WHITE PAPER

noble™

Enabling Artificial Intelligence for mobility.

Overcoming the challenges in mobility to support sustainable product developments.

KUENA ENGINEERING

Contents

Executive Summary

In this white paper we introduce noble™, the product sustainability manager, we discuss how Kuona Engineering's new product overcomes the manifold challenges facing sustainability and research and development (R&D) teams worldwide. We also share application examples in which noble™ can be used to provide valuable insight, optimise products, and reduce resource intensity and time to launch drastically.

Artificial Intelligence (AI) and Machine Learning (ML) can support organisations greatly by learning from existing data sets and creating predictive models that capture the high-dimensional, non-linear relationships that exist between a vehicle's specifications and its overall environmental impact. Such models can then be used to explore alternative business models and vehicle configurations, to identify potential trade-offs between business wants and environmental needs. This allows teams across the globe to focus on impact reduction activities. But machine learning methods can struggle where data is sparse, as it often is in sustainability. These methods are also difficult for domain experts to apply and interpret. And their use is constrained by concerns about trustworthiness and transparency.

By leveraging the computational power of AI and ML based solutions and combining this with known and trusted data sets, organisations can reduce their experimental efforts by ~80 percent and save hundreds of thousands in R&D resource costs [1]. This will enable companies to get their product to market faster whilst avoiding the complex tasks of manually calculating and estimating their environmental impact.

A lack of available data, expertise and time mean that many organisations are not able to decarbonise their products and processes within the timeframe of a given project. Enter noble™, a machine learning tool that is set to revolutionise sustainable product management across the value chain.

Introduction

The automotive industry is responsible for ~10% of the world's carbon dioxide (CO_2) emissions by producing 80 million vehicles yearly [2]. The need to reduce the environmental impact of new vehicle models is becoming more pressing, with the disastrous effects of climate change becoming part of our everyday lives.

By the start of 2026, car makers sometimes known as Original Equipment Manufacturers (OEMs) will by law, be required to undertake Life Cycle Analyses (LCAs) for the products they intend to sell in local and international markets. This legislation will be required for sale in the European Union (EU) to begin with, but with the increasing need for sustainability, will become a global requirement. Legislation as well as customer demand, means that for the first time, OEMs must set environmental targets and meet them. OEMs must now ensure that the cars they intend to sell will meet minimum thresholds before they know anything about the car. This is the opposite situation today. Where the actual impact is more or less estimated only once the car has been built and everything has been measured. One key missing piece in the world where automotive meets LCAs is the availability of data.

The automotive industry along with the mobility sector in general are fundamental to the global economy and to net zero goals. This is true both for original equipment manufacturers (OEMs) as well as their upstream and downstream supply chains inclusive of component manufacturers and raw material providers of metals, plastics, composites, and other advanced materials. There is a continued need for agile innovation to develop new solutions that address the manifold sustainability challenges within complex supply chains.

The majority of these challenges can be grouped and simplified to data collection, expertise, environmental impact analyses and regulatory targets. These must be overcome whilst still maximising the value of corporate intellectual property (IP) and profit making which makes businesses in themselves sustainable. Making sustainable business decisions requires teams to understand complex, high-dimensional, non-linear relationships between design and manufacturing in a context where data is often sparse, incomplete and not accessible. The result is high reliance on costly third party environmental impact analyses.

Other key drivers pushing the need to be proactive instead of reactive when it comes to environmental impacts of new vehicles is the incoming EU battery regulation [3] and the new (ELV) directive [4]. These updated regulations, in the first instance, require all Electric Vehicle (EV) batteries to capture the carbon footprint of the batteries placed on the EU market or report recycled content of new vehicles in aid of a Circular Economy.

In the future, there will be environmental targets set on batteries and further, whole vehicles. Since it will be costly for manufacturers to realise late on in a project that their product is at risk of not complying, it is in the best interest of OEMs and their value chains to be able to accurately predict the environmental impact of their products even without data as is required today.

Problem

In a survey conducted by Kuona Engineering it was found that OEMs cannot collect, process and analyse the data that they need fast enough or accurately enough to set realistic environmental targets based on traditional automotive business plans, which are usually centred around performance or technological attributes that do not easily translate to sustainability metrics.

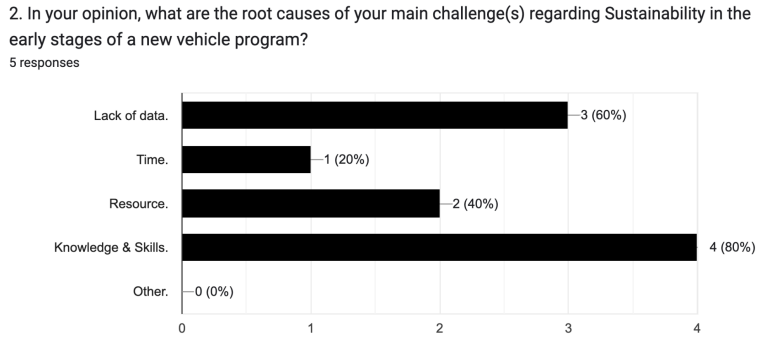

Figure One - Graph showing the main challenges of sustainability teams.

The majority of car makers rely on LCAs towards the end of their vehicle project to calculate the environmental impact of their product. This is because a Bill of Materials (BOM) is required to calculate the relative impacts of each material group or category, this is then tallied up for a total for the whole vehicle. This raises problems for OEMs that want to understand the environmental impact of their products at the time of inception.

Since sustainability is quickly becoming a unique selling point for businesses particularly in the European market, having realistic and achievable targets has become something of a troublesome part of many sustainability professionals' day jobs. On top of that, hiring external consultants or conducting third party verified LCAs is expensive. With each LCA costing no less than £10,000, and since several LCAs may be needed throughout a project, to check status and validate the engineering design versus legal and corporate targets. The costs can quickly spiral into a significant business expense, with the risk of legislative fines if environmental targets are not met.

It is not only additional costs that OEMs must now consider, there is real and tangible risk to their vehicle programs. The cost of resources and time are always scarce throughout car projects. This is evidenced by the number of delayed, cancelled and failed attempts to launch a new vehicle. With the requirement to now conduct vehicle level LCAs, this situation is going to get worse, increasing the strain on automotive manufacturers and the teams responsible for delivering them.

The problems facing car makers today in regards to sustainable product management can be summarised as follows:

1. **Time Intensive** It takes months to collect, process & analyse data.
2. **Inaccurate** Poor data means that assessments aren't used in decision-making.
3. **Expensive** Lifecycle assessments carry high costs due to speciality.
4. **Resource Intense** A team of specialists are needed to undertake LCAs internally.

Context

The world needs more sustainable solutions. On the current trajectory, we, as a species, are set to overshoot the Earth's carrying capacity which the Intergovernmental Panel on Climate Change (IPCC) has warned will have non-reversible and devastating effects on all inhabitants of the earth. Now is the time for industry to pull all available levers to halt the damage being done to the environment in our current linear, high polluting economy.

Dr Anish Shah, CEO and MD of Mahindra Group in an interview with the World Economic Forum said, "Simplification of reporting and disclosures, especially on environment-related impact of the automobile industry, is an important leadership agenda, evident from conversations within the Forum's Automotive and New Mobility industry community. This will also act as a key enabler for investors to understand performance and further unlock climate financing for the sector. While financial performance is easy to compare, the absence of well-defined global guidelines on climate-related reporting currently makes measuring performance tricky. It is also a time-intensive effort to track and report on multiple standards currently without commensurate value addition from this exercise." [2]

Sustainable mobility will play a significant role in decarbonising tailpipe emissions, and the automotive sector has its role to play. According to EY, global sales of internal combustion engines (ICE) vehicles are predicted to be below 1% by 2040 [5].

Coupled with the environmental challenges we are facing is the rise to prominence of AI. In all industries and trades, AI has become almost monolithic in its promise to deliver innovation and efficiency. From safety systems to material selection to defect recognition, AI is breaking boundaries and bringing a new aspect to how we work today. The UK government in 2025 have stated the importance of evolving with technology and using it as a tool for the betterment of society in general and industry in particular.

Kier Starmer "Artificial Intelligence is the defining opportunity of our generation. It is not a technology that is coming; a future revolution on the horizon. It is already here, materially changing lives – preventing illness in our NHS, creating exciting new companies in our economy, pushing the boundaries of scientific discovery in our universities. It will turbocharge every mission in this government's Plan for Change. And the potential for further innovation is vast."

AI is here to stay, and it is up to industry to apply it in ways that enable greater efficiency, accuracy and importantly increase the level of sustainability in their operations. There is no time to waste, profit margins and tipping points hang in the balance and AI could be one of the levers that supports the revival and repair of the failing parts of our economy.

Discussion

Cars are complex things, systems built upon systems and over one-hundred unique materials. All joined in different ways, some with screws, some with clips and some welded to each other. And since the development time for a new car model is anywhere between two and four years, the amount of changes in materials and assumptions is almost infinite.

Over the period that a new vehicle is being developed, many changes happen either changes in the project assumptions or ways of working. These changes could be due to unforeseen circumstances such as ... or business changes to the vehicle design or specification of a given model. Whatever the cause, organisations need systems that can keep up with the increasing rate of change of the modern world.

It is a fact that our economies and lives would struggle to function without the freedom of travel that personal transport offers. That is why it is so important that sustainability is integrated into business decisions. On the road to net zero, organisations have created roadmaps for the decarbonisation of their Scope 1, 2 and 3 emissions. In order to stay true to the commitments that have been made to investors and the public, organisations need to find ways to stay on top of the environmental impact of their products and operations. Figure Two shows how the lack of agile and accurate sustainability metrics affects their business goals.

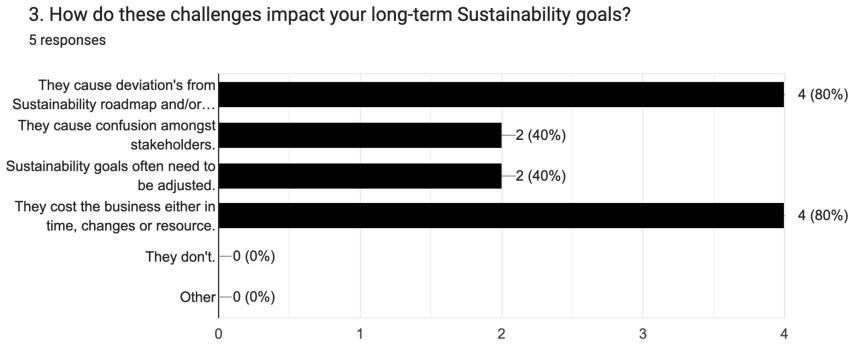

Figure Two - What are the effects of the challenges facing OEMs in regards to Sustainability (Source: Kuona Engineering).

Currently the need for agility and accuracy is not being met, the capability is there. However, the application is missing. Sustainability as a discipline is not new, but the emphasis on its integration into business-as-usual (BAU) has caused teething problems due to the additional strain on existing and often out of date methods. Practical tools that could be used by engineering teams and sustainability professionals are scares, and generally speaking are not tailored to specific industries. The result of this is that they require more manual intervention than can be provided by the already resource-tight landscape in an organisation. Figure Three details the tools available to support organisations in their assessment of new vehicle models.

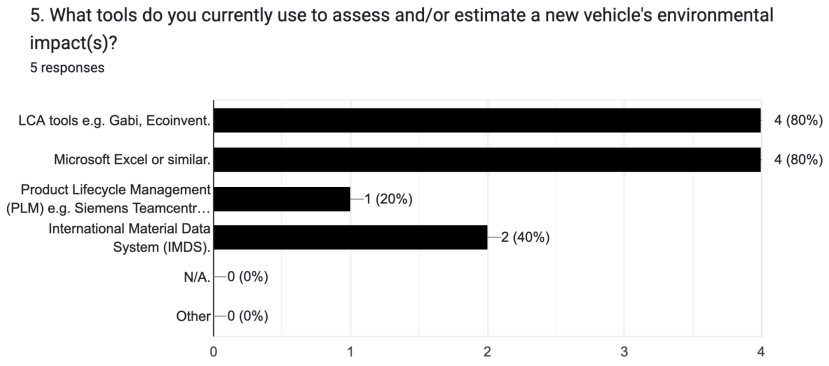

Figure Three - Tools available to assess the environmental impact of new products (Source: Kuona Engineering).

The tools used today to assess the environmental impact of new products works, but they are inefficient and are prone to error due to the manual processes involved. One source of error for example is the data collection across different parts of an organisation which is then aggregated to understand the overall environmental impact of a product. In Kuona Engineering's research and experience, this data collection exercise can take anywhere between three to six months for a full vehicle. Time which could otherwise be spent creatively finding solutions to pressing environmental issues.

The challenges that organisations and solution providers face is how to integrate new innovations with current ways of working. Even though these methods may be legacy, it is vital that organisations transition in a stable way to a better way of achieving their goals. Any solution that is provided to support businesses in their decarbonisation journey must offer customisation as standard. Whether it is reporting formats, or accepting data in specific formats, any solutions must integrate with organisations otherwise it risks rebound effects or worse still, taking the business off their path to net zero and losing precious time which affects their bottomline.

In addition to this, it is clear from industry trends and stakeholder requirements that transparency plays a critical part in a sustainable future. At every step of development and at every milestone, it is becoming increasingly important that organisations are transparent with the work they undertake. New tools which might include software-as-a-service (SaaS) or new innovations must be transparent about their workings, data sources, materials etc. Of course there is a balance to be maintained, since the unique selling point of intellectual property of new players in the market is of the utmost importance. It allows them, for a short period at least, to maintain the competitive edge that marks them as change makers.

Recommendations

The need for business transformation is clear, in regards to both sustainability and also in legacy ways of working. There are significant gains to be made for organisations that leverage AI and similar technologies to streamline their operations and support their product development initiatives.

80% of respondents in Kuona Engineering's survey said that they did not use any digital tools or platforms to help manage sustainability of new vehicle programs. Although surprising, this presents an opportunity for many organisations to improve their profitability and effectiveness.

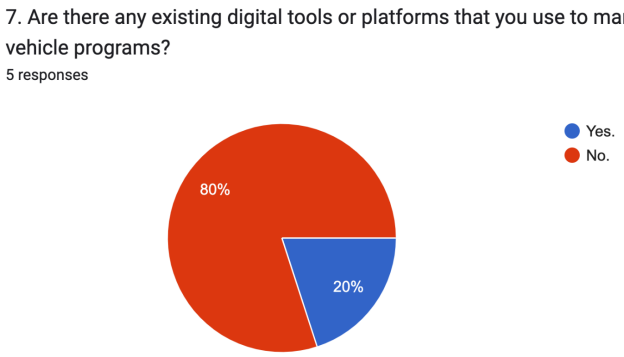

Figure Four - What digital tools do organisations use to manage sustainability of new products? Kuona Engineering).

These opportunities must be exploited in order for organisations to gain or maintain their advantage in an increasingly competitive market. With this in mind, here are three recommendations for organisations that would like to take their first steps in realising the potential that is offered by AI and ML in their:

1. Start with Clear Business Objectives and Use Cases

Before implementing AI in any capacity businesses should define clear objectives and identify specific use cases where AI can provide tangible value. Pain points such as operational inefficiencies, high costs, or resource intensity should be assessed in a methodical way. Aligning AI initiatives with strategic business goals will enable organisations to ensure that the right solution is chosen, whether for automating repetitive tasks, improving decision-making through data analysis, or enhancing products based on data sets internal to the organisation.

Business Benefit: Targeted AI implementation leads to higher return-on-investment ROI by addressing areas that matter the most to an organization. With clear objectives, businesses can avoid the risk of adopting irrelevant technologies and allow them to prioritise solutions that deliver tangible results.

2. Foster a Culture of Collaboration Between AI and Human Teams

AI is most effective when integrated into existing workflows that already involve human expertise. Businesses should encourage collaboration between new systems and their employees to create a hybrid

work environment where AI analyses large datasets and humans provide creative, strategic thinking and oversight. This approach ensures that AI augments the talent already existing in many organisations today.

Business Benefit: This collaboration leads to increased operational efficiency and productivity by allowing employees to focus on higher-value tasks. It also means that organisations do not need to spend as much money or time training their teams in certain areas because the tasks become automated.

3. Continuously Monitor and Optimize AI Systems

AI like all dynamic solutions require ongoing monitoring and adjustment to ensure they continue to perform optimally over time. Organisations should implement systems to monitor and adjust the performance of their chosen solutions. This includes periodically retraining AI models, fine-tuning algorithms, and integrating new data sources.

Business Benefit: Continuous improvement across the board ensures that AI-enabled solutions evolve in line with the business landscape, enhancing long-term value. By addressing issues early on, businesses can reduce the risk of inefficiencies, increase competitiveness, and sustain growth while ensuring AI tools continue to provide cost-effective solutions and improved resource management.

Conclusion

The rise of AI has come at a time of need. Industry, now more than ever, must find more effective and efficient ways of working in order to mitigate the environmental impact of their operations and products. Below, we have summarised three key take-aways from this white paper:

1. For all business functions, sustainability is taking on an increasingly important role. From business analysts, to project managers, to engineering teams and beyond. The need to integrate sustainability into everyday decisions is now a requirement. An important requirement that is needed to protect the environment and to protect a business's bottom line. Investors are focussed on how organisations plan to decarbonise and ensure the longevity of their business. However, the tools that many teams are using worldwide are inadequate and they cause a significant drain on resources.
2. Artificial Intelligence can eliminate the exhaustive task of manual data collection and entry that is fraught with error. By leveraging the computational power of products like noble™, organisations can manage the sustainability of their products and their projects with a fraction of the resources used today. The predictive capability of AI and ML means that less cost is associated with trial and error or late program changes that create risk into an already complex network of dependencies.
3. We truly are in the age of technology. Adoption of new tools is a question of when rather than if. The organisations that understand and act to reap the benefits of such technology will reduce the strain on their work force which in turn will provide more space and time for them to deal with the challenges that require human ingenuity, and in the final analysis will enable them to focus on developing world class, sustainable and profitable products.

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