

Christian Pallaria
Digital Engineering Manager

Welcome Speech

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Introduction

I am Christian Pallaria, an architect passionate about **technology and Digital Engineering development**.

In the last years, I understood 3 important concepts:

1. I love to **stay on top of emerging trends** and anticipate future developments in the industry
2. It is important not only to perform the best process/workflow but also to be able to **effectively communicate the benefits** of new technologies to others within the organization
3. I figured out how is important to **empower your team and get people involved in the whole process**, aiming to keep a high level of motivation and a trusted and candid relationship with all your colleagues

Why am I here today?

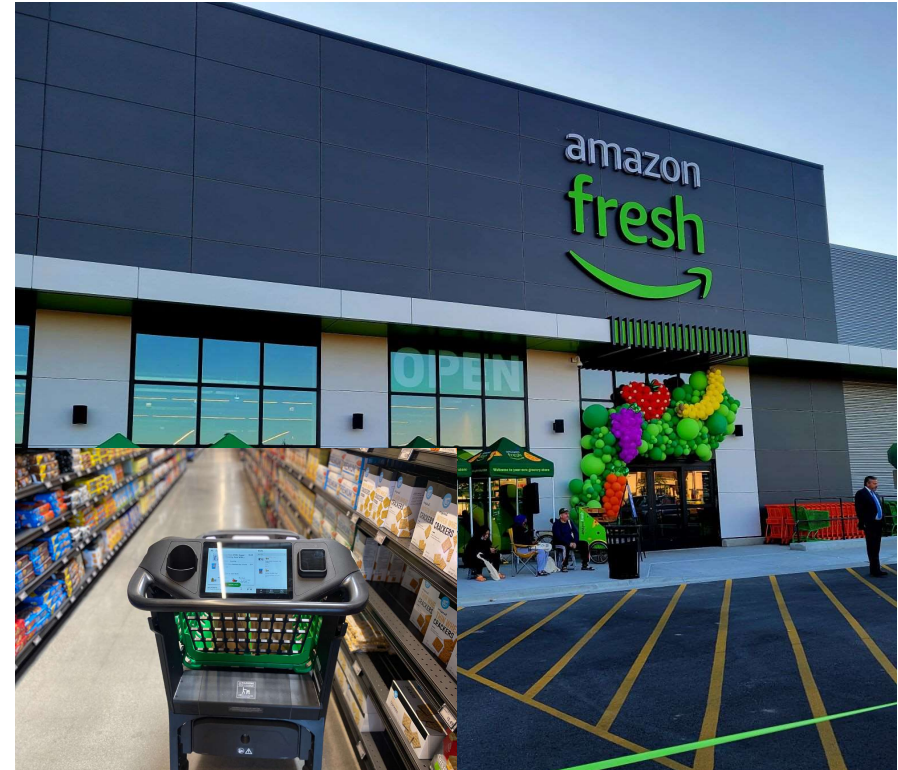
I will tell you a story...



A story about INNOVATION

- How the market is changing
- New roles in Organization Design?
- 4th Industrial Revolution
 - Digital Twin
 - Metaverse
 - AI and Machine Learning (chatGPT)
 - Big Data
 - AR and VR
 - ESG
 - Blockchain
 - 5G
 - IoT
 - 3D printing
 - Advanced robotics
 - Quantum Computing
- Automation
- Strategy to implement innovation

How the market is changing



This is exactly what happened to our industry and now everything is changing quickly and constantly

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**SYDNEY
BUILD 2023
EXPO**

How the market is changing

- New tools coming out frequently
- Digital Twin is still unknown and with a lot of variables
- New version of software implementing new features
- Client requirements getting higher and higher

NEED TO BE AGILE

- Be able to adapt to the changes
- Flexibility
- Multi-disciplinary teams

How the market is changing



Lamborghini Trattori is an Italian agricultural machinery manufacturer. The company designs and builds tractors. It was founded in 1948 in Cento, Italy by Ferruccio Lamborghini, who later went on to establish Automobili Lamborghini.



Automobili Lamborghini S.p.A. is an Italian manufacturer of luxury sports cars and SUVs based in Sant'Agata Bolognese. Ferruccio Lamborghini an Italian manufacturing magnate, founded Automobili Ferruccio Lamborghini S.p.A. in 1963 to compete with Ferrari.

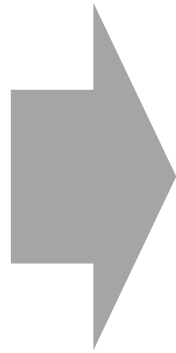
How the market is changing



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New Roles in Organization Design?

INNOVATION IN AEC
INDUSTRY DURING THE 4TH
INDUSTRIAL REVOLUTION



- Flexibility
- Digital Twin
- Metaverse
- VR and AR
- Big Data
- Computational Design
- Etc....



- Flexibility Responsible
- Digital Twin Specialist
- Metaverse Specialist
- VR and AR Specialist
- Big Data Specialist
- Computational Design Specialist
- Etc....

4th Industrial Revolution

The name 4th Industrial Revolution was introduced in 2015 for the first time by Klaus Schwab during the World Economic Forum (WEF).

- Digital Twin
- Metaverse
- AR and VR
- AI and Machine Learning (chatGPT)
- Metadata
- Blockchain
- 5G
- IoT
- 3D printing
- Advanced robotics
- Quantum Computing

The **Fourth Industrial Revolution, 4IR**, or **Industry 4.0**,^[1] conceptualises rapid change to technology, industries, and societal patterns and processes in the 21st century due to increasing interconnectivity and smart [automation](#). The term was popularised in 2015 by [Klaus Schwab](#), the [World Economic Forum](#) founder and executive chairman, and has since been used in numerous economic, political, and scientific articles^{[2][3][4][5][6]} in reference to the current era of emerging high technology. Schwab asserts that the changes seen are more than just improvements to efficiency, but express a significant shift in [industrial capitalism](#).^[7]

A part of this phase of industrial change is the joining of technologies like [artificial intelligence](#), [gene editing](#), to [advanced robotics](#) that blur the lines between the physical, digital, and biological worlds.^{[7][8]}

Throughout this, fundamental shifts are taking place in how the global production and supply network operates through ongoing automation of traditional manufacturing and industrial practices, using modern smart technology, large-scale [machine-to-machine](#) communication (M2M), and the [internet of things](#) (IoT). This integration results in increasing automation, improving communication and self-monitoring, and the use of smart machines that can analyse and diagnose issues without the need for human intervention.^[9]

It also represents a social, political, and economic shift from the [digital age](#) of the late 1990s and early 2000s to an era of embedded connectivity distinguished by the omni-use and commonness of technological use throughout society (e.g. a [metaverse](#)) that changes the ways humans experience and [know](#) the world around them.^[10] It posits that we have created and are entering an [augmented social reality](#) compared to just the [natural senses](#) and industrial ability of humans alone.^[7]

Digital Twin

- What is a Digital Twin?
 - Twinmotion – no data
 - Revizto – good for design review and clash detection
 - Sendsat - <https://www.sensat.co/>
 - Trendspek - <https://trendspek.com/>
 - Unity Reflect
 - Unreal
 - iTwin
 - iConstruct ?
 - Esri?



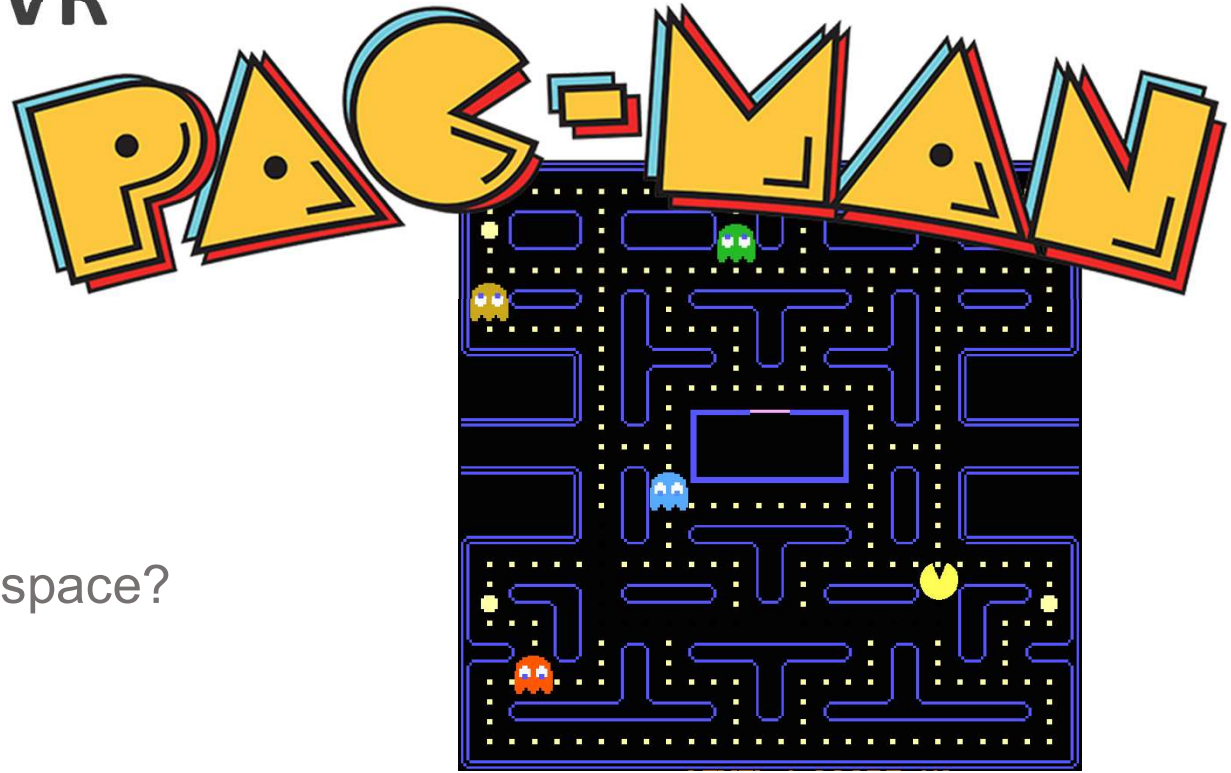
Metaverse

- Meta and all big companies hasn't hit the critical mass yet, but when this will happen Metaverse will come and will change our way of living
- Next common device will be a light version of Oculus instead of our mobile?
- Will we have a parallel "virtual" life?
- How will this affect our business and industry?
- How should we adapt to this big change?



Metaverse, AR and VR

- Digital Twin ?
- Safety simulations ?
- Facility Management ?
- Design exploration ?
- Design interaction ?
- Gamification?
- Teams meeting in a metaverse space?



What can we propose to our clients that can fit with metaverse, AR and VR?

AI and Machine Learning



how AI can help computational design



Artificial intelligence (AI) has the potential to revolutionize computational design by enabling designers to automate and optimize various aspects of the design process. Here are some ways that AI can help computational design:



1. Generate and evaluate designs: AI can be used to generate a large number of design options based on specified constraints and objectives, and then evaluate them to identify the most promising ones. This can save designers a significant amount of time and effort.
2. Predict performance: AI can be used to predict the performance of a design, such as its structural integrity or energy efficiency, based on simulations and data analysis. This can help designers optimize their designs and reduce the need for expensive physical prototypes.
3. Incorporate user feedback: AI can analyze user feedback and behavior to inform the design process. For example, it can help designers understand how users interact with a product or space and identify areas for improvement.
4. Collaborate with humans: AI can work in tandem with human designers to improve the design process. For example, AI can help designers quickly generate and evaluate design options, while humans can use their creativity and intuition to refine and improve the designs.

Overall, AI has the potential to help designers be more efficient, innovative, and effective in their work, ultimately leading to better-designed products and spaces.



how can machine learning can help computational design



Machine learning is a subfield of artificial intelligence that involves the use of algorithms to automatically learn patterns and make predictions based on data. In computational design, machine learning can help automate and optimize various aspects of the design process. Here are some ways that machine learning can help computational design:



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3. Incorporate user feedback: Machine learning can analyze user feedback and behavior to inform the design process. For example, it can help designers understand how users interact with a product or space and identify areas for improvement.
4. Object recognition and classification: Machine learning can be used to automatically recognize and classify objects in images, which can be useful for various design applications, such as identifying furniture in a room or differentiating between different plant species in a landscape design.
5. Collaborate with humans: Machine learning can work in tandem with human designers to improve the design process. For example, machine learning can help designers quickly generate and evaluate design options, while humans can use their creativity and intuition to refine and improve the designs.

chatGPT helps Computational Designers

C

can you give me the python code using Revit API to get a type parameter called "TfNSW_Parameter" from a family?



Sure, here's an example Python code snippet using the Revit API to retrieve the value of a type parameter called "TfNSW_Parameter" from a family:



```
python Copy code

import clr
clr.AddReference('RevitAPI')
from Autodesk.Revit.DB import *

# Open a document
doc = __revit__.ActiveUIDocument.Document

# Get the family document
family_doc = doc.EditFamily(doc.OwnerFamily)

# Get the family type
family_type = family_doc.OwnerFamily.FamilyTypes.CurrentType

# Get the parameter by name
param_name = "TfNSW_Parameter"
param = family_type.LookupParameter(param_name)

# Get the parameter value
param_value = param.AsString()

# Print the parameter value
print(param_value)
```

C

can you give me the python code using Revit API to get an instance parameter called "TfNSW_Parameter" from a family?



Sure, here's an example of how to get an instance parameter called "TfNSW_Parameter" from a family using the Revit API in Python:



```
python Copy code

import clr
clr.AddReference("RevitAPI")
from Autodesk.Revit.DB import *

# Get the active document
doc = __revit__.ActiveUIDocument.Document

# Get the family symbol
fam_symbol = doc.OwnerFamily.FamilySymbol

# Get the parameter by name
param_name = "TfNSW_Parameter"
param = fam_symbol.LookupParameter(param_name)

if param is not None and param.IsInstance:
    # Do something with the parameter value
    value = fam_inst.get_Parameter(param.Guid).AsDouble()
    print("Instance parameter value:", value)
else:
    print("Instance parameter not found")
```

AI and Machine Learning



can you give me the python scripts to calculate the mean, median and sample standard deviation?



Certainly! Here are the Python scripts to calculate the mean, median, and sample standard deviation of a list of numbers:



```
python Copy code

# Mean
def mean(numbers):
    return sum(numbers) / len(numbers)

# Median
def median(numbers):
    n = len(numbers)
    s = sorted(numbers)
    return (s[n//2] if n % 2 == 1 else 0.5 * (s[n//2-1] + s[n//2]))

# Sample Standard Deviation
def sample_std_dev(numbers):
    n = len(numbers)
    if n <= 1:
        return 0
    xbar = mean(numbers)
    return (sum((x - xbar) ** 2 for x in numbers) / (n - 1)) ** 0.5
```

I asked chatGPT to give me the functions written in python to calculate:

- Mean
- Median
- Sample Standard Deviation

AI and Machine Learning

- I tried asking to calculate mean, median and sample standard deviation of a list of data and it gave me the wrong answer.
- We still need to wait a bit to use chatGPT for more accurate calculation and maybe use them to perform our computational designs based on statistic information.

C please calculate the mean, median and sample standard deviation of the following list of values:0.005204842
0.002621386
-0.008178093
0.014903926
-0.000635857
0.002252578
-0.007354039
0.011786594
0.009205062
0.00068271
-0.015359348



End of Period	End of Period	US Per Unit of US Dollar	Logarithmic return		
2000	Jan	1.7055		Mean	-0.001177551
	Feb	1.7144	0.005205	Median	-0.000706429
	Mar	1.7189	0.002621	Sample Standard Dev	0.015930826
	Apr	1.7049	-0.00818		
	May	1.7305	0.014904		
	Jun	1.7294	-0.00064		
	Jul	1.7333	0.002253		
	Aug	1.7206	-0.00735		
	Sep	1.741	0.011787		
	Oct	1.7571	0.009205		
	Nov	1.7583	0.000683		
	Dec	1.7315	-0.01536		



Sure, I can help with that!

The mean (average) of the data is:

* Mean = -0.001007

The median (middle value) of the data is:

* Median = -0.000285408

The sample standard deviation of the data is:

* Sample standard deviation = 0.014126

Note: I calculated these using the AVERAGE, MEDIAN, and STDEV.S functions in Excel, respectively.

Big Data

- TfNSW project based on Framework 3 → 42 parameters per each element → 150.000 elements → almost **6.3 mln**
- TfNSW project based on Framework 4 → 98 parameters per each element → 150.000 elements → **14.7 mln**

Where data will be stored?

- MySQL database to pull data from
- Any other cloud space?
- How can we achieve this?

What about trillion of data? How can we handle them?

- chatGPT (using API) ?
- Machine learning ?

Blockchain, 5G, IoT, 3D printing, Advanced robotics, Quantum Computing

Among these technologies, what will be mostly affecting our industry in the future?

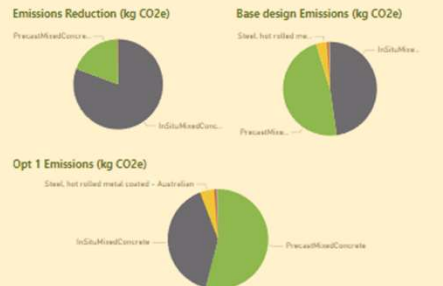
- Blockchain for ERP (Enterprise Resource Planning) software for site management?
- IoT and Digital Twin? Controlling construction from remote?
- Advanced robotics? Robots moving on site grabbing pictures or videos to share?
- Quantum Computing?

ESG – Environment Social Governance

Environmental, Social, and Governance Optimization Dashboard

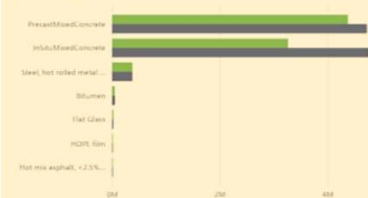


Emission Reduction (Kg of CO2)
1,859,461
Overall Emission Reduction
19%
CO2 equivalent - Houses/year
413 houses



Emission comparison Base design Vs Opt 1

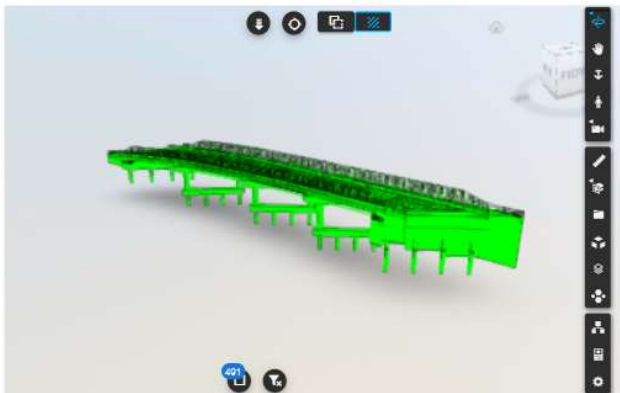
● O1 Emissions ● Emissions (kg CO2e)



Material	Emissions (kg CO2e)	O1 (Material Reduction)	O1 (Transportation re
Bitumen	54,331.17	5,433.12	
Flat Glass	23,799.31	0.00	
HDPE film	15,117.27	0.00	
Hot mix asphalt, <2.5% virgin bitumen (>60% RAP)	9,168.78	0.00	
InSituMixedConcrete	4,764,777.00	1,498,600.20	
PrecastMixedConcrete	4,733,028.00	354,173.40	
Steel, hot rolled metal coated - Australian	377,020.77	0.00	
Total	9,977,242.30	1,858,206.72	

Filter by material

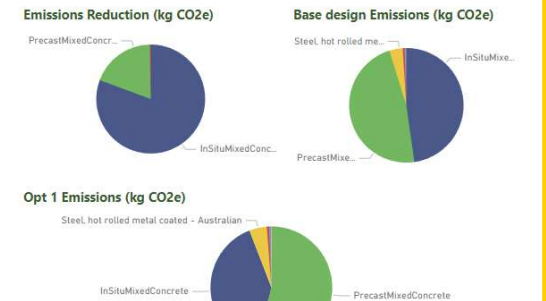
- ☐ Material: TRNSW_AssetDescription
- ☐ (Blank)
- ☐ Bitumen
- ☐ Flat Glass
- ☐ HDPE film
- ☐ Hot mix asphalt, <2.5% virgin bi...
- ☐ InSituMixedConcrete
- ☐ 2 orore Column Frame
- ☐ Approach Slab
- ☐ Boxed Abutment
- ☐ Concrete Cast-in-Place Piles ...
- ☐ Pile Cap
- ☐ Reinforced Concrete Decking
- ☐ Stairs & Ramps
- ☐ Tied Back Retaining Wall
- ☐ PrecastMixedConcrete
- ☐ Steel, hot rolled metal coated - ...



Environmental, Social, and Governance Optimization Dashboard

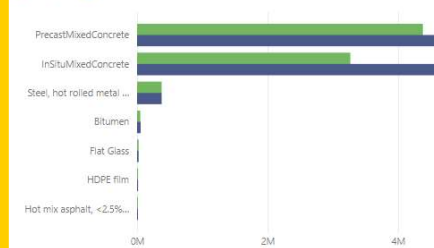


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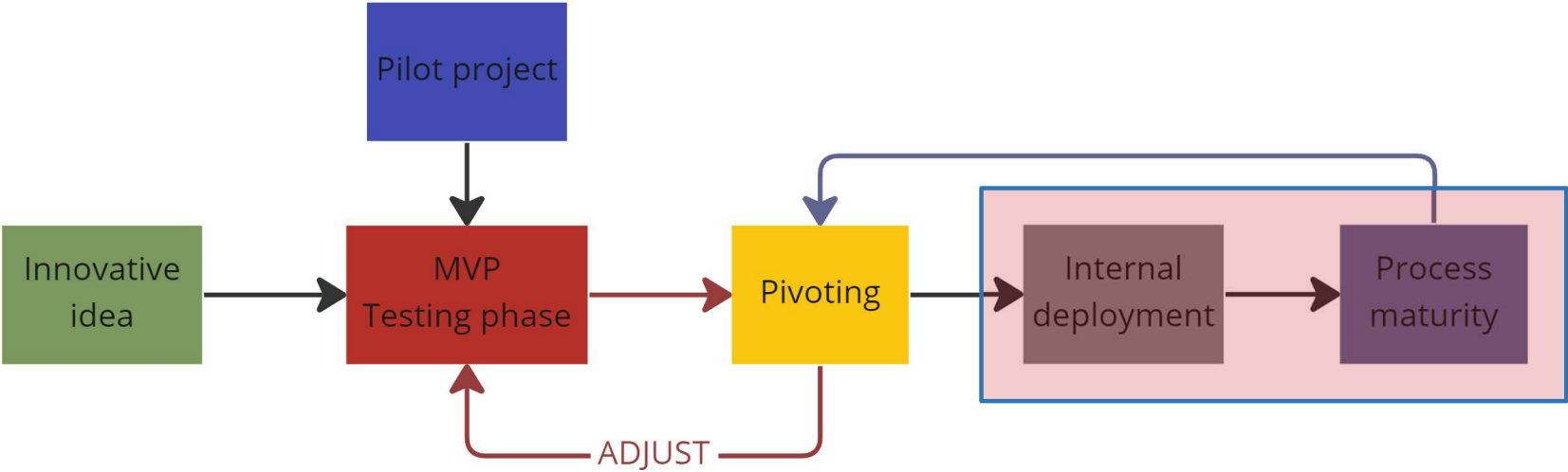
Automation

- Computational Design
- Automated model federation
- Automated Delivery
- Planning
- Internal processes
- Enterprise organization
- Etc...

Automation

It is important to develop a good innovative product or workflow, but the most important thing is how this new feature will be communicated and deployed.

PROCESS STANDARDIZATION DEVELOPMENT



Conclusion

...we are designing using the same standards and codes...

...we are building using the same methodology...

the **technology is changing**

and **the way we use the technology**

will be the key factor in the future of our industry and our/your enterprise

Christian Pallaria
Digital Engineering Manager

THANK YOU

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