Project Proposal and Management

Action Plan

Ongoing Evaluation

Identification of the Need
- Brainstorm and figure out the need which will be addressed / problem which will be solved.
- Complete design situation, design brief, identification of the need, personal motivation, target market, parameters, and conducting a survey.

Areas of Investigation
- Set guidelines on relevant areas of investigation to research (including materials, ergonomics, manufacturing, design, target market and branding/advertising).
- This will allow for further development of the design concept.

Creation of Plans for Project
- An action plan and time plan will then be created to make sure that the project is completed before the due date and to a high standard.
- Will be useful in making sure that enough time is delegated to certain aspects and components of the task.

Criteria to Evaluate Success
- Criteria to evaluate success will be established to act as a guideline and checklist throughout the project.
- This will set goals in which the project must meet and will help evaluate the outcome of the project.

Idea Generation
- Sketch and generate ideas for the design of the product using Cad software, sketching and annotating various design ideas on paper, using a mind map to convey different ideas, as well as showing different design styles and ideas through a mood board.

Ongoing Evaluation

Finance Plan
- Finance plan will be created after gaining a clearer idea on what the product might look like / materials to be used.
- Couldn't be completed earlier on in the project as materials with different properties needed to be tested and prototyped (allow for an accurate representation of cost).

Prototyping
- Prototype / conduct further investigation and testing regarding materials and techniques/tools that can be applied (lightweight materials, and portability/foldability of design).
- Document the processes and steps used to create the prototype throughout the various stages.

Consideration of Relevant Design Factors
- Consideration of relevant design factors will figure out / show which design factors are most important and relevant to the success of the product and therefore need to be considered the most throughout the development and evaluation.

Degree of Difference
- Complete the degree of difference for the product, which will highlight how it differs from existing designs and why it is more suitable for consumers.
- Essential in ensuring market share for the product.

Exploration of Existing Designs/Ideas
- Explore existing designs through research (in-store and online) and then annotate and analyze the existing product designs.
- This will give insight into the competition of the product and characteristics that could be incorporated.

Ongoing Evaluation

Analysis and Evaluation of Results (application of conclusions)
- Application of conclusions will be drawn from the research and experimenting (prototyping), to evaluate the best design for the product in order for it to be successful and fulfil its need of being compactable, portable and light weight.

Creation and Documentation of Final Product
- After drawing conclusions and evaluating prototypes, manufacturing and creation of the final product will begin.
- Document and photograph the processes and steps undertaken in order to show the development and evaluation throughout.

Project Evaluation
- Reflect upon and evaluate-
  - The overall product and project in terms of function and aesthetics.
  - The impact on individuals, society and the environment.
  - The relationship to the project proposal.

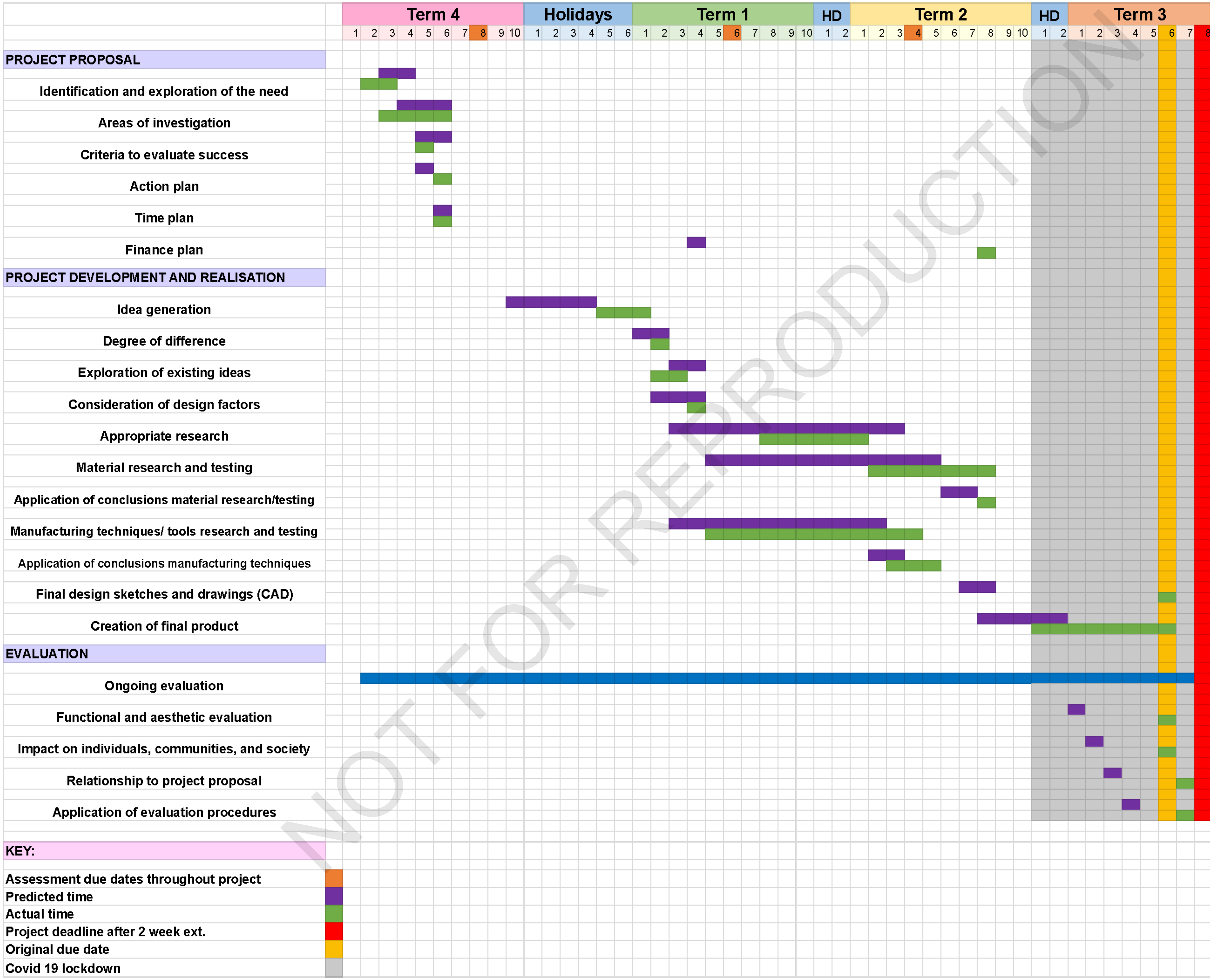
Ongoing evaluation:

The creation of an action plan is very important in ensuring that the project stays on track and all components are completed to a high standard. The flow chart design of my action plan allows me to visually see what stages of the task I need to undertake before starting on the next, and as it is designed specifically for the creation, development and evaluation of my project, the order of the stages is vital in ensuring that the design of the product can develop. The creation of the finance plan is placed later on in the project, as, at such an early stage, materials to be used are still unknown and therefore, in order to give an accurate representation of cost, prototyping of materials and techniques needs to be conducted prior.

Key:
- Project Proposal
- Project Develop.
- Evaluation

Project Proposal and Management

Time Plan



Ongoing evaluation:

Creating a time plan is an important step in order to ensure that time is managed effectively, and that goals and objectives are met. I used Google Sheets to create my time plan. As shown in my time plan, I originally thought that the finance plan would be completed earlier in the project, however I ended up completing it much later on (once material and manufacturing techniques had been conducted). This was because without developing a clearer understanding of what materials I was going to use and the quantity they would be needed in, it was hard to plan costings. Additionally, a lot of my planned deadlines towards the end of the project got pushed further back. This was especially the case with the manufacturing of the final product and the evaluation. I had originally underestimated the complexity of my design and how long it would take to manufacture. Without the **two-week extension** of the deadline due to the **Covid19** lockdown, I think that it would have been quite challenging to complete my project because of how long manufacturing took and how far back it pushed my planned schedule. However, luckily, I was able to complete the project and have additional time at the end to finesse and edit.

Prototype A:

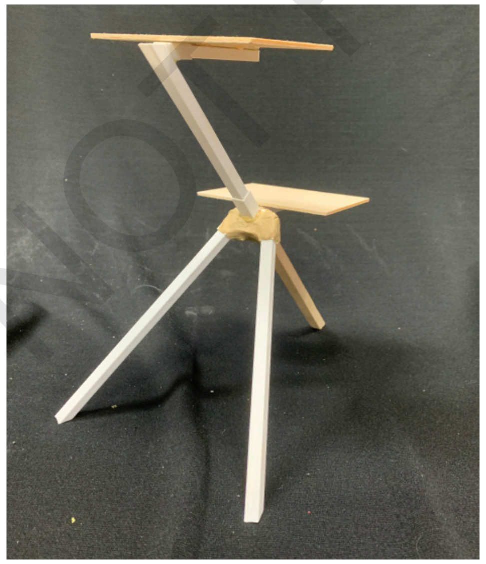
The conclusions drawn from this prototype were that the two front legs of the product need to be placed at an angle that allows them to come further forward than the edge of the table. As evaluated previously, this will allow for an **ergonomic and counterbalanced design**. The conclusions that were made from prototype A helped direct me forward in terms of creating prototype B and further experimenting with the placement of the legs.

Prototype B:

After drawing conclusions from prototype A regarding the placement and angle of the legs, prototype B allowed me to test the hypothesis of re-angling the legs further forward. As per my deduction from prototype A, placing the legs further out on prototype B did successfully ensure that the weight was counterbalanced and a device could be placed on the desk without the concern of the workstation tipping forward. Prototype B allowed me to better understand the main structure of my design and assisted me in the next process of prototyping; testing/ experimenting with different techniques on a larger scale.

Prototype C:

The next step in my prototyping journey was to create a larger scale model (not yet full scale), to evaluate techniques that could be used to assist the product in being as portable and compact as possible. Conclusions drawn from prototype C were that the slot in technique for the three legs, and the table/seat, would be ergonomic and easy for users, as well as allow for a transportable product. I also concluded that to see if this slot in technique was viable for the final product, I would need to test on a full-scale size, which would also confirm if the slot in technique would bare the weight of the user.



Prototype D:

For the hub of my product (where all the legs meet), I initially thought that it could be made with aluminium welded together (by a professional), and then wrapped in carbon fibre to give it extra strength and the desired sleek and sculpted aesthetic. However, I found out through online research, that aluminium and carbon fibre can have a **negative reaction** (corrosion) when permanently fixed to each other. Because of this I had to rethink my idea and instead make the hub purely out of carbon fibre. This meant I had to hand wrap the channels (where the legs slot in) out of carbon fibre, then secure the legs together at the correct angles before wrapping it again so that it became sculpted and had more strength to bare weight. Additionally, after making this full-scale prototype I entertained the idea that legs could be telescopic for them to be more compactable, however after going to different aluminium manufacturers I found that I could not find two aluminium tubes that were close enough in size to closely fit in one another and then telescope out. The final conclusion was that each leg would need to split in half and then follow the same slot in technique used throughout the design to join up (which later proved to be unsuccessful).

Wrapping carbon fibre experimentation/test 1:

My first carbon fibre wrapping experimentation led me to conclude that, even though the release agent assisted in removing the aluminium tube from the wrapped carbon fibre, it was still quite challenging and required a lot of effort to do so. Additionally, in the process of doing this, the carbon fibre tube was occasionally damaged because of the banging action, which was not ideal. This led me to experimenting different ways of removing the aluminium tube from the cured carbon fibre, as I already knew that the sushi method of rolling the wet carbon fibre around the aluminium tube was successful.

Wrapping carbon fibre experimentation/test 2:

The conclusions that were drawn from the second carbon fibre experimentation was that having the excess material around the aluminium tube created unnecessary width when the carbon fibre was cured and removed, even though it was easier to remove than wrapping on straight aluminium tube (with release agent). These deductions assisted in bringing me closer to finding a more suitable, effective, and successful method of removing the aluminium tube from the cured carbon fibre.

Wrapping carbon fibre experimentation/test 3:

The third, and final, carbon fibre wrapping experimentation led me to finding a **viable solution** to the difficulties faced when removing the carbon fibre from the aluminium tube it was wrapped around. The conclusions drawn from this experimentation were that the best technique for removing the carbon fibre from the aluminium tube was to initially wrap a thin shell/skeleton around the carbon fibre, and once cured, cutting down the middle of it with a multitool or Dremel. After doing so, this skeleton was then re-wrapped to give it its final shape. This experimentation assisted in providing direction as to the future of my design, as well as the necessary experience I would need to begin creating the final product.

Ongoing evaluation:

In drawing conclusions from each of my prototypes and experimentations, I was able to continually develop and refine my design to assist in producing a product that has been thoughtfully considered throughout. The conclusions reached also provided me with a clearer direction needed to move forward, as well as providing me with some of the confidence and experience needed for the manufacturing my workstation in carbon fibre. Testing and analyzing my prototypes also provided me with an opportunity to reflect upon my progress thus far.

Finance plan

Budgeted costs:

Material/tool	*Quantity*	*Supplier*	*Estimate cost*	*Actual cost*	*Explanation/use*	*Justification/evaluation*
Mini model material	Balsa sheet 1 x 75x915 mm	Northern Beaches Hobby Centre	$5	$2.99	Table/seat for the miniature prototype models.	Prototyping was an essential part of the development of the design as the correct angle and placing of the legs was vital.
	5 x Square balsa	Northern Beaches Hobby Centre	$10	$9.65	Legs for prototype A and B.	
	5 x Square plastic tube	Northern Beaches Hobby Centre	$30	$49.95 @ $9.99 each	Legs and channels for Prototype C.	
Release agent	1 x Carnauba wax	Bunnings	$15	$17.90	Release agent for making the carbon fibre tubes.	Having a release agent was very important for working with the carbon fibre as without it, it would be impossible to remove the cured carbon fibre from what it was wrapped around.
	1 x Solvent release agent	Ian, Sydney Composite Solutions	$0	$0		
Carbon fibre	6 meters total (twill, biaxial, square weaves)	The Boat Warehouse, Sydney Composite Solutions, Allnex Trade Centre	$350	$392	Used to make all the carbon fibre components (hub, table/seat, etc).	The carbon fibre was bought from different places, each with a different selling price which meant that the costs per metre differed between the stores.
Aluminium square tube	8 x 1.2m	Bunnings	$70	$135.20 @ $16.90 each	Used for the legs, channels under the seat/table and the top post.	Spent a lot more than what I had originally planned for - didn't take into consideration errors and damage.
Mixing contain.	15 x 250mL	Bunnings	$20	$34.35 @ $2.29 each	Mixing the epoxy resin and hardener.	More mixing cups than expected were purchased.
Paint brushes	10 x 25mm twinpk	Bunnings	$20	$32.50 @ 3.25 each	Used to apply resin to dry carbon fibre.	More brushes than expected were purchased.
Plastic sheet	5 m	Eckersley's Art & Craft	$10	$16.2 @ $3.24 per m	Protect the table doing the wet lay-up.	The wet layup process is messier than that of prepreg.
Epoxy resin and hardener	1 x Fast Hardener	The Boat Warehouse	$15	$13.36	Used for the wet layup of the carbon fibre.	I ended up using more resin and hardener than I had originally expected, however not all of what was purchased was completely used.
	2 x Slow Hardener	The Boat Warehouse	$15	$26.72 @ $13.36 each		
	3 x Epoxy Resin	The Boat Warehouse	$75	$113.07 @ $37.69 each		
Mould for seat/ table	5 x Acetate	Eckersley's Art & Craft	$10	$15.01 @ $3.01 each	Smooth surface for seat/table mould.	As I did not have access to the machinery and resources to create a professional mould, it meant that I had to make one myself.
	1 x Wooden board	Eckersley's Art & Craft	$20	$25.87	The base of the mould for the seat/table.	
	1 x Square timber	Bunnings	$10	$11.40	The sides of the mould for the seat/table.	
	Silicon	Home	$0	$0	Use where balsa sides meet up with base.	
Roller	1 x Fibreglass roll.	Bunnings	$15	$9.95	To spread the resin.	The roller was a vital part of the wet layup.
Peel ply	7 m	The Boat Warehouse	$25	$13.30 @ $1.90 per m	Used to absorb any excess resin.	The peel ply ended up being cheaper than I thought.
Techni-glue	x 1	Home	$0	$0	Stick carbon fibre components together.	Already had this material at home - didn't need to buy.
Polyurethane	1 x Wipe on poly	Bunnings	$30	$39.90	Used for a finishing gloss on the carbon fibre.	The brush on and the spray didn't work as well as the wipe on did in achieving a glassy look.
	1 x Cabothane	Bunnings	$15	$14		
	1 x Spray on poly	Bunnings	$20	$20.10		
Material for bag	Nylon, felt, and chord + toggle	Home	$45	$0	Used to make a bag for the hub, top angle, and the legs.	Ended up using some material that I already had at home.
End caps for aluminium tubes	19 x end caps	Bunnings	$10	$9.50 @ $0.50 each	Used as stopper at the ends of the aluminium.	I ended up buying more end caps than I actually needed. just in case.
Plug for bottom of legs	Wood	Home	$0	$0	To insert into the base of the legs	As the bottom of the legs were cut at an angle it meant I needed to make my own plugs.
	Rubber	Bunnings	$15	$16.00	To stick to the bottom of the legs for grip	
Folio printing	x 1	Officeworks	$70	$100	Printing and presenting portfolio.	Purchased paper + portfolio folder and printed at school.

Ongoing evaluation:

Because of the complexity of my design and the manufacturing process that it entailed, many of the resources and materials purchased couldn't be budgeted for. The unbudgeted list is mainly comprised of materials used in the production process that weren't planned for, whereas the budgeted list includes materials and resources I knew I needed. This is why the finance plan and costing for my project is not a true representation of production cost if the product went to the next stage of manufacturing (many of the resources that I purchased wouldn't be purchased/needed at the next stage). Additionally, not all of what was purchased was completely used (for example – the carnauba wax and wipe-on poly). Therefore, the approximated final costings are a more accurate representation of materials used in the physical final product.

Estimate cost	$920
Unbudgeted costs	$911.11
Total cost	$2030.03
Approx. final costings	$645.10