water bottle at worst case scenarios	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
O	Study Time Vs Reactivity	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
5.1	•Study if water reacts with bottle ingredients	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
5.2	•Check if water changes color or taste	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
P	Study different elements in water bottle and reactivity with water	4	160	152	160	200.00	165.33	64.00	2.67	1.633	95%
5.3	•Check reactivity of diferent ingredients in bottle and its reactivity with water	4	160	152	160	200.00	165.33	64.00	2.67	1.633	95%
Q	Determine best ingredients to keep water colorless and Odorless	3	120	114	120	150.00	124.00	36.00	1.50	1.225	89%
5.4	•Select ingredients which are intert to water	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
5.5	•Select ingredients in bottle to be water repulsive	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
R	Testing5	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
5.6	•Test to see if water remains colourless and odourless	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
S	Determine Optimum concentration of color	1	40	38	40	50.00	41.33	4.00	0.17	0.408	66%
6.1	•Study different color concentration for water bottle.	0.5	20	19	20	25.00	20.67	1.00	0.04	0.204	59%
6.2	•Study different color concentration vs change in water taste	0.5	20	19	20	25.00	20.67	1.00	0.04	0.204	59%
T	Determine optimum concentration for flavour	6	240	228	240	300.00	248.00	144.00	6.00	2.449	99%
6.3	•Study different flavour concentration for water bottle.	2	80	76	80	100.00	82.67	16.00	0.67	0.816	79%
6.4	•Study different flavor concentration vs change in water taste	4	160	152	160	200.00	165.33	64.00	2.67	1.633	95%
U	Check for natural/artificial colors and flavorurs	8	320	304	320	400.00	330.67	256.00	10.67	3.266	100%
6.5	•study artificial vs natural flavours	5	200	190	200	250.00	206.67	100.00	4.17	2.041	97%
6.6	•Study what flavors to market	3	120	114	120	150.00	124.00	36.00	1.50	1.225	89%
V	Testing 6	8	320	304	320	400.00	330.67	256.00	10.67	3.266	100%
6.7	•Test for best color concentration of the bottle	3	120	114	120	150.00	124.00	36.00	1.50	1.225	89%
6.8	•select best flavors to market by sampling to people.	5	200	190	200	250.00	206.67	100.00	4.17	2.041	97%
W	Set up Ptoto lab	10	400	380	400	500.00	413.33	400.00	16.67	4.082	100%
8	FDA approval	10	400	380	400	500.00	413.33	400.00	16.67	4.082	100%
											79%

Appendix H: open excel calculations for clear view: [Group Project caluclations_latest.xlsx]

Solved AON Diagram



PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

APPENDIX J: open excel calculations for clear view: [Group Project caluclations latest.xlsx]

Resource Allocation chart:

R&D Manager	40	8	8	8	8	8	20	20	0	0	0	0	0	20	20	0	8	21.33	21.33	21.33	8	80	0	0	0	0	0	5	5	5	5	5	5	45	5	25	25	5	5	5	5	5	5
Study FDA Regulation	40	8	8	8	8	8																																					
Neutrition scientist# 1	399.99																																										
Research resources for neutrition	40						20	20																																			
study bottle size vs neutrition to achieve 200 calories	80																8	8	8	8	8													40									
determine best ingredients to keep water colorless and Odorless	39.99																	13.33	13.33	13.33																							
Study time vs reactivity	40													20	20																												
Determine Optimum concentration of color	40																					40																					
Check for natural/artificial colors and flavorurs	40																											5	5	5	5	5	5	5	5								
Testing	40																					40																					
Testing 4	40																																			5	5	5	5	5	5	5	5
Study time vs reactivity	40																																			20	20						
Neutrition scientist # 2	326.87	0	0	0	0	0	20	27	0	0	6.66	6.66	6.66	16.66	16.66	16.66	10	13.33	13.33	13.33	0	53.32	13.32	13.32	13.32	13.32	13.32	0	0	0	0	0	0	0	0	5	5	5	5	5	5	5	5
Research resources for neutrition	40						20	20																																			
Determine thickness of bottle	39.96										6.66	6.66	6.66	6.66	6.66	6.66																											
study different elements in water bottle and reactivity with water	40													10	10	10	10																										
determine best ingredients to keep water colorless and Odorless	39.99																	13.33	13.33	13.33																							
study the effect of temprature UV and exposure	39.96																					6.66	6.66	6.66	6.66	6.66	6.66																
Determine the optimum concentration of flavor	39.96																					6.66	6.66	6.66	6.66	6.66	6.66																
Testing 4	47							7																												5	5	5	5	5	5	5	5
Testing	40																					40																					
Polymer scientist # 1	159.96	0	0	0	0	0	30	30	10	10	6.66	6.66	6.66	26.66	26.66	6.66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research peelable plastic wrap	40						20	20																																			
Determine the shape and size of the bottle	40						10	10	10	10																																	
Study time vs reactivity	40													20	20																												
Determine thickness of bottle	39.96										6.66	6.66	6.66	6.66	6.66	6.66																											
Polymer scientist # 2	100	0	0	0	0	0	0	0	20	0	0	0	0	10	10	10	18	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research adhesive plastic wrape	20								20																																		
study bottle size vs neutrition to achieve 200 calories	40																8	8	8	8	8																						
study different elements in water bottle and reactivity with water	40													10	10	10	10																										
Lab Tech# 1	459.94	0	0	0	0	0	30	30	36.66	36.66	26.66	20	20	20	20	0	8	8	8	8	8	46.66	6.66	6.66	6.66	6.66	6.66	5	5	5	5	5	5	5	5	5	25	5	5	5	5	5	5
Research Resources for Neutrition	40						20	20																																			
Determine Concentration Formula for 200 Calories	39.99								13.33	13.33	13.33																																
Testing 1	40											20	20																														
Determine the shape and size of bottle	40						10	10	10	10																																	
Study bottle size vs Nutrition to achive 200 calories	79.99								13.33	13.33	13.33						8	8	8	8	8																						
Study Time Vs Reactivity	40													20	20																												
Determine Optimum concentration of color	40																					40																					
Determine optimum concentration for flavour	39.96																					6.66	6.66	6.66	6.66	6.66	6.66																
Check for natural/artificial colors and flavorurs	40																											5	5	5	5	5	5	5	5								
Study time vs reactivity	20																																			s	20						
Testing 4	40																																			5	5	5	5	5	5	5	5
Lab tech # 2	319.9	0	0	0	0	0	20	20	13.33	13.33	19.99	6.66	6.66	16.66	16.66	16.66	10	13.33	13.33	13.33	0	46.66	6.66	6.66	6.66	6.66	6.66	0	0	0	0	0	0	0	0	5	5	5	5	5	5	5	5
Research Resources for Neutrition	40						20	20																																			
Determine Concentration Formula for 200 Calories	39.99								13.33	13.33	13.33																																
Determine the thickness of bottle	39.96										6.66	6.66	6.66	6.66	6.66	6.66																											
Study effect of temp, UV and exposure	39.96																					6.66	6.66	6.66	6.66	6.66	6.66																
Study different elements in water bottle and reactivity with water	40													10	10	10	10																										
Determine best ingredients to keep water colorless and Odorless	39.99																	13.33	13.33	13.33																							
Determine Optimum concentration of color	40																					40																					
Testing 4	40																																			5	5	5	5	5	5	5	5
Lab Tech # 3	79.99	0	0	0	0	0	20	20	0	0	0	0	0	0	0	0	0	13.33	13.33	13.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research on Peelable Plastic wrap	40						20	20																																			
Determine the thickness of bottle	0																																										
Determine best ingredients to keep water colorless and Odorless	39.99																	13.33	13.33	13.33																							
Lab Tech # 4	259.96	0	0	0	0	0	0	0	20	20	26.66	6.66	6.66	6.66	6.66	6.66	8	8	8	8	8	60	20	0	0	0	0	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research on adhesive plastic wrap Peelable Plastic wrap	20								20																																		
study bottle size vs neutrition to achieve 200 calories	40																8	8	8	8	8																						
Determine the thickness of bottle	39.96										6.66	6.66	6.66	6.66	6.66	6.66																											
Testing	40									20	20																																
Testing 2	40																					20	20																				
Testing 3	40																											20	20														
Testing	40																					40																					
Analytical Scientist	240	0	0	0	0	0	0	0	0	20	20	20	20	0	0	0	0	0	0	0	0	60	20	0	0	0	0	20	20	0	0	0	0	0	0	5	5	5	5	5	5	5	5
Testing 1	40											20	20																														
Testing	40									20	20																																
Testing 2	40																					20	20																				
Testing 3	40																											20	20														
Testing	40																					40																					
Testing 4	40																																			5	5	5	5	5	5	5	5
FDA Consultant	40	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Study FDA Regulation	40	8	8	8	8	8																																					
FDA Approval		NA																																									

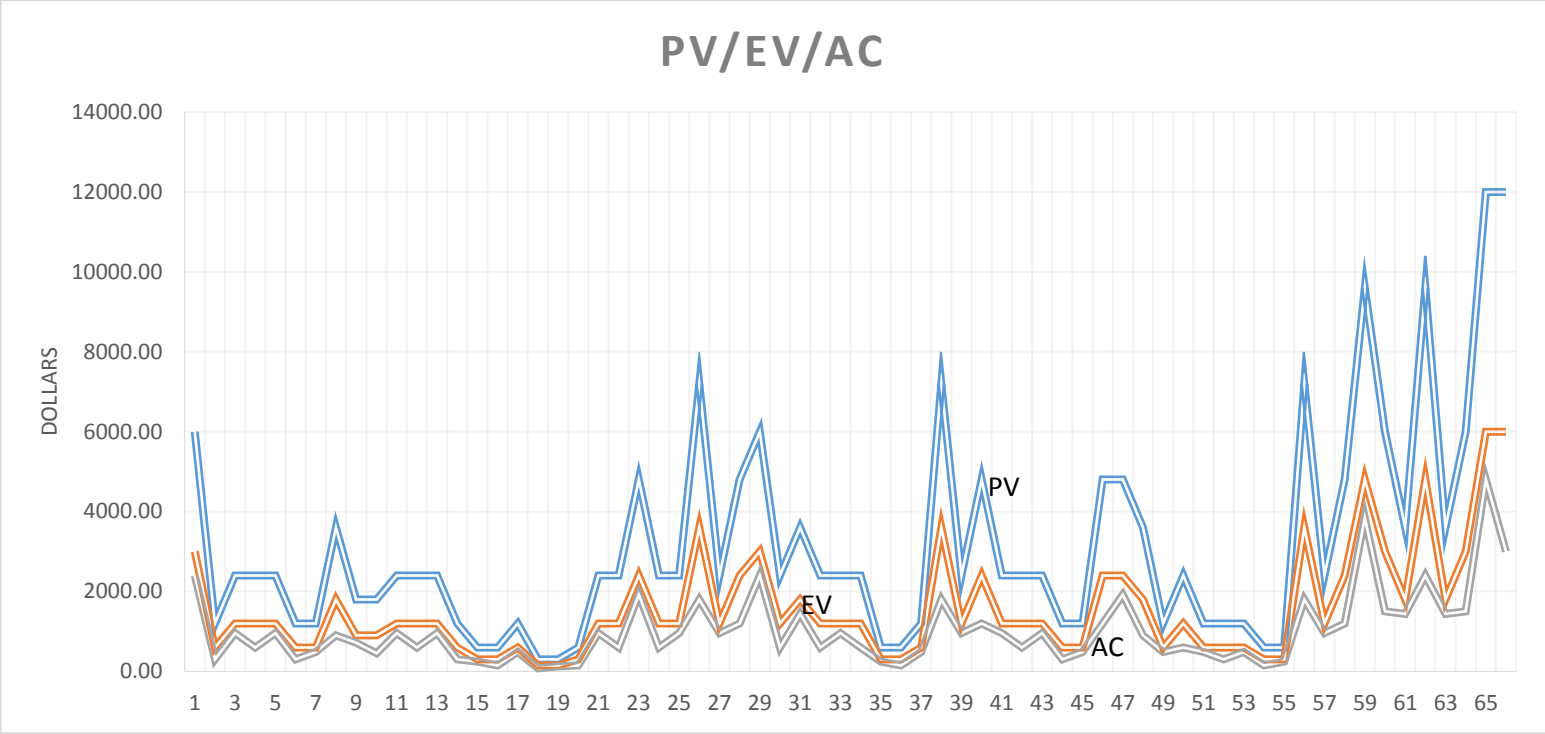
PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

Appendix K, L, M, N: open excel calculations for clear view: Group Project caluclations latest.xlsx

	Tasks & Subtasks	PV	EV	AC	EV-AC = CV	EV-PV=SV	CPI=EV/AC	SPI=EV/PV	CSI = CPIxSPI
A	Study FDA Regulation	6000.00	3000.00	2400.00	600.00	-3000.00	1.25	0.5	0.63
1.1	•Find a consultant	1200.00	600.00	300.00	300.00	-600.00	2.00	0.5	1.00
1.2	•. investigate regulation policy and cost	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
1.3	•prepare a sample for testing	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
B	Research resources for Nutrition	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
1.4	•. Find out artificial and natural resources	1200.00	600.00	300.00	300.00	-600.00	2.00	0.5	1.00
1.5	•determine the exact quantity and mix	1200.00	600.00	480.00	120.00	-600.00	1.25	0.5	0.63
C	Determine concentration formula for 200 Calories	3600.00	1800.00	900.00	900.00	-1800.00	2.00	0.5	1.00
1.6	•determine the calorie-quantity ratio	1800.00	900.00	720.00	180.00	-900.00	1.25	0.5	0.63
1.7	•determine best cal-ingredient ratio	1800.00	900.00	450.00	450.00	-900.00	2.00	0.5	1.00
D	Testing 1	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
1.8	•Test the results to achieve required nutrition	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
E	Research on Peelable Plastic wrap	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
2.1	•research on type of material required	1200.00	600.00	300.00	300.00	-600.00	2.00	0.5	1.00
2.2	•determine the cost	600.00	300.00	240.00	60.00	-300.00	1.25	0.5	0.63
2.3	•determine the cost	600.00	300.00	150.00	150.00	-300.00	2.00	0.5	1.00
F	Research on adhesive for plastic wrap	1200.00	600.00	480.00	120.00	-600.00	1.25	0.5	0.63
2.4	•research on type of material required	300.00	150.00	75.00	75.00	-150.00	2.00	0.5	1.00
2.5	•determine the cost	300.00	150.00	120.00	30.00	-150.00	1.25	0.5	0.63
2.6	•study the reaction with bottle and wrapper	600.00	300.00	150.00	150.00	-300.00	2.00	0.5	1.00
G	Testing 2	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
2.7	Testing	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
H	Determine the shape and size of bottle	4800.00	2400.00	1920.00	480.00	-2400.00	1.25	0.5	0.63
3.1	•Study different shapes and sizes	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
3.2	•determine ideal shape to hold required quantity of calories and water	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
I	Determine the thickness of bottle	7200.00	3600.00	1800.00	1800.00	-3600.00	2.00	0.5	1.00
3.3	•Study different thickness	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
3.4	•determine ideal thickness to hold required quantity of cal and water	4800.00	2400.00	1200.00	1200.00	-2400.00	2.00	0.5	1.00
J	Study bottle size vs Nutrition to achive 200 calories	6000.00	3000.00	2400.00	600.00	-3000.00	1.25	0.5	0.63
3.5	•Study size vs calories	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
3.6	•Study size vs quantity of water	3600.00	1800.00	1440.00	360.00	-1800.00	1.25	0.5	0.63
k	Testing 3	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
3.7	Testing	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
L	Study Time Vs Reactivity	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
4.1	•Study reactivity on bottle to plastic	600.00	300.00	240.00	60.00	-300.00	1.25	0.5	0.63
4.2	•study reactivity on bottle to water	600.00	300.00	150.00	150.00	-300.00	2.00	0.5	1.00
4.3	•study reactivity on adhesive to bottle	1200.00	600.00	480.00	120.00	-600.00	1.25	0.5	0.63
M	Study effect of temp, UV and exposure	7200.00	3600.00	1800.00	1800.00	-3600.00	2.00	0.5	1.00
4.4	•Study exposure of bottle to sunlight	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
4.5	•Study the exposure of bottle to various hrash conditions	4800.00	2400.00	1200.00	1200.00	-2400.00	2.00	0.5	1.00
N	Testing 4	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
4.6	•test the water bottle at worst case scenarios	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
O	Study Time Vs Reactivity	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
5.1	•Study if water reacts with bottle ingredients	1200.00	600.00	300.00	300.00	-600.00	2.00	0.5	1.00
5.2	•Check if water changes color or taste	1200.00	600.00	480.00	120.00	-600.00	1.25	0.5	0.63
P	Study different elements in water bottle and reactivity with water	4800.00	2400.00	1200.00	1200.00	-2400.00	2.00	0.5	1.00
5.3	•Check reactivity of diferent ingredients in bottle and its reactivity with water	4800.00	2400.00	1920.00	480.00	-2400.00	1.25	0.5	0.63
Q	Determine best ingredients to keep water colorless and Odorless	3600.00	1800.00	900.00	900.00	-1800.00	2.00	0.5	1.00
5.4	•Select ingredients which are intert to water	1200.00	600.00	480.00	120.00	-600.00	1.25	0.5	0.63
5.5	•Select ingredients in bottle to be water repulsive	2400.00	1200.00	600.00	600.00	-1200.00	2.00	0.5	1.00
R	Testing 5	1200.00	600.00	480.00	120.00	-600.00	1.25	0.5	0.63
5.6	•Test to see if water remains colourless and odourless	1200.00	600.00	300.00	300.00	-600.00	2.00	0.5	1.00
S	Determine Optimum concentration of color	1200.00	600.00	480.00	120.00	-600.00	1.25	0.5	0.63
6.1	•Study different color concentration for water bottle.	600.00	300.00	150.00	150.00	-300.00	2.00	0.5	1.00
6.2	•Study different color concentration vs change in water taste	600.00	300.00	240.00	60.00	-300.00	1.25	0.5	0.63
T	Determine optimum concentration for flavour	7200.00	3600.00	1800.00	1800.00	-3600.00	2.00	0.5	1.00
6.3	•Study different flavour concentration for water bottle.	2400.00	1200.00	960.00	240.00	-1200.00	1.25	0.5	0.63
6.4	•Study different flavor concentration vs change in water taste	4800.00	2400.00	1200.00	1200.00	-2400.00	2.00	0.5	1.00
U	Check for natural/artificial colors and flavorurs	9600.00	4800.00	3840.00	960.00	-4800.00	1.25	0.5	0.63
6.5	•study artificial vs natural flavours	6000.00	3000.00	1500.00	1500.00	-3000.00	2.00	0.5	1.00
6.6	•Study what flavors to market	3600.00	1800.00	1440.00	360.00	-1800.00	1.25	0.5	0.63
V	Testing 6	9600.00	4800.00	2400.00	2400.00	-4800.00	2.00	0.5	1.00
6.7	•Test for best color concentration of the bottle	3600.00	1800.00	1440.00	360.00	-1800.00	1.25	0.5	0.63
6.8	•select best flavors to market by sampling to people.	6000.00	3000.00	1500.00	1500.00	-3000.00	2.00	0.5	1.00
W	Set up proto Lab	12000.00	6000.00	4800.00	1200.00	-6000.00	1.25	0.5	0.63
7.1	FDA approval	12000.00	6000.00	3000.00	3000.00	-6000.00	2.00	0.5	1.00

By 50-50 EV analysis, we came out the potential problem area when CSI ratio (CPI x SPI) < 1.

The graph is as below PV>EV>AC therefore, -SV and +CV



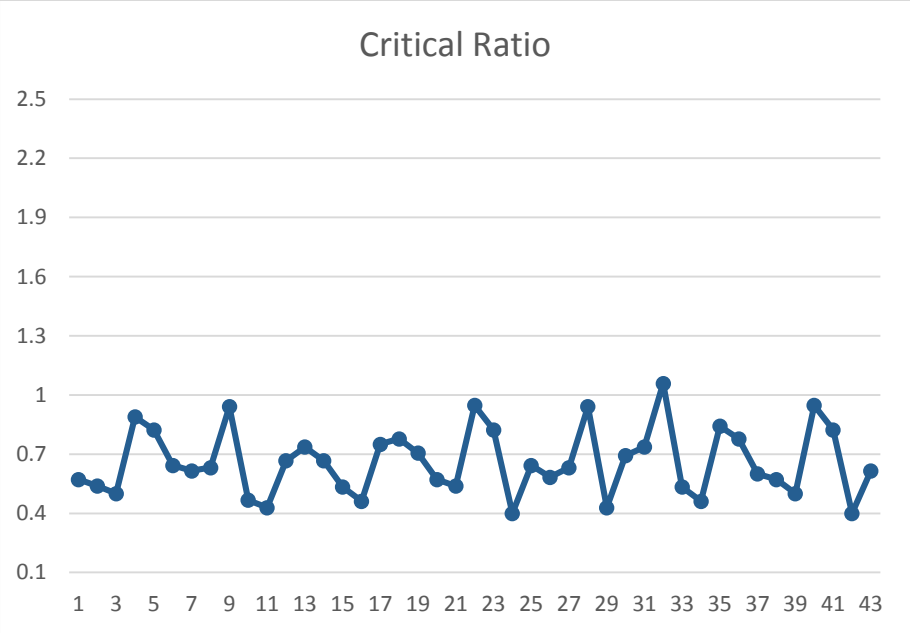
The Critical Ratio can also be used with earned values, bearing in mind that "progress" in earned value nomenclature is expressed in monetary units, and we have only three measures instead of four, actual progress is EV, scheduled progress is EV and Actual Cost is AC.

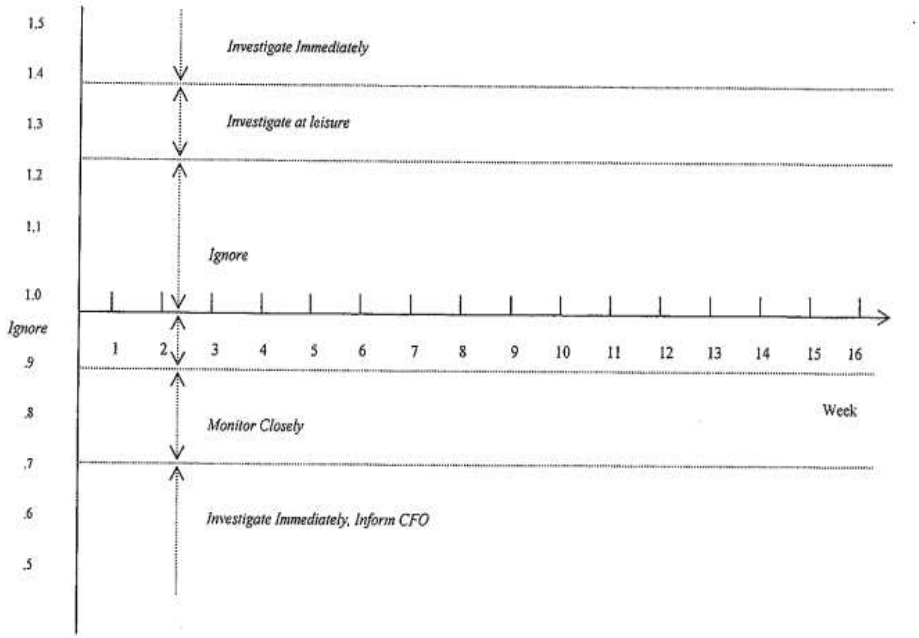
Critical Ratio method has an extra budgeted cost, although budgeted cost is similar to PV, the analysis would not be correct. There critical ratio method is one of the other tool to control and monitor the project. Sometimes even when the project was late, the critical ratio indicates everything is fine! Therefore it is preferable to use earned value and hen Critical Ratio. We cannot rely only on critical ratio.

It is worthwhile to on large projects for Project Manager to calculate a set of critical ratios of all project activities. The Critical ratio is defined as

Critical Ratio: (actual progress/scheduled progress) x (budgeted cost/actual cost)

Critical ratio varying to much above or too much below 1 is a problem. Those tasks must be given priority first.





PROJECT: DEVELOPMENT OF EDIBLE WATER BOTTLE

Sub Task Number	Weeks	Scheduled	Actual progress	Budgeted Cost	Actual Cost	Critical Ratio
1.1	1	1	0.8	1200	1680.00	0.57
1.2	2	2	1.4	2400	3120.00	0.54
1.3	3	2	1.2	2400	2880.00	0.50
1.4	4	1	0.8	6000	5400.00	0.89
1.5	5	1	0.7	6000	5100	0.82
1.6	6	1.5	1.35	3000	4200.00	0.64
1.7	7	1.5	1.2	3000	3900.00	0.62
1.8	8	2	1.2	6000	5700.00	0.63
2.1	9	1	0.8	3000	2550	0.94
2.2	10	0.5	0.35	1500	2250.00	0.47
2.3	11	0.5	0.3	1500	2100.00	0.43
2.4	12	0.25	0.2	1500	1800.00	0.67
2.5	13	0.25	0.175	1500	1425.00	0.74
2.6	14	0.5	0.3	3000	2700.00	0.67
2.7	15	2	1.6	6000	9000.00	0.53
3.1	16	2	1.2	3000	3900.00	0.46
3.2	17	2	1.8	3000	3600.00	0.75
3.3	18	2	1.4	4000	3600.00	0.78
3.4	19	4	2.4	8000	6800	0.71
3.5	20	2	1.6	4800	6720.00	0.57
3.6	21	3	2.1	7200	9360.00	0.54
3.7	22	2	1.8	6000	5700.00	0.95
4.1	23	0.5	0.35	1500	1275	0.82
4.2	24	0.5	0.3	1500	2250.00	0.40
4.3	25	1	0.9	3000	4200.00	0.64
4.4	26	2	1.4	2000	2400.00	0.58
4.5	27	4	2.4	4000	3800.00	0.63
4.6	28	2	1.6	6000	5100	0.94
5.1	29	1	0.6	4500	6300.00	0.43
5.2	30	1	0.9	4500	5850.00	0.69
5.3	31	4	2.8	9000	8550.00	0.74
5.4	32	1	0.9	4000	3400	1.06
5.5	33	2	1.6	8000	12000.00	0.53
5.6	34	1	0.6	12000	15600.00	0.46
6.1	35	0.5	0.4	4500	4275.00	0.84
6.2	36	0.5	0.35	4500	4050.00	0.78
6.3	37	2	1.8	2000	3000.00	0.60
6.4	38	4	3.2	4000	5600.00	0.57
6.5	39	5	3	3750	4500.00	0.50
6.6	40	3	2.7	2250	2137.50	0.95
6.7	41	3	2.1	5625	4781.25	0.82
6.8	42	5	3	9375	14062.50	0.40
7.1	43	10	8	3000	3900.00	0.62

APPENDIX O:

Project Termination: This project will be terminated by integration.

The following important transitions will take place after the project has been terminated by integration:

- Personnel: People who worked on this project will head back to their regular work in R&D department and meanwhile they will start preparing large scale manufacturing procedures for manufacturing.

- Equipment: The Proto labs will be handed over to manufacturing department for training purposes.

- Materials: Materials along with the specifications will be handed over to purchase department, in order to procure on bulk large scale productions.

- Notify: Notify manufacturing, sales, marketing quality and other departments about the successful completion of the project.

- Accounting and Finance: Close project accounts and the accounts have to be audited

- Evaluate project history: Project performance, resources performance and administrative performance need to be recorded and Project management techniques used to be documented for future references.