International Journal of Business and Management Invention (IJBMI)
ISSN (Online): 2319-8028, ISSN (Print):2319-801X
www.ijbmi.org || Volume 11 Issue 2 Ser. I || February 2022 || PP 50-54

The concept of "Carbon Credit" in the construction industry: A case study of viAct's scenario based AI in carbon credit management

Gary Ng[1], Hugo Cheuk[2], Surendra Singh[3], Barnali Sharma[4], Baby Sharma[5]*
118 Wai Yip St, Kwun Tong, Hong Kong
**[4] Corresponding Author: Baby Sharma*

Abstract
This paper is an attempt at explaining what carbon credits are and how AI helps in carbon emission monitoring and carbon credit management in construction taking the case study of viAct (A ConTech Startup from HongKong). viAct's scenario-based AI has been designed to play a significant role in measuring, monitoring, tracking, predicting and reducing carbon emissions. Further, its solutions like fleet management and its AI modules such as Air Quality Detection, C&D Waste Classification, and Illegal Dumping Detection has helped the construction companies to optimize construction machinery usage; monitor air quality and C&D wastes and detect illegal dumping of these wastes, respectively. In addition to this, the auto-documentation and analytics capabilities of viAct's AI monitoring platform – viHUB is an exclusive solution helping stakeholders in managing their carbon credits and well as empowering their carbon credit trading in a holistic manner.

Keywords: *Carbon Credits, Carbon Footprint, Carbon Offsets, Artificial Intelligence, Computer Vision.*

Date of Submission: 14-02-2022 Date of Acceptance: 28-02-2022

I. Introduction

The increase in regulation of governments of different countries are pressuring the private sector to limit greenhouse gas emissions that has led to the popularity of terms like "Carbon Credit", "Carbon Footprints" "Carbon offset" etc. This market has boomed as high as $1 billion in 2021 due to the upsurge in concerns about a sustainable future (Ecosystem Marketplace, 2021). The U.N. Environment Programme under United Nations Climate Change Conference in 2021 has also highlighted that with defined rules and transparency, the carbon markets could really help in tackling "slash emissions". Carbon credits are not just entities created through forestry and agricultural practices but any industry can make credits by reducing, avoiding, destroying or capturing carbon emissions. The trend of carbon credit trading has also seen a boom in recent times. Individuals or companies looking to offset their own greenhouse gas emissions can buy those credits through a middleman apart from directly capturing the carbon and gaining credits. A simple illustration of the carbon credit trading can be depicted with the below example: Let's suppose a farmer that plants trees, the landowner gets money; the corporation pays to offset their emissions; and the middleman, if there is one, can earn a profit along the way.

The voluntary market in carbon trading records a phenomenal boom especially after the COVID-19 pandemic when the notion of saving the environment has become a primary focus. At the end of 2021, the voluntary market reaches $6.7 billion as reported by Ecosystem Marketplace. Currently, traders in the European compliance market project carbon prices to increase 88 percent to about $67 per metric ton by 2030, according to a survey released in June by the International Emissions Trading Association. Furthermore, the growing interest of corporate to join the mission set by Paris Agreement for limiting global warming to 1.5 degrees Celsius over pre-industrial levels and the accelerated interest in achieving net-zero goals have subsequently triggered the entire carbon credit market especially over the course of the year.

The increasing demand of carbon credits thus has become a key global effort used to reduce greenhouse-gas emissions. Thus the voluntary carbon market is expected to be large, transparent, verifiable, and environmentally robust to meet the rising demand. However the current market is quite fragmented, complex and cumbersome. Many parts of the carbon crediting system are questionable due to low accuracy of auditing and monitoring carbon footprints. Furthermore, lack of limited pricing data often makes it difficult for the buyers to evaluate the ROI against the credit purchase. Moreover, the complexity of the system becomes even more challenging when it comes to managing carbon offset records and calculation of the entire carbon footprint. While the increase in demand for carbon credits is significant, analysis by McKinsey reports that the demand of carbon credits in 2030 will match the potential annual supply of carbon credits which is 8 to 12 $GtCO_2$ per year. The report also suggests that the carbon credit market would revolve around four major

categories: avoidance of nature loss (including deforestation); nature-based sequestration (like reforestation); avoidance or reduction of emissions (like methane from landfills); and technology-based removal of carbon dioxide from the atmosphere. Thus, the scale up of the voluntary carbon market can be stated to have great influence on standard-setting organizations, financial institutions, market participants, market-infrastructure providers, and other constituencies.

Even though the buzz of "Carbon Credit" has been something that is predicted to strengthen in the coming few years, the building and construction sector seem to have a slower adaptation of such approach. This leads to extreme environmental non-compliances and adds to carbon footprints. Thus, the current paper puts forward an attempt to understand the concept of carbon credits and the drawbacks in the current auditing system. The paper also tries to investigate various technologies such as AI, IoT and blockchain that are associated with tracking, auditing and organizing carbon credits with special reference to the construction industry. To better understand the scenario, the paper investigates how viAct, an AI based construction monitoring solution provider from Hong Kong has leveraged the ability of its scenario based AI to audit, monitor and manage carbon credit for any construction site.

II. Background concepts of Carbon Credit and trading

Carbon credit is defined as "a tradable permit or certificate that provides the holder of the credit the right to emit one ton of carbon dioxide or an equivalent of another greenhouse gas – it's essentially an offset for producers of such gases". The major aim for creation of carbon credits is the reduction of carbon emissions and other greenhouse gases generated from various industrial activities. In a broader perspective the creation of carbon credits can be done by either "compliance" or "voluntary" markets. The compliance markets include "cap and trade" programs enacted pursuant to law. This program "caps" carbon emissions at some amount which usually declines over time making the program extremely stringent. This then enables the creation of tradable rights to emit the capped pollutant. The common currency available in the carbon market is "carbon credit". One carbon credit is equivalent to one ton of carbon dioxide. The entities having additional credits can then resell them to buyers who want to purchase additional credits. On the other hand, the voluntary market is based on a contractual relationship between buyer and seller which involves carbon credits that are created and traded outside of a legal mandate. The Chicago Climate Exchange is a notable example of a voluntary market. In such markets, companies often voluntarily agree to opt into a program whereby they take on emission reduction obligations and can trade carbon credits amongst themselves. Moreover, the vetting of carbon credits has also been done using various standards.

There are two broad categories of tradable credits, within the compliance carbon market. These categories are: "allowances" and "offsets." "Allowances" can be defined as credits which are created by government fiat. These credits are allocated to entities like those regulated by a cap and trade program, and may be those included in a broad array of other actors who may trade such credits like financial institutions. They are either for free or through an auction. Furthermore, projects with initiatives for reduction of greenhouse gas emissions that are undertaken by entities that have no compliance obligation under a cap and trade regime, often deal in "Offset credits". "Offsets" are considered as activities "outside the cap,". Carbon credits generated from such projects may be used by capped entities to meet a compliance obligation.

Tracing back to the carbon credit market in 2007, it was seen that the market started to grow. This trend called upon by the compliance obligations of the Kyoto Protocol to the United Nations Framework Convention on Climate Change. Under Kyoto, the countries were bifurcated into developed and developing. In this context, over the first Kyoto "commitment period" – from 2008 to 2012; the developed countries agreed for an annual reduction of their emissions by an average of around 5%. The threshold for measuring the emission reduction obligations were the "baseline" emissions as they existed in 1990. On the other hand, Under Kyoto, in parallel to the emission reduction target of developed countries, developing countries were agreed to generate offset credits under the Clean Development Mechanism (CDM). Thus, under Kyoto it can be stated that, the emissions of countries in the *developed* world were capped while the emissions of countries in the *developing* world were not, but were put under the CDM to provide a mechanism for financing projects in the developing world. Thus, the tradable carbon credit business was fueled by CDM for providing an additional revenue stream for "green" projects in the form of tradable carbon credits.

III. Technology Innovation strengthening the carbon market

Various technologies have been employed in the carbon market to strengthen the monitoring of carbon emissions, tracing carbon footprints, auditing and trading carbon credits. The most emerging technology in this connection is AI, IoT and Blockchain. AI and IoT often seem to work in conjugation to detect carbon emissions from various industrial sources at real time which otherwise was difficult to be estimated. Furthermore, the blockchain technology has worked for making the entire carbon market reliable, safe and transparent in terms of its functionality.

3.1 AIoT for optimizing carbon emission and saving credits

The ability to collect large amounts of data, to learn by experience, intuit connections that the human fail to notice and to recommend proper actions based on its conclusions - are the unique features and the strengths of AI & IoT. Those companies that are willing to reduce their carbon footprint should make use of AIoT for all the three elements of the effort. Monitoring emissions is the first area of application in this regard. AI-powered data engineering can help companies to track emissions automatically through their entire carbon footprint. They can arrange and collect data from their operations and activities, such as IT equipment and corporate travel; and from every bit of the value chain, including their suppliers (materials and components), transporters and even their product users. Further, AI can exploit data from new sources like satellites, and by using intelligence on data; it can also generate an approximation of missing data and estimate the certainty levels of results. The second area of application is for Predicting Emissions. With predictive AI companies can forecast the future emissions across their carbon footprints, relative to their present efforts at reduction, new methodologies to reduce carbon, and the future demands. This helps companies to set, adjust, and achieve their targets of reducing carbon with more accuracy. Thirdly, AIoT also has its utility in Reducing Emissions. Predictive AI and optimization can provide detailed insight into every element of the value chain, thus improving efficiency production, transportation and such other aspects. This ultimately helps in reducing carbon emissions and cost cutting.

By providing detailed insight into every aspect of the value chain, prescriptive AI and optimization can improve efficiency in production, transportation, and elsewhere, thereby reducing carbon emissions and cutting costs.

3.2Blockchain for managing carbon credit

Application of blockchain to a corporate carbon transaction helps check the production and consumption status of a company at specific intervals, and the output or the reduced carbon emissions that corresponds to the status gets stored in the database, following which the autonomous trading or block can be performed. The trading route is arranged by the chain and the carbon emission transaction directly with another party is completed. The concept of a distributed ledger in blockchain theory requires that, in order to ensure the safety of carbon emissions in the transaction cycle, the transactions taking place between the participants of the network be recorded in a shared ledger. Further, each record needs to have a timestamp and a unique cryptographic signature. This is to ensure that every transaction can be traced back to the record. Also to prevent mistakes and prohibit anyone from alerting the record maliciously, any change in the ledger will get reflected in all the copies, in a matter of minutes or seconds. Thus, blockchain technology can be a reliable option for recording and transmitting information flow in carbon emissions trading. To avoid problems such as lost quotas and repeated transactions, a consensus network can be created that makes it possible to locate directly the problems in the transaction link and ensure information traceability. Further, any instance of fraud or illegal trading can be detected and the normative operation of the carbon market can be further strengthened.

IV. Carbon Footprint in Construction Industry

The construction industry is one of the highest carbon emitting industries. According to Global ABC Global Status Report 2018, nearly 40% of the CO2 emitted globally is generated by the buildings. Out of this, 28% is annually generated by the building operations and an additional 11% is generated by embodied carbon (that is, building materials and construction), annually. Handling of embodied carbons is critical since unlike the case with operational carbons that can be reduced over a period of time with the use of renewable energy, and building energy upgrades; the embodied carbons get locked in the place itself, no sooner a building is built. The statistics do not end here. Reports show three materials, namely, concrete, steel and aluminum (the most used material in the built environment) are responsible for 23% of the total global emissions.

Study shows 2/3rd of the existing building area shall exist in 2040 as well. If decarbonisation of the existing buildings is not carried out, they shall continue to emit CO2 in 2040. Moreover, it is expected that in order to accommodate the largest wave of urbanization in human history, it is expected to add 2.4 trillion sq. ft. of new floor area to the global building stock by 2060, which means the global building floor is expected to double by 2060.

V. Case Study: viAct's approach towards carbon credit auditing

viAct is a ConTech startup from Hong Kong that provides "Scenario-based Vision Intelligence" solutions exclusively for construction industry all across Asia & Europe by successfully deploying around 50 sites. viAct's smart AI modules has been successfully providing extremely granular insights on environmental compliances in construction jobsites by not only tracking objects but by transforming vision to practical actions. In this notion, viAct's scenario-based AI is playing a significant role in measuring, monitoring, tracking, predicting and reducing carbon emissions. It has been constantly striving to help the construction industry in

tracking carbon credit emission and carbon credit monitoring and auditing. In the present times, with the continuous increase in carbon emissions, it has become pertinent for the construction companies to reduce their carbon footprint and erect buildings that are not just economical but also environmentally sustainable. However, calculating and monitoring carbon footprints manually is not a smart way to do, as it includes elements of inaccuracy, inefficiency and errors. However, viAct with its AIoT solution can help construction companies to track and monitor emissions throughout their carbon footprint.Apart from emissions, another source of carbon from the built environment is "Embodied Carbon". It refers to "the carbon dioxide emissions that are associated with the materials and construction processes throughout the lifecycle of a building or any infrastructure". It includes any CO_2 generated during the manufacturing of building materials, starting from material extraction, to transport to manufacturer, to manufacturing process; transport of those materials to the jobsites and then the construction practices themselves. However, measuring embodied carbon is very complicated as it requires tracking materials through elaborate manufacturing supply chains. As of 2018, 11% of the global energy and process-related emissions were generated by the materials production for the building. Further, approximately half of the steel, concrete and brick produced are used in the building sector. viAct's AI has also been playing a significant role in monitoring the overall material embodied carbon emission, which otherwise becomes difficult to be tracked for large construction sites. The next application of viAct's AI is tracking fuel carbon emissions. Fuel carbon emission reflects the carbon emissions caused due to combustion of different types fuels. AI along with other technologies like IoT can be trained to track carbon emissions from different sources in the construction site. This can help construction companies to find out the high-emitting and low-emitting fuels, and thus accordingly set targets, make decisions on their use and reduce emissions. For instance, machinery running on CNG is often shown to emit less carbon as compared to a vehicle running on diesel. In such a case, detection of the emissions could be done through IoT devices; while an AI integrated record keeping dashboard can give a comprehensive view about the carbon emission status. This eases fuel usage planning for managing carbon credits. Thus viAct's AIoT devices alomg with its start AI dashboard (viHUB) has leveraged the power of machine learning to become a best-fit for this solution.Furthermore,the construction machineries are one of the major sources of GHG emissions and other harmful substances such as carbon monoxide, nitrogen oxide and particulate matter. As the construction projects make use of huge numbers of machinery, manual fleet management becomes very inefficient since it is out of human reach to monitor each-and-every machinery at all the times. Thus, to regulate this, proper fleet management becomes very important. viAct being a pioneer in fleet management in construction industry has incorporated its scenario based AI to monitor the operating hours, fuel usage or instances of unnecessary machinery usage round-the-clock without any miss and thus help in optimizing construction machinery usage which in turn saves carbon credits.

Anotherproblem related to decarbonisation in the construction industry is carbon offset monitoring. It requires proper and elaborate tracking of all the different types of activities undertaken by a company to compensate for carbon emission. It involves extensive calculations, analysis, comparison and contrast between rates of carbon emissions and carbon offset, which definitely cannot be done manually. In this regard viAct's AI monitoring platform- viHUB is helping construction companies automatically record and perform various data analytics that too with minimal human interference. The intuitive decarbonisation dashboard of viAct under viHUB has helped construction industries to have a consolidated view of the same. viAct has also its AI to help the industry to measure the air quality. Its Air Quality Detection Module can record air quality and environmental data in real-time. The AI can be used to improve air quality by leveraging its potentiality to detect minute particles in the air. Construction industry being a major source of air pollution can reduce it using such AI solutions.Like air pollution, 35% of the world's industrial waste is solely generated by the construction industry. Much of the carbon is emitted into the atmosphere through the accumulated C&D waste dumped in the dumping areas. Proper management and on-site segregation of these C&D wastes thus becomes important. Understanding this well, viAct has tailor-made its C&D Waste Management Module that is well-trained and tested to detect different types of C&D wastes, like rock, soil, slurry, etc. thus, helping on-site segregation of wastes. Further, viAct's Illegal Dumping Detection Modules has been trained to detect any instance of illegal dumping. These solutions can help the construction companies in tackling carbon emission and environmental pollution at large.

The decarbonisation process has a huge role of carbon credits and viAct also plays an important role in managing carbon credit of a construction company. As discussed earlier, carbon credits are a tradable permit or certificate that provides the credit holder the right to emit a specific amount of CO_2 or any other GHG. Since the credit holder company needs to comply with these limits, exceeding which might bring in compensations to them, it is very important to keep a close track of the carbon credits. Manual management of carbon credits is cumbersome and inefficient. But by applying technologies such as AI, IoT, and cloud computing together viAct has made it simple for any company in keeping automatic track of the carbon credits of the construction company through its intuitive dashboard.Thus, by keeping a track of all emission and offset sources and linking them it to viAct's scenario based AI, viAct has helped construction industries to set, adjust and achieve

reduction targets with greater accuracy by keeping a track of all emission sources. This has also helped the construction industries to monitor the carbon footprint and in turn manage and predict the expenditure of carbon credits.

VI. Conclusion

Carbon dioxide is one of the seven harmful greenhouse gases. It solely makes up 85% of these harmful gases and all the other emissions are expressed in equivalents of carbon dioxide or CO_2e. According to the Global Status Report for Building and Construction 2020, the building operations accounted for 28% of global emissions, while the construction-related industries, like cement, glass etc. added an extra 10% to it. The construction companies are now having caps on the amount of CO_2 emissions as it is very pertinent to control the amount of CO_2 emissions and work towards climate change.

This paper is an attempt at explaining what carbon credits are and how AI helps in carbon emission monitoring and carbon credit management in construction taking the case study of viAct (A ConTech Startup from HongKong). viAct's scenario-based AI has been designed to play a significant role in measuring, monitoring, tracking, predicting and reducing carbon emissions. Further, its solutions like fleet management and its AI modules such as Air Quality Detection, C&D Waste Classification, and Illegal Dumping Detection has helped the construction companies to optimize construction machinery usage; monitor air quality and C&D wastes and detect illegal dumping of these wastes, respectively. In addition to this, the auto-documentation and analytics capabilities of viAct's AI monitoring platform – viHUB is an exclusive solution helping stakeholders in managing their carbon credits and well as empowering their carbon credit trading in a holistic manner.

References

[1]. Cowls, J., Tsamados, A., Taddeo, M., & Floridi, L. (2021). The Ai Gambit: Leveraging artificial intelligence to combat climate change—opportunities, challenges, and recommendations. *AI & SOCIETY*. https://doi.org/10.1007/s00146-021-01294-x
[2]. https://environmentjournal.online/articles/emissions-from-the-construction-industry-reach-highest-levels/
[3]. https://unfccc.int/climate-action/race-to-zero-campaign
[4]. https://unfccc.int/kyoto_protocol
[5]. https://www.designingbuildings.co.uk/wiki/Carbon_dioxide_in_construction
[6]. https://www.infosys.com/oracle/white-papers/documents/carbon-supply-chain-blockchain-technology.pdf
[7]. Huntingford, C., Jeffers, E. S., Bonsall, M. B., Christensen, H. M., Lees, T., & Yang, H. (2019). Machine Learning and Artificial Intelligence to aid climate change research and Preparedness. *Environmental Research Letters*, *14*(12), 124007. https://doi.org/10.1088/1748-9326/ab4e55
[8]. Onat, N. C., & Kucukvar, M. (2020). Carbon footprint of Construction Industry: A global review and Supply Chain Analysis. *Renewable and Sustainable Energy Reviews*, *124*, 109783. https://doi.org/10.1016/j.rser.2020.109783
[9]. Pan, Y., Zhang, X., Wang, Y., Yan, J., Zhou, S., Li, G., & Bao, J. (2019). Application of blockchain in carbon trading. *Energy Procedia*, *158*, 4286–4291. https://doi.org/10.1016/j.egypro.2019.01.509
[10]. Tamburrini, G. (2022). The ai carbon footprint and responsibilities of ai scientists. *Philosophies*, *7*(1), 4. https://doi.org/10.3390/philosophies7010004

Baby Sharma, et. al. "The concept of "Carbon Credit" in the construction industry: A case study of viAct's scenario based AI in carbon credit management." *International Journal of Business and Management Invention (IJBMI)*, vol. 11(02), 2022, pp. 50-54. Journal DOI- 10.35629/8028