

# **Carbon Accounting and Sustainable Designs in Product Lifecycle Management**

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**Week 07**

**Lecture32**

**Carbon accounting software (Part-1)**

Hello friends, welcome back to the course Carbon Accounting and Sustainable Designs in Product Lifecycle Management. I have talked about the carbon and business data and emissions activities in this week. Now I will further talk about the software solutions for carbon accounting. We will talk about the development of a database, development of a software or a program in this course itself in the coming weeks. But what are the existing big software solutions which are available and big pioneer companies such as Microsoft, IBM, Siemens.

They are working in this direction because there is a big push by the EPA Environmental Protection Agency or ESG goals. So that when you try to have a full accountancy of your carbon, even in the MSMEs, that is the micro, small and medium enterprises.

When they develop an organization, when they develop a business, and they suppose had a goal to sell this business. They if are carbon conscious, carbon conscious or emission conscious and they have maintained the full data stream of whatever has come as input. What has been the emission and what is their color in the terms of the carbon emission.

Then the selling price or the valuation of the company goes high. So, carbon accounting software are used by most of the companies who are working in the manufacturing. Also, we'll talk about the scope of the carbon emissions here.

# Carbon Accounting Software

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## Mars' Digital Transformation

- User-centric approach:
- AI and data integration:
- Automation ~~was~~ on focus:
- Digital venture structures:
- Test and learn (Fail <sup>early</sup>)
- Pandemic Innovation
- Continuous improvement

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In the last lecture, the video that you watched on the story of Mars' digital transformation. You saw how they worked upon a user-centric approach.

User-centric approach where Mars' digital engine focused on placing users at the center of the design thinking and problem-solving and they used tools such as AI and data integration. So, this is all we had been discussing since the commencement of this course that problems are addressed using multiple ways.

So, here Mars used the artificial intelligence or data-driven digital solutions for accurate resolution and for accurate transformation into digital. Then automation was on focus that is also mentioned here. I would say was or I would better put it is on focus now.

It is the ease and speed of automation allowing for scalable and efficient processes. Then they talked about digital venture structures, which involved digital hackathons that is experimentation for quick test and learn cycles. Which they kept on running to have solutions within their mass associates. This helped them test and learn time and again. That is they learnt to fail early.

If something that fails early they say. You also learn more and you become more mature. That is, quick test and learn systems are there. Then they talked about an innovation during pandemic, which was orders without the involvement of the sales representative, that's right. Customers' orders to digital channels were there.

So this was one of the solutions that they have gotten in pandemic time itself. Then finally, they talked about a continuous growth improvement that is ongoing sprints, or sprint meeting. Is a quick meeting a two to three minutes or maybe between two to five minutes of meeting of four to six people to understand the current problem and quickly take an action. So this is also one of the endeavors that they talked about. Also I will talk about the software solutions in this lecture and while giving you examples of the existing software solutions.

I will give you another video where Mars had a collaboration with a carbon accounting software system provider and how did that help them. We will also see in the course of this lecture.

## Contents

### Carbon Accounting Software

- ✓ tools for software development GUI  
GUX
- ✓ key characteristics
- ✓ popular software [Scope of emissions]
- ~~digital transformation~~
- ~~operational technology~~

So this lecture will flow in this way. I'll talk about certain tools which are used for software development. I will just give a brief introduction or name of the tools only.

Such as for the data analysis or visualization for the frameworks or libraries or maybe the programming languages are used to develop. That is the GUI whatever the software has. So what do we have at the back that is helping us to come up with this GUI or I call it GUX GUI is Graphic User Interface. GUX is Graphic User Experience, then we'll talk

about if we have to pick or design a Carbon accounting software. What should be the key characteristics or what should be the functions that we expect from a good software?

Then I will talk about certain solutions, that is software solutions or popular software available. And I will also talk about the scope of emissions. So, there are scope 1 emissions, scope 2 emissions, scope 3 emissions. I will talk about them in this lecture itself.

## CA Software development tools

Handwritten notes on CA Software development tools, categorized into Programming Languages, Data Analysis and Visualization Tools, Libraries and Frameworks, and Databases.

**PROGRAMMING LANGUAGES:**

1. Python: (Panda, Numpy)
2. R:
3. JavaScript: Web-based applications
4. Java: Large-scale use
5. C# : For Windows-based applications

**DATA ANALYSIS AND VISUALIZATION TOOLS:**

1. SQL: Manage queries
2. MATLAB: Numerical computing/modeling
3. Tableau: interactive dashboards that are shareable
4. Power BI: Used for Business Analytics

**LIBRARIES AND FRAMEWORKS:**

1. Django/Flask (Python)
2. Spring Boot (Java)
3. React (JavaScript)

**DATABASES:**

1. Maria DB, My Sql
1. Git/GitHub/GitLab: Collaborative development
2. Docker:

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So, Carbon Accounting Software Development Tools. If I try to talk about the tools, there are categories of the tools. There are programming languages. There are data analysis tools. And visualization tools and there are libraries available libraries or I could call them as frameworks. So, if I talk about the programming languages, first thing and the foremost thing that we do is we try to develop a database.

So, database is generally developed by maybe a certain tool such as MariaDB or we used MySQL. This would be more covered in detail by Professor Prabal Pratap Singh. Now programming languages number one, I could not miss to start with python. So python is a popular language for its versatility and its extensive libraries for data analysis. For example, it has panda, it has numpy.

So then comes R. So I'm only suggesting you certain programs that you can also use. R is widely used statistical analysis and data visualization software, which is open source.

And this is also used by many students as well in the institutions in doing their assignments, in doing their regular projects or so. Then one of the programming language that is widely being used even before python was there is javascript.

So essential for web-based applications and interactive dashboards. This is for web-based applications or maybe some interactive dashboards that where you need to input the data. And you then you like to see something coming as an output another. Java is a language that is often used in large scale. That is, enterprise-level applications, the software solutions which I am going to show you, majorly use Java or JavaScript for their development.

And they also use C hash, which is commonly used for window-based applications. Data analysis and visualization tools, though visualization could also be taken through the R language or through the JavaScript. But they are specifically tools such as SQL. So for database management and to manage queries. So this is used here.

Then MATLAB is also widely used when we talk about data analysis. MATLAB cannot be missed. MATLAB is a software tool that is widely used for numerical computing or modeling. Tableau is also one of the tools that is used for creating interactive and shareable dashboards. I will put that are shareable.

Then Power BI. Power BI, what is BI? It is Business Intelligence. You can definitely visit our past course that is showing us the web-based development that is the advanced business simulation course. There I have given certain examples on these tools as well.

This is used for business analytics. Libraries and frameworks, if you wish to talk about. So there are certain libraries available, like I mentioned about one of the libraries to be that is a ready-made library that is EIOLC. Here I will more talk about the libraries which are used by the programming languages or the data analysis visualization tools above. So for example we have Django or Flask.

So, this is a Python-based library where web frameworks for building scalable web applications are used. This is Python-based. Then comes Spring Boot, which is Java-based. There is a long list that we can discuss upon. There is one that is React.

That is JavaScript based. But not all of them are widely used. There are other tools as well such as we have Git or GitHub. That is generally for the collaborative development. This is also GitLab.

This is generally used for collaborative development. Other tools, I can also talk about maybe Docker. This is an application that ensures consistent environments. Then Jupyter notebooks, multiple other systems are there. So these tools and languages can help with various aspects of carbon accounting software.

Including data collection, data analysis, reporting, user interface development. So the point is, what is a carbon accounting software and what do we expect from it?

## CA Software solutions - key characteristics

(ESG) GHGP

### ASSIST IN MANAGING CARBON EMISSIONS

1. Unified Auditing: Level of automation  
Susceptibility to change
2. Sustainability Market Experience: Ability to track including performance  
Include pertinent industry knowledge on sustainable solutions
3. Industrial Collaborations: Check the network of industry partnership providers.
4. Reporting of emissions data: Analytics capabilities are inherent in CA Software solutions.
5. Customization / Individualized assistance: - Offer tailored guidance  
- immediate assistance (industry, region...)

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Let us try to understand this. What are the key characteristics of a carbon accounting software? So, broadly speaking, carbon accounting software is specifically developed to assist organizations in effectively managing and measuring their carbon emissions.

So, the basic purpose is to assist in managing carbon emissions. Now, through the use of appropriate technological solutions, organizations can precisely monitor their emissions data. They can gather essential knowledge required to initiate a thoughtful, educated a deliberate reduction or maybe total elimination of the carbon emissions. Now, in order to provide additional background.

ESG is one of the platforms or environmental social governance system that is pushing the agencies or the manufacturers to have their carbon accounting in place.

So there are protocols such as GHGP which is greenhouse gas protocol which serves as a foundation for carbon accounting software. So term carbon is used here as a

comprehensive term, because we know, we have already discussed that when we talk about carbon. We talk about many other gases such as methane, nitrogen oxide, hydrofluorocarbons or many other chlorofluorochemicals. It could also be sulfur hexafluoride and so on. So certain characteristics to talk about the carbon accounting software solutions is number one, the unified auditing has to be there.

When I say unified auditing, it means this is essential to optimize the carbon management and sustainability reporting process. That is to evaluate the level of automation and susceptibility to manipulation of the vendors itself. When we are trying to place the orders, so unified auditing means, whatever we are out in, within our manufacturing concern. The people whom we are distributing to people, whom we are getting the material from are also aware of the software and also comfortable with the same software that we are using. So this is unified auditing.

Here I would like to put here that the level of automation that is the kind of the sensors, they are using your vendors or your suppliers or your third party logistics. So, what is the level of automation or so, what is their susceptibility to change. Susceptibility change means any manipulation if they can do in their software itself. So that it is unified or it is in the same lines as we are doing in our own software system. Now, also when you need to pick a software, sustainability market experience of the software is very important of the company who is working.

What is their sustainability experience? Market experience. If you pick a company that has just come two years back and does not have much exposure on it. Market experience in sustainability the company who is working for decades in one direction is having a lot of collaborations is having a lot of database within their companies itself and they have a lot of clients previously as well. So that also makes an important point to talk about the characteristics of the software.

So given the constantly changing nature of emissions accounting and exposure in the software solution that you pick is imperative. That is their ability to track industry performance. Ability to track industry performance. That is where are we lying and where is the competition? Where are the partners?

Where are the competitors? So this is very important. That is we need to include pertinent industry knowledge or expertise and a strategic focus on sustainable solutions. So this becomes an integral component of a comprehensive set of purchasing criteria when

you're going to pay for a software. The annual maintenance charges when you're going to take or the overall contract for next five years going to take.

What is the exposure of that? So it all depends. The investment that you're making should be definitely be paying back in time and effectively. Next characteristic is demand, industrial collaborations. So only compilation of the carbon accounting data is insufficient.

It is important to establish a pertinent industrial collaborations, which means we need to check the network of industry partnerships. The software solutions which already have industry partnerships, they can get you in connection with the people or other industry in the same domain where you're working. For example, if you're working in maybe leather tanning or you're working in the shoes itself, that is a leather industry. Other leather industries, the raw material providers, the final purchasing, the logistics systems. The mature software will have a lot of collaborations that you can get you connected to.

So we need to check the network. It is an ongoing point from point number two. That means we need to check the network of industry partnership provider. This serves as a robust measure of industry expertise, present and future capacity to provide support and the capacity to address present and future requirements related to climate change and emissions. Then definitely one cannot miss the emissions data or benchmark reporting systems.

Reporting of emissions data that is reporting on energy consumption rates are essential components of the auditing. So, analytics capabilities should be inherent in carbon accounting system that is, I will put it here analytics capabilities are inherent in CA software solutions. So that the organization can develop their own frameworks that aim to reduce carbon emissions and so that they can achieve their desired goals. One of the last pointers, I would like to put here that is customization. Customization or I would say digitalized assistance.

Individualized or customized or personified assistance. That is, how it can be tailored to our own needs that is it should be able to offer tailored guidance on, what do we need in our software. That is immediate assistance based upon industry that you are working upon. The region we are focusing on and any other relevant criteria that is regulations do change, the change in the orders are there. International change in the market could be there, the shortages, the surplus materials could be there.



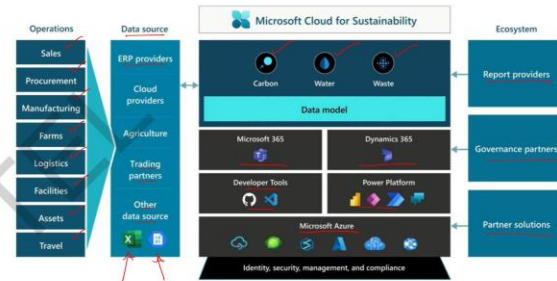
So, change management and resilience to change is one of the characteristics that is expected from a carbon accounting software solution. These were the key characteristics that I talked about and the major purpose again assist in managing carbon emission is what we expect from a carbon software solution.

## CA Software solutions

- popular software

### 1. Microsoft Sustainability Cloud

- ESG
- Data, BI, AI
- Microsoft Sustainability Manager
- enhance data transparency
- MSMPs - ?



Let me talk about a few of the huge or big software solutions which are available in the market itself. First and foremost, I would like to talk about Microsoft Sustainability Cloud. You can see the way the Microsoft Sustainability or Microsoft Cloud for Sustainability works.

The options of carbon, water, waste, what are you going to work upon? And it talks about these operations such as sales, procurement, manufacturing, farms, logistics, facilities, assets, travel and data source. Where is the data even coming from? If you talk about farms, data might have come from the agriculture. If you're talking about the sales and procurement, ERP providers give you the data.

What is the data source? So what are their connections and where do they get data from? The trading partners, the other data source, that is you provide some files in various formats in Excel or in any of the usable database forms. Because it is Microsoft, it has a

complete internal interface with Microsoft 365, with Dynamics 365, whatever we are doing in Windows. So this can definitely help in that.

And whatever the cloud solutions are available with Microsoft, for example, Microsoft Azure, we can store the data there. So Microsoft Azure is also supporting the Microsoft Cloud for sustainability. So ecosystems are report providers, governance partners, and partner solutions. So that is, this is a sustainability cloud developed by Microsoft, and this is a strategic expansion of the company's enduring commitment to the sustainable initiatives. So this is, again, working in the direction of, what ESG requirements are.

So this is specifically created to enable organizations to expedite their sustainability efforts. And to maximize commercial expansion by leveraging the capabilities of data, business intelligence. Or I could not miss to put it here, artificial intelligence as well to some extent. So there is a tool or system that they have, they call it Microsoft Sustainability Manager. This enables customer to enhance the data transparency.

And it helps to gain valuable insights to facilitate the implementation of practical measures. The sustainability cloud developed by Microsoft has already established a number of significant partnerships. So that also fulfills the criteria of the industrial collaborations which I have put here. Microsoft Sustainability Cloud analyzes data from all the aspects of ESC, environmental, social governance factors. Which determines the level of detail in its carbon accounting data.

And this can result in the insights that it offers you better solutions. So, but still it is a question whether these could be used by MSMEs or not. This is a question mark because of the cost of the software, because the smaller modules are not yet available. It is still not providing the smaller versions or the affordable versions by MSMEs. For example, Siemens PLM software that helps you to also give you velocity series.

Siemens' full PLM software includes Annex, that is the CAD software, then it gives you plant simulation, that is technomatics, then it gives you team center. Team center is there to have the carbon footprint evaluation as well. So that I will also talk about as one of the carbon software solutions here. It also has a velocity series in which all of these solutions have been given in a smaller version so that the smaller organizations can also afford them. Here MSME is Could or could not afford it. That is one of the questions.

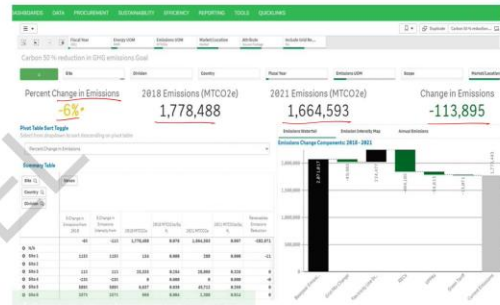
# CA Software solutions

- popular software

## 2. EcoStruxure Resource Advisor *Schneider Electric (SE)*

*collected  
- analyze (information)  
- automate*  
↓  
*to meet sustainability objectives*

*VIDEO: Mars and SE*  
 - *Gabriel Poking: #4*  
 - *>200 factories*  
 - *Digital Simulations*  
 - *Advanced Data Processing (in contrast to Big Green Box)*  
 - *Mars ↔ SE*  
*mutuality (fastening collaboration)*  
*(inefficient system)*



Another software solution that is there is developed by Shandra Electric. That is EcoStruxure Resource Advisor. This is developed by Shandra Electric. So, Shandra Electric, that is SE, we know is a multinational corporation that specializes in digital automation and energy management.

This is also now a collaborative with Mars, the video of Mars digital transformation we showed you in the last lecture. So, Shandra Electric also has collaborated with them to develop their technology, energy use and environmental impact. So this is a robust tool designed for this purpose and it effectively controls and minimize the energy use. So this platform collects, analyze and automate the information that is relevant to any sustainability, objectives of enterprises. So I will put it here.

It helps you to collect, analyze, automate the information, to meet your sustainability objectives. There is a tool that they have developed which has this dashboard. I'm just showing you the percentage emissions here, like in a specific operation that we're talking about, 2008, these were emmissions. 2021, these are the emissions. And change animation is this in three years.

So user interface is also very friendly or easy to be understood by the people whom they train. And Shandra also provides a continuous support for the contract period so as the manpower within the enterprise is also trained to use the software. This utilizes digital

advancements in energy and resource management to optimize company decision making and expedite outcomes. Let us now watch a video where Mars had a collaboration with Shandra. Where Shandra provides them with digital solutions, that is solutions to meet their sustainability objectives and also to enhance their throughput.

And they conducted digital simulations, they conducted certain sophisticated analysis of their systems. So as there is a gain to both the organizations.



If you look at most of our manufacturing plants, Schneider is there providing all different types of solutions. We are learning and collaborating on several individual proof of technologies and proof of concepts in terms of industry, internet of things, digital factories and digital plants. To truly understand how Schneider has driven their digital transformation, has driven their digital factories, and take those learnings and lessons and then put it back into our experience.

Metro Electric has been a strong player, helping us to learn and also collaborate on experiences that really matter in terms of digital factories and digitalizing our plants. We've historically, a hundred years back, been a hardware manufacturer. We make lots of pieces that do really cool things. Bringing those things together in a connected capacity

that captures the information or the data rather than that drives that informational output is what really matters. It's eco-structured, right.

So Schneider sees the world in a three-tiered approach. Those connected devices that gather all of that data. We're able to put that data in a methodology or an information pack. That can be processed through advanced analytics to identify what's really happening in the factory and where they need to make tweaks. So we see it in an end-to-end perspective.

Part of the reason that we're good at this is we're a manufacturer. We have 200+ factories around the world where we're, for lack of a better phrase, eating our own food. These are the things that we're really good at. Recently rated two years in a row now by Gartner as number four in supply chain management. This is a test and learn that we wanted to do with Royal Canin, where we are trying to optimize our giveaway.

Which is once we manufacture a product, there's a lot of variance in the product and we want to reduce the variance to a minimum. Schneider really helped us to conduct a proof of technology using their existing technology. Where they capture the data and use their existing models to give an optimized outcome. That has been a very interesting proof of technology working with Schneider on it and a lot of learnings. How we can optimize our plans by simulating the digital way of the process.

At the same time, ensuring that we are applying data and AI in the back to get to optimize results. They've seen us as a big gray box guy for a long time. And there's a lot more to what we offer. It's not just about automation. It's not just about sustainability.

It's not just about electrical distribution, power surveillance, you know, security and access control. It's about bringing all of those things together that bring an efficient, manufacturing operation that is secure. Looking at the bigger picture, we see the world moving away from hardware. We see it moving into a decoupled environment, where it doesn't matter what the PLC is. What matters is the data set that's behind that.

And how do we crunch that data to provide information? Again, for better output for the client, so that they can become more efficient, more sustainable, less waste, better metrics, better sustainability in the planet. NIDR is a great leader in its own space of electrical and digital manufacturing support. Versus Mars, we are very much leaders in our manufacturing processes, in manufacturing food and pet food products. So bringing that synergy and experiences together has become a really important thing in.

How we learn from each other and how we make a difference. And what's really cool about working with Mars and one of my favorite things is that they are in fact open. They live by the five principles, one of which is mutuality, right. What is mutually beneficial for all stakeholders? And they talk about these.

These are their culture. These are the things that matter to them. So from a relationship perspective, at times I find it challenging because there's so many things going on. But we're in a great space and I think I'm pretty fortunate to have Mars as a client and look forward to another 10 years. So I hope you learned from the video what were the collaborations. I'll discuss about certain pointers in this video in the next part of this lecture.

Thank you.