Dear Commissioners Woods and Weickardt,

Please find my second submission to the Review of the Australian Automotive Manufacturing Industry. The aim of this submission is to comment on the Commission's Preliminary Findings Report, to add further information that has not been discussed in the report or other submissions so far, and to provide further suggestions that can be considered for the Position Paper to be published end of January.

Furthermore I have attached another submission which I made 2008 relating to a similar review. Interestingly, most issues, questions, answers and proposals are still the same.

I am a senior lecturer at Deakin University but this submission does not necessarily reflect the views of the University.

Best Regards,

Frank Will

Executive summary

Important market and regulatory factors are:

1. **Production Locations:** Porsche, the world's most profitable car manufacturer, only makes cars in its home country which has very high labour costs, like Australia.
2. **Contract Product Development:** Engineering services such as contract product development can be very profitable and often is conducted far away from production facilities.
3. **Non-tariff barrier – Flexibilities in measuring and publishing fuel consumption** are very common in Europe and can result in cost advantages of up to around A$3,000 per vehicle
4. **Independent Certification Laboratories** are used by many Asian countries such as Japan, China and India to provide a fair and level playing field and to avoid the application of testing flexibilities that may mislead consumers.
5. **Patents** are currently valued much less than publications by universities to measure excellence in research.
6. **Potential conflicts of interest between university research and private commercialisation** can be a significant barrier for the fast industrialisation of new inventions.
7. **Rapid growth of Compressed Natural Gas (CNG)** as vehicle fuel represents an attractive export niche for Australia if a critical market size can be established in Australia, similar as has happened in Germany, a country which does not even possess significant natural gas resources.
8. **Update on Proposal for Australian Leaning Car Consortium:** The FAMP supports the proposal and 18 organisations expressed interest to be part of it.

Proposals for alternative public support mechanisms are as follows:

1. **Support for local production and Product Development in Australia** should be based on **loans** or should be treated as investment with resulting **share of equity**
2. **The combination of local production and contract product development** should be encouraged further with special incentives
3. **An Independent Fuel Economy Certification Laboratory** should be established to provide a plain playing field between Australian manufacturers and importers
4. **Patents and patent applications should be valued a multiple compared to publications** when evaluating research excellence through ERA
5. **ARC grant applications should only be assessed by reviewers who are not cited in the relevant application,** to avoid potential of conflicts, and to provide fair chances for smaller research sectors such as Automotive Engineering
6. **A policy should be developed to encourage universities and researchers to start spin-offs to commercialise inventions together.** The policy should regulate the interaction with students and university facilities for such spin off-s for a limited period until the spin-offs become self-sufficient.
7. **Establish a Framework with the Vision to Become the Global Leader related to CNG,** including incentives for utility providers to install CNG fuel stations, and for OEM's and suppliers to develop and offer CNG vehicles, and for consumers to buy CNG vehicles.
8. **Following through next steps to establish Australian Leaning Car Consortium.**

NATIONAL AND INTERNATIONAL MARKET AND REGULATORY FACTORS THAT ARE AFFECTING THE AUSTRALIAN AUTOMOTIVE MANUFACTURING INDUSTRY'S INTERNATIONAL COMPETITIVENESS, WORKFORCE PRACTICES AND LONG TERM SUSTAINABILITY

1. Production Locations

The Preliminary Findings Report mentions that "many motor vehicle producers have increased the share of their production that occurs outside the country in which their headquarters are based" with some examples of OEM's that produce over 50% of their vehicles outside of their home-country and that this trend towards the shift of production into countries with low labour costs is increasing /1/. However, there is no correlation that this strategy necessarily leads to higher profitability. In contrast the report cites Porsche, "which attracted the highest profit margins of any marque during the first half of 2013" /2/. Porsche only produces its niche vehicles in the country of it's headquarters in Germany, and which has one of the world's highest labour costs, even though the majority of their sales are overseas. The same applies for the second most profitable automobile company Ferrari-Maserati

A similar trend can be observed for motorcycle production: Harley Davidson is one of the world's most profitable producers of large motorcycles with a net profitabilitys of around 12% /3/. Harley Davidson also manufactures mainly in the country of it's headquarters in the USA, another high labour cost country. This indicates that manufacturing in a high labour cost country can even help to

ensure sustainable profits if combined with the right strategy and product portfolio that is based on the skills and education of the local workforce.

2. Contract Product Development

Another interesting fact about Porsche is that a significant percentage of their R&D activities is to provide engineering services to other OEM's, in a similar way as AVL, EDAG, or Ricardo, as also mentioned in the Preliminary Findings Report /1/. These independent service providers are successful as they have been growing significantly during the last years, as is also demonstrated by other examples like FEV or IAV. Unfortunately information about their profitability is difficult to find as most of these service providers are owned privately.

Coming back to the Porsche example, Porsche is also one of the only car makers that generate significant revenue and profits from providing engineering services, similar to companies like AVL. FEV, etc. Providing engineering service has several advantages:

- Larger flexibility to transfer workforce between production and R&D
- Larger focus on R&D cost control and effectiveness to maintain competitive
- Broader and faster learning from other OEM's problems
- Attractive business field that provides further profits
- Better utilisation of expensive R&D facilities

Commissioner Woods asked the FCAI representatives during the Melbourne hearing about Ford Australia's "move to an R and D and engineering-only operation. That seems to be reasonably unusual, looking around the world, or are there other models of that happening ?"/4/ In fact, this move is not very unusual, there are plenty of car manufacturers that operate R&D centres in countries where they don't have a vehicle production plant, examples are:

- Hyundai Germany /5/
- Mazda Germany /6/
- Honda Germany /7/
- Subaru Germany /8/
- Toyota Belgium /9/
- Ford Dunton Technical Centre /10/
- Ford Lommel Proving Ground, Belgium /11/ http://www.fordlpg.com/ Ford announced to close the Belgium manufacturing plant in 2014 /12/

Chinese car manufacturers are looking at a similar business model to quickly increase their R&D capabilities. During the Automotive Super Trade Mission to China in 2012 several Chinese OEM's expressed interest in having an R&D representation in Australia. Here two examples:

Foton has already established R&D centres in all other continents and major markets other than Australia. They also want to establish an R&D presence in Australia in the next 3-5 years as they like the innovative Australian culture. The same applies for SAIC that that operates an engineering centre in the UK that "was established in 2005 to enable SAIC Group to benefit from the wealth of highly skilled automotive engineering and design talent present in the UK, especially in the Midlands" /25/

3. Non-tariff barrier – Flexibility in measuring and publishing fuel consumption

The Preliminary Findings Report mentioned the existence of "non-tariff barriers" and that "smaller, more fuel-efficient vehicles and SUVs have become more popular" /1/. One such a non-tariff trade barrier is the current flexibility in measuring and publishing fuel consumption in Europe.

The European Union recently contracted a study that verified this trend /13/. The report identified 13 different types of flexibility measures which can each result in fuel consumption results that look better instead of when conducted in the spirit of the law. The individual flexibility measures give between 0.3% and 6% better looking fuel consumption. The resulting total range of flexibilities is between 6.2% and 16%. That means that a car manufacturer can achieve a 16% better fuel economy just by using flexibilities in the regulations.

The cost advantage of using such testing flexibilities can be calculated by using the CO2 tax penalty of 95 Euros per gram CO2 per km that exceeds the limit value. For the average weight a CO2 limit of 130 g/km applies from 2015 onwards, so a reduction of 16% by applying testing flexibilities can be worth a CO reduction of 20.8g/km which is worth a tax reduction of Euro 1,976 or around A$3,000.

That means that Australian car manufacturers are seriously disadvantaged related to how the publishing of fuel consumption labels compared to tests results that have been produced in Europe. Ford Australia's emission lab for example is NATA accredited according to the toughest lab standard ISO17025. That requires managerial independence from the rest of the product development team so that they cannot influence the test processes. In Europe the situation is different: most labs are not accredited to ISO17025. In contrast, they are an integral part of the Product Development organisation. Certification tests are witnessed by independent agencies which certify that the tests were completed according to the standards. However, that means that a wide range of tolerances can be used to derive better looking results which are not necessarily in the spirit of the law. As there is a strong competition between the certification agencies, they have a strong interest that the customer is happy and therefore they don not complain about test processes, as long as they are still followed just within the legal boundaries.

4. Independent Certification Laboratories

In contrast to the flexibilities which are possible in Europe for publishing fuel consumption values, many Asian countries have implemented a much stricter approach by establishing their own independent certification laboratories, for example in Japan, India and China

- In Japan all emission and fuel consumption certifications are conducted or witnessed by the National Traffic Safety and Environment Laboratory, a Government owned independent organisation which also conducts research related to vehicle safety and environmental issues /14/
- In India the situation is very similar, India has "6 Government-owned autonomous testing agencies nationwide charged with type approval and COP testing for emissions from new vehicles" /15/
- In China, several independent testing labs also conduct emissions and fuel consumption testing for type approval and conformity of production /16/.

5. Patents versus publications

In my previous submission I mentioned the relatively poor performance of the Australian universities relating to research excellence in the Automotive sector which received the lowest possible rating of only 1 out of a maximum possible score of 5. One of the main reasons is that the most important assessment criteria within most universities is publications, both in numbers and related to citations. Publication success and -track record is also the key evaluation criteria for research grants from the Australian Research Council (ARC). Consequently the universities also focus on publications instead of patents.

I personally experienced this during a grant application which was rejected due to an insufficient number of publications. The rejection occurred even though I held 4 sealed patent families which is 4 times as much compared to the one sealed patent family that was reported in the 2012 ERA review for the complete sector Automotive Engineering.

Even though sealed patents are counted as one criterion in the Excellence for Research Australia Review (ERA) /17/, the problem is that it takes around 5 years from the time a patent application is filed until it is granted and it is quite expensive to file a patent application and to get it examined. Furthermore, only a relatively small number of patent applications are granted. So there is a very long lead time between the patent application and the time when a patent is granted. This means that the risks of investing in patent applications is relatively high compared to publications.

The next problem is that during the 2012 ERA review, patents were only counted for a 3 year period in contrast to publications which were counted over a period of 6 years which is twice as long despite the fact that it takes significantly longer to get a patent sealed.

Furthermore the ERA reviews are only conducted every few years so it takes another couple of years until a sealed patent counts in the ERA review.

Considering typical employment churn rates in Australia of over 20% for organisations for organisations with more than 2500 employees /26/, like the typical universities, this means that it is not very attractive for university managers to invest in patents as they most likely will not be working anymore for the same university.

The overvaluation of publications compared to patents in research is demonstrated through statistics: During the Shell Innovation Open House Keynote Panel with the Chief Scientist, Australia, Prof Ian Chubb, the Minister for Industry, The Hon Ian Macfarlane, and others, it was mentioned that Australia produces around 3% of all scientific papers globally, but only around 1% of the patents and that this mismatch should be addressed towards a higher share of patents globally /18/.

However, even though the low rating for Automotive research excellence at Australian universities, the picture is different if the number of patents per full time employee (FTE) are analysed for different sectors:

- For the sector Automotive Engineering per year an average of 0.038 patents were sealed per FTE
- The equivalent number across all engineering sectors was an average of 0.021 sealed patents per year per FTE

- Across all evaluated research sectors an average of 0.011 patents were sealed per year per FTE

That means that related to sealed patents per FTE the sector of Automotive Engineering performed almost twice as good compared to the average across all Engineering sectors and almost 4 times as good as the average across all sectors.

Another indicator that patents are not valued highly by the universities is that the Enterprise Agreements from most universities do not include any references to patents, but instead many of them refer to publications, and some of them quite frequently /19/.

Regarding the application of ARC grants, it can be argued that larger sectors with more academics have an advantage over very small fields like Automotive Engineering through potential conflict of interests. Even though a reviewer must to declare a conflict of interest that only relates to instances where the reviewer collaborated with the applicant, it does not relate to instances where the applicant references the work of the reviewer. If the reviewer's work is cited in an application that can also be considered as a conflict of interest as the reviewer will have a natural interest to get his work cited in future publication because the number of citations is an important criterion to research excellence under ERA. So if a reviewer approves an application where his own work is cited, the chances will be high that his work will also be cited in publications that will come out of the project, if it gets approved. That is in contrast to applications where the name of the reviewer is not cited. For research fields with a large number of researchers in Australia, the chances that the reviewers work will be cited more often is larger compared to very small sectors such as Automotive Engineering, so the chances that an application from a larger research field is approved is higher than an application from a small field. This is a bit like a virtual circle for larger fields which makes it extremely difficult for smaller research sectors to grow.

6. Conflict of interest between university research and private commercialisation

Most universities have commercialisation departments which are responsible to generate income from intellectual property, particularly from inventions which can be patented. This is a commendable trend. However, it does not come without its own problems, for example, if a researcher or student decides to take over the ownership of his or her invention, in case the relevant university policy allows it, or the invention was made during activities outside of the university, and the inventor starts a new spin-off company to commercialise the invention. In such a case many universities do not allow the inventor to continue working on the invention as part of the university employment. The reason could be to avoid potential conflicts of interest, for example related to the use of university facilities or the supervision of students, as this could be considered a potential unfair cost advantage to the spin-off under the "Competition Principles Agreement".

This unfortunately delays the commercialisation of new inventions unnecessarily and it does not help the university nor the inventor.

In Germany that is handled much differently where it is almost the norm that Professors in the Engineering discipline operate a private business in parallel to their full time university position. One of the most outstanding example is the collaboration between one of Germany's most renowned Technical Universities, RWTH Aachen and automotive engineering service provider FEV. Prof Pischinger is Director of the Institute for Combustion Engines at RWTH Aachen University with over

160 employees /27/ and at the same time CEO of FEV Group that "employs a staff of over 2,700 highly skilled specialists at advanced technical centres on three continents" /28/

7. Rapid growth of Compressed Natural Gas (CNG) as vehicle fuel

The number of vehicles powered by CNG is growing rapidly world-wide, the annual growth rate since 2001 is over 24% as shown in figure 1 /20/. What is really interesting about this fact is not this large growth rate alone, but where this growth is happening which is mainly in Asia, including the neighbouring countries of Australia. Even countries without significant natural gas resources like Germany, which buy most of its natural gas from Russia, has invested heavily in CNG in several ways. Firstly a critical number of CNG refuelling stations were established, currently over 900 CNG fuel stations with open access exist and 2200 in total /21/. That is almost two thirds of the number of LPG fuel stations in Australia. Secondly there are significant Government incentives for CNG cars and for CNG conversions, up to EURO 1,500 per car plus similar incentives from gas utility companies. The car manufacturers and conversion companies responded and made several dual fuel cars available which are also being exported. The result is that Germany already has 97,000 registered CNG cars /22/.

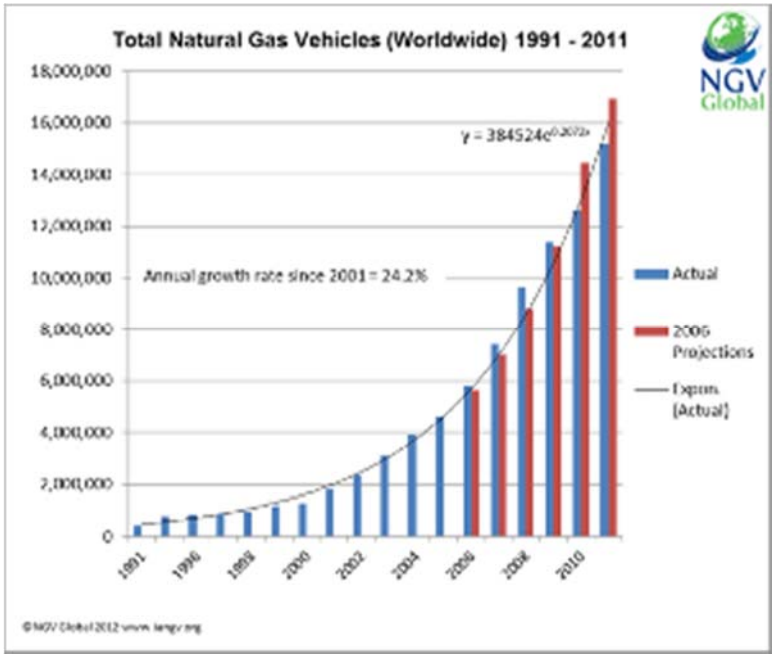

Figure 1: Total number of Natural Gas vehicles world wide /20/

There are several reasons for this politics to support CNG:

- It reduces the dependency from importing oil from politically unstable countries which are relatively far away in the Middle East
- CNG is much cleaner than Petrol or Diesel fuel. Opel and other car manufacturers claim that their CNG cars produce "80 percent less nitrogen oxide than a diesel, and around 20 percent less CO2 than a gasoline model" which is ca. "15 percent less CO2 than diesel" and "the exhaust gases contain almost no soot particles" /23/
- CNG vehicles are a growing global market niche and provide a significant export opportunity

Australia, in contrast, is the country with the world's 10th largest resources of natural gas. However, there are only a few public refuelling stations available and almost no CNG cars offered from car manufacturers.

CNG conversion kits that are easy to install and therefore cost effective would be another good export opportunity. But to establish such a market in Australia it is a chicken and egg situation as it needs investments for refuelling stations at the same time.

8. Update on Proposal for Australian Leaning Car Consortium

In my initial submission I proposed to establish a "Consortium to Develop, Produce and Commercialise the World's First Global Cross-Over Vehicle between a Car and a Motorcycle that Really Combines the Best of Both Worlds". So far I've discussed that proposal with a few organisations and received a very positive response. The FAPM supports the proposals by providing the following support:

- Introductions to key decision makers of their member companies
- Promoting in the monthly e-newsletter
- Opportunity to present during regional meetings

Furthermore I have discussed the proposals with CSIRO, as recommended by the Commissioners, because CSIRO previously led the AxcessAustralia projects. I have also talked to some key people from EV Engineering to learn from their experiences with similar consortia and collaborations. So far 18 organisations have expressed interest and the number is growing every day.

I have also been in contact with the three Australian local car producers. They are all interested as well but haven't made a decision yet if they want to get involved. From overseas I've got very strong interest now from 3 vehicle manufacturers.

PROPOSALS FOR ALTERNATIVE PUBLIC SUPPORT MECHANISMS

1. Support for Production and Development should be based on loans or equity investment

During the global financial crises the three big three American car manufacturers almost went bankrupt so the US government provided loans to enable them to restructure. In contrast to grants, loans provide a much larger incentive for the beneficiary to use the assistant as effective as possible to be able to repay the loan in the future, so the focus is to create a sustainable and profitable business in the long term instead of short term focused support policy.

Another alternative would be the Government investing in a company in a similar way as an external investor and would receive an appropriate equity share for that investment. If the company becomes profitable that share could be sold again. If the company would not recover the Government would be able to divert some of the remaining assets towards a potentially more attractive business opportunity.

2. Incentives to Encourage Local Production with Contract Product Development for Competitors

As described before, companies like Porsche, which produce goods and provide engineering services to their competitors, are more profitable compared to companies that do not apply a similar strategy. A unique support program could be devised to encourage such a strategy, for instance providing similar loans as under proposal 1, but with more attractive conditions, such as lower interest rates or longer durations.

3. Establish an Independent Fuel Economy Certification Testing Laboratory

Similar to many of our Asian neighbours, Australia should establish its own independent fuel economy certification testing laboratory. This will ensure that the spirit of the law is followed for all fuel economy and emission certifications and that Australian car manufacturers are not at a disadvantage to those European manufactures that might be using such test flexibilities.

Once such a laboratory is established, it is suggested not to accept any fuel economy tests that were performed outside of Australia. Instead, the new independent fuel economy certification laboratory should perform all fuel consumption certification tests for vehicle to be imported and sold in Australia. To implement this change as fast as possible without the need to build a new laboratory there are several options, either taking over the Ford / ACART or the Holden vehicle emissions lab. As Ford discontinues the Falcon and Territory, there will be excessive test capacities available. Furthermore the lab currently only operates 2 of its 3 emission chassis test cells and only in 2 shifts. If all 3 cells are operated in 3 shifts, the capacity could easily be doubled. In addition, the lab could increase efficiency by another 50% or more if global best practices would be applied.

The advantage of using the Ford/ACART Lab would be

- it was already certified by NATA, the National Association of Testing Authorities, Australia
- it has been performing emission certification tests for external customers for many years including testing for all local competitors Toyota and Holden
- it is correlated with other international and Australian vehicle emission certification labs
- it has capabilities to test all fuels including Petrol, Diesel, LPG, etc.
- it has already been co-funded by the Victorian Government to make such services available in Australia

Furthermore, the ADR regulations should also require the use of robot drivers to minimise potential differences between different human drivers.

4. Value Patents Higher than Publications when Evaluating Research Excellence

For the next ERA reviews, much more weight should be put on patents and patent applications compared to scientific publication. The weighting should reflect the probability of getting a patent granted compared to geting a publication published. During the last ERA review across all scientific disciplines that ratio was

265 = (413,477publications over 6 years divided through 781.1 sealed patents over 3 years)

This ratio should be adjusted in subsequent ERA reviews to reflect the impact of such a change.

The reference period for patents should be increased to at least the same as for publications, which is 6 years, but ideally even longer, perhaps 10 or 12 years, considering the fact that it takes many years until a patent application is granted.

Further patent related criteria should also be added, depending on different stages of the patenting and examination process, the weightings should still be higher compared to publications, but with a lower weighting compared to sealed patents (possibly with a weighting of 10 to 30):

- Provisional or initial Patent applications should also be counted as a first indicator, with the lowest weighting
- Examination requests (which can be filed any time, either with the patent application or within a certain number of years after) should follow with a higher weighting as it is a sign of additional confidence as well as financial commitment
- International PCT applications (which can be filed within 12 months after the initial patent application). Again they document a higher commitment and confidence to get a patent granted
- Applications in the national phases (which can be filed within 30 month after the initial patent application)

5. Review of ARC grant applications only by reviewers that are not cited in application

ARC grant applications should only be assessed by reviewers who are not cited in the relevant application, to avoid potential conflicts of interest, and to provide fair chances for smaller research sectors such as Automotive Engineering. This can be implemented very easily just by electronically searching for the name of the proposed reviewer in the application. If the reviewer's name does not come up, the reviewer can be accepted, if does comes up, he/she cannot be accepted and alternative reviewers must be found.

6. Establish a Policy to Encourage Universities and Researchers to start Spin-Offs Together

A policy should be developed to encourage universities and researchers to start spin-offs to commercialise inventions together instead of separate from each other. The policy should regulate the interaction with students and university facilities for such spin-offs for a limited period until the spin-offs become self-sufficient. The policy could include examples of what type of interaction might be appropriate and which not. For example, is it appropriate for a researcher who is also part of a start-up to supervise a student who is working on the technology of the spin-off company, maybe as a final year engineer project or even a PhD project, or should such students have an independent supervisor from the faculty, as for external industry projects, or should it not be allowed for students to work on such projects ?

Another example could include the use of university facilities, for instance would it be appropriate for the university to provide access to such facilities free of charge, or could that be considered a potentially unfair cost advantage to the spin-off under the "Competition Principles Agreement" ?

7. Establish a Framework with the Vision to Become the Global Leader related to CNG

CNG should be supported through several incentives with the aim for Australia to become the global leader related to CNG. Such incentives should include support for utility providers to install CNG fuel stations, for OEM's to develop and import CNG vehicles, for suppliers to develop and sell affordable and effective aftermarket conversion kits and rebates for consumers to buy CNG vehicles.

The incentives for the development and production of CNG and CNG conversion kits should be designed in such a way so that solutions will be prioritised by receiving a larger support if they can be exported into the countries with a significant CNG market. Such countries could be characterised by their number of CNG fuel stations. These countries with the largest number of CNG fuel stations include Pakistan, China, Argentina, Iran, Brazil, USA, Germany, Italy, India, Columbia, Bangladesh, Thailand, Armenia, Ukraine, Japan, South Korea, and Malaysia.

To create a critical size for a CNG market in a short time frame it might be worth eliminating the import tariffs for a limited time for vehicles and conversion kits that are already available overseas.

Another possible incentive is for consumers to purchase CNG cars and conversion kits, similar to the prior LPG rebate scheme. This consumer rebate scheme should also be extended to include the installation of home refilling compressors, similar as in Europe.

8. Next steps to establish Australian Leaning Car Consortium

Some images of how the "Leaning Tandem Car" could look like are shown in figures 2 – 3. As mentioned in the previous submission, it is a complete new generation of ultra-efficient cross-overs between cars and a motorbikes that combine the best of both worlds: safe and comfortable like cars and easy to park and fun to ride like motorbikes.

Figure 2: Styling sketches of proposed Australian Leaning Car (by Richard Li /24/)

Figure 3: Parking advantage of proposed Australian Leaning Car with another styling

During the time from now until the period of the next submission further organisations will be contacted to generate further interest from the industry by locking in further committed collaboration partners. That will be done firstly by following up the contacts that have been provide by the FAPM as well as contacting other organisations from networks outside of the FAPM.

Then it needs to be decided what type of legal form the consortium should have and a separate entity needs to be formed. A normal Pty Ltd format is suggested to reiterate the purpose of generating an economically sustainable entity. Another important detail is the distribution of the ownership of the consortium. That could be based related to the contribution of cash and in-kind support during a predefined initial duration, until the first functional prototypes are available. This would be quite different to the AxcessAustralia projects where most participating companies didn't own any equity in the organisation that was set up solely for the purpose of these 2 projects, but it would be more similar to the typical Japanese "keiretsu" linkages between suppliers and vehicle manufacturers.

A viable business plan including target markets and a budget for the next 5 years has to be formulated and agreed. The broad technical specifications need to be agreed on together with the relevant development targets. Such first critical decisions could be made during a kick off meeting where all interested organisations would participate.

Another important factor is to generate further customer endorsement and lead user uptake of the product. One of the key reasons that the EV Engineering Electric Commodore project was supported also by Holden was that General Electric was committed to buy between 1000 to 2000 vehicle if the project was successful. Similar potential supporting consumers, additional to the Victorian Police, who wants to try the vehicle and are committed to pay a higher price compared to their existing BMW Police Bikes if our Leaning Car is safer, could be the following:

- Police and law enforcement organisations in other states and countries
- Ambulance service providers, as they have a similar need for faster and safer access to their "clients"

- City councils with an interest to make better use of their roads and parking spaces, particularly those cities that will be negatively affected by the closure of Ford's and Holden's manufacturing, like Geelong, Melbourne and Adelaide.
- Perhaps the Australian Post might be interested to improve the safety of their staff and to improve their efficiency by increasing the load capacity compared to the "posty bikes" and to avoid the mail to get delivered wet during rain
- Utility providers for electricity could be another target group so they could use their own electricity to power the vehicles instead of petrol, as it is envisaged to build the vehicle with a Plug In Electric

The basic initial specifications of the main vehicle version are as follows, some images of how the vehicle could look like are shown in figures 2 - 3:

- Dimensions
    - Width 0.8m (to fit 2 vehicles side by side in one standard car park)
    - Length 2.4m (to fit 4 vehicles sideways into a standard car park that has access perpendicular to the normal driving direction, like along the side of the road, and for easy handling)
    - Height 1.8m (to provide a wide range vision and good visibility)
- 3 or 4 wheels, 2 at the front, one or two at the rear (to enable stability control)
- 1 - 4 passengers in tandem configuration (1 - 2 passengers with 3-wheels and 3 – 4 passengers for a longer version with 4 wheels)
- Safety
    - Leaning to side to provide self-stabilisation while driving like a bike
    - Encapsulation
    - Roll over protection
    - Crush zones
    - Passive low cost real time electronic stability control
    - State of the art car safety features – Aim for 5 start ANCAP rating
- Powertrain: Plug In Hybrid Electric (to enable fast acceleration and a high top speed required for Police Vehicles in combination minimal emissions)

In parallel to the development of the prototype a whole range of research projects should be completed to serve several purposes: firstly to help making the final product as safe and competitive as possible and secondly to be able to generate further intellectual property that should be used to generate early income through engineering services to established vehicle manufacturers, similar to what Porsche has been doing for a very long time. Examples for such research projects related to the specifics of such a new generation of vehicles are the following:

- Crash performance including the development of new relevant crash test standards due to the leaning nature of the vehicle to ensure that the vehicle can freely tilt during a crash test
- Unique light weight body structures that don't need to provide high torsional stiffness
- Vehicle dynamics performance simulation and testing
- Novel door concepts that minimise the change of the centre of gravity during opening and closing

- Novel seat arrangements and seat belt systems that allow sideway body movements and are space saving and light
- Novel handlebar designs with integrated functionalities like modern car steering wheels
- Specialised wheels and tyres for higher weight compared to motorcycles
- New powertrain concepts that are driving all three wheels
- Specific business models
- Consumer acceptance and –behaviour.

In summary, this could become the first real global game-changer in the automotive industry since Henry Ford introduced vehicle mass production.

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