

MATTEREUM

Diplomacy, Politics and Technology – Transcript

Mattereum Event

9th November 2021

[00:57:54 – Beginning]

Anton: Dear friends, welcome to Mattereum's second event at COP26, where we will be discussing the three futures of climate action, whether it is politics, diplomacy, or technology. Now, of course COP26, the 26th conference of the parties, is an example of global diplomacy all coming together on this occasion in the city of Glasgow, to plan, to iterate, to discuss how the world can tackle the climate crisis.

We have seen political action on the streets, we have seen protesters, we have seen performers, we have seen people trying to send their message via political action, and of course we are seeing political action both in national parliaments and in city council chambers. We are also seeing technology companies, some of them startups with innovative ideas, of how they can make things better, some technology companies being almost as powerful as some nation states. The question is can these three dimensions come together and work together to make things better, or is their path so diverse that this cannot happen?

We have an amazing panel here today, we will introduce folks as they speak. First we're going to hear remotely from Professor Michael Mainelli of Z/Yen, the financial science think-tank. He's also an Alderman in the City of London, and Sheriff of the City of London, hugely knowledgeable and experienced individual – we're very lucky to have this message from him.

Real Finance Beyond ESG or Why I'm Not At COP26

Professor Michael Mainelli
Executive Chairman, Z/Yen Group
9 November 2021



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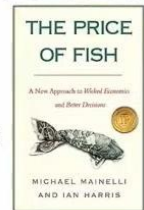


Michael:

Good evening. I am Michael Mainelli, and it is a delight to have been invited by Vinay Gupta and the team at Mattereum to address you today, in Glasgow at COP26. The title I've been given is Real Finance Beyond ESG, beyond environmental, social, or governance, and I've deliberately chosen this World War One advertisement *on the right* "Daddy, what did YOU do in the Great War?" to emphasise that all of us I feel are trying to figure out our place in the great climate change war. But I also hope that today you'll understand why I'm not at conference 26; I believe there are better things to do than interfere with the people trying to get their job done up there.



- ◆ Services – projects, strategy, coaching, research, analytics, systems
- ◆ Sectors – technology, finance, voluntary, professional services, outsourcing
- Independent Publisher Book Awards Finance, Investment & Economics Gold Prize for *The Price of Fish*
- British Computer Society **IT Director of the Year**, DTI **Smart Award** for PropheZy
- £1.9M **Foresight Challenge Award** for Financial Laboratory visualising financial risk
- ChainZy smart ledger (blockchain) 1995
- Indices – Global Financial Centres, Global Green Finance, Smart Centres



However, we here in London run a think-tank called Z/Yen, and we have many ideas on what we feel could help enormously. I'm going to talk about two: one, which many people talk about, a carbon tax or carbon price, and the second is government policy performance bonds. I'll come on to both of those, but they are based on a lot of research that we do here, in particular from our three indices: the Global Financial Centres Index, the Global Green Finance Index, and the Smart Centres Index.

Agenda

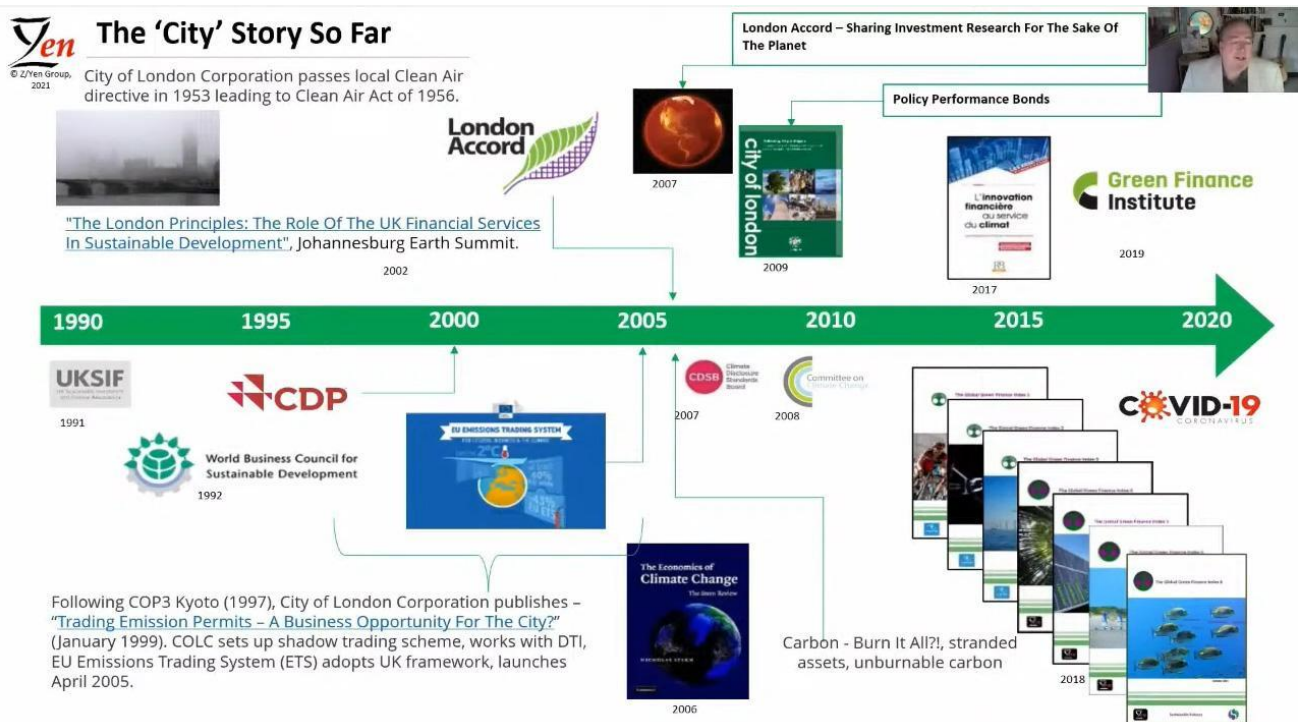


- 'Green So Far'
- Multiple views
- Roadmaps
- What will FinTech do in the climate wars?



"Get a detailed grip on the big picture."
Chao Kli Ning

What I'd like to cover in the short time available is my thoughts on green so far, the various viewpoints and frames that we use, the roadmaps that will get us to net-zero carbon in 2050, and what might fintech do in these climate wars.



The first thing of course to emphasise is that the City, or the financial sector, has actually taken climate change quite seriously for far longer than most people know. The very first Clean Air Act was in 1953 in the City of London, well before the national clean air acts, and we had a number of initiatives ranging from the London Accord, which was commissioned before the Stern Review, including the support as well for the Stern Review, our various indices, and currently the Green Finance Institute. I had my first debate on climate change in 1984 here in the City of London, and that debate would end today where it ended then: does society really want to pay for it, and can we talk honestly about the numbers involved?

Policies Need Pricing In 1997 (COP3), 2007 (London Accord), Or 2021 (COP26)



- **Focus on the Carbon Market** - business investment follows the carbon price
- **Set Higher Policy Standards to Realise Existing Positive Abatement Opportunities** - lower consumption, and increase efficiency of existing energy
- **Avoid Carbon-Dumping Wars** – duties on carbon ‘at the borders’ could be worse than anti-dumping trade wars
- **Support More Research:**
 - Validate the impact of forestry
 - Assess carbon capture and sequestration
 - Energy storage is the great equaliser

BUT ‘listen to the music’ of COP26

1% to 2% of GDP = US\$403 to US\$806/UK citizen

US\$50 tonne/UK Citizen = US\$500/year

US\$100/tonne/UK citizen = US\$1,000/year

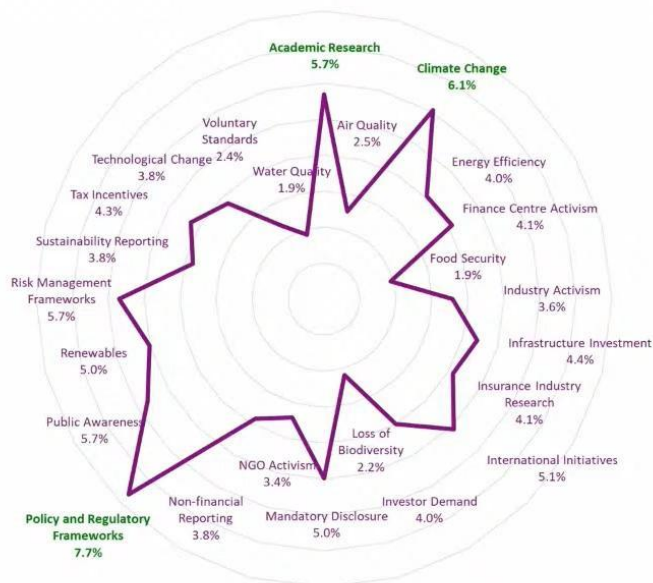


What we are focusing on here as a theme is that policies need pricing. The top half of this slide actually comes from 2007: focus on the carbon market, set higher policy standards, avoid carbon-dumping wars, and support more research, because some of these areas are not as well researched as people might have you believe.

But on the bottom of this slide I’ve said listen to the music of COP26, or should I say the financial music. The Stern Review concluded that 1% to 2% of GDP was required, so too did the London Accord, and this translates today into approximately US\$400 to US\$800 per UK citizen.

Another way of looking at it is to take the just slightly under 10 tonnes emitted on average by each British citizen, and multiply it by the current price of carbon, which is approximately US\$50, and you come to US\$500 per year per capita. Or multiply it by a target which is likely to come about, if the carbon markets are extended from approximately 40% to 100%, of something circa US\$100, in other words US\$1,000 per year. And these are not the numbers you hear, and until you hear realistic numbers, I think it’s difficult to talk about climate change ~in the round~, not least because awareness isn’t going to be sufficient. We had an enormous shutdown and change of behaviour in developing countries around the world last year due to the pandemic, and found in fact that emissions only dropped by 6%, at a small point.

What Is On Practitioners' Minds?



We need to look too to what are finance people thinking. Well, they are thinking pricing, and that's very, very important, in terms of carbon pricing. But the second thing that's bothering them is in fact the political and regulatory frameworks, which they don't trust. An argument here in the City has been if you wanted to be a successful investor, you probably got that way by betting against government policies on green, which often are capricious and change, and cost those who follow the government quite significantly, when they are altered unseemingly or due to political interests.

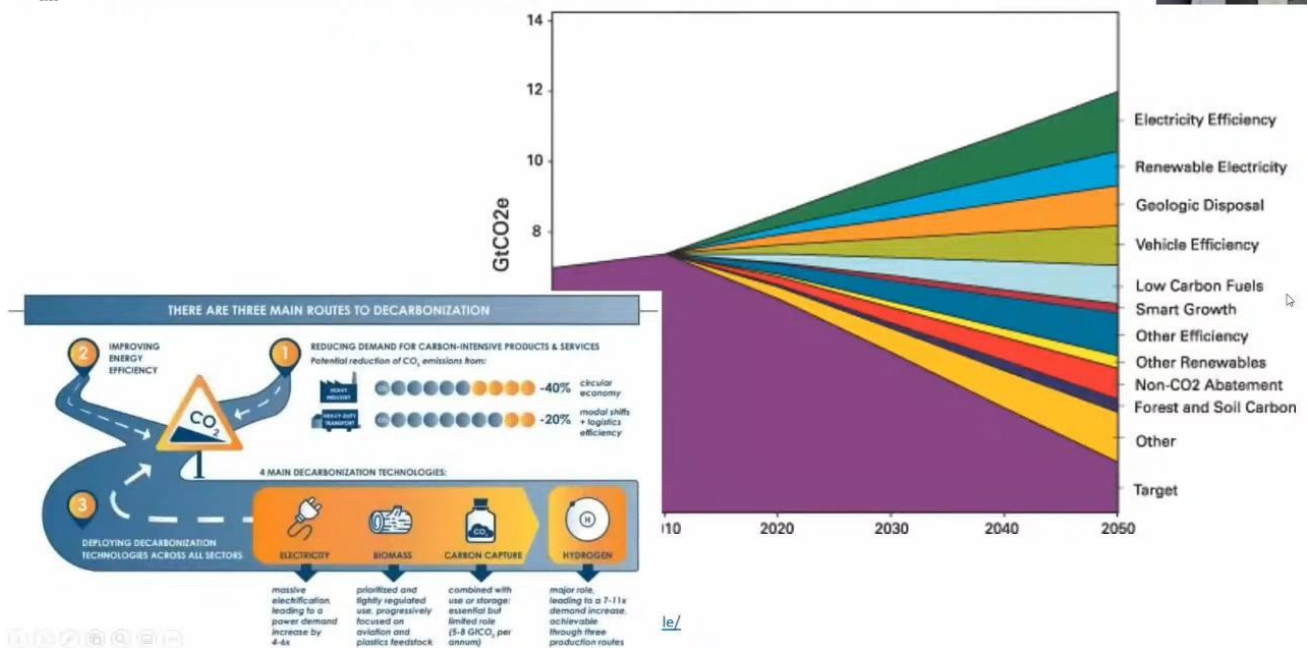


- ESG has had 25 years+ already
- MIT 'Aggregate Confusion' project found companies could be in the top 5% on one ESG rating algorithm and the bottom 20% on another - reputable firms like Shell find their ratings to be A from one rating agency and C+ from another
- 'Alphabet' soup of ESG models may be irresolvable problem
- Creating separate 'currency'
- Out of time



Another area that's not particularly strong on what I might call deep practitioners' minds is ESG, environmental, social, and governance, this idea has been that investment can be redirected. Well, it's had 25 years and more already, but it's still, as MIT calls it, an 'aggregate confusion' project, with companies such as Shell in the top 5% on one ESG algorithm and at the bottom of another. There's an alphabet soup that these model, and we're creating effectively a separate currency, as well as, I might point out, driving a number of ground firms into private equity. And what we are seeing in gross aggregate is in fact that firms around the world, finance firms and industrial firms, are still betting in ranges of approximately 8 to 1 that fossil fuels will be around for some time; in other words, they don't believe in government policies.

FinTech? Everything Starts With A Roadmap



Roadmaps Differ



Top 10 solutions to climate change

Total gigatons of CO₂-equivalent emissions that could be reduced by 2050

SOLUTION		PLAUSIBLE SCENARIO		DRAWDOWN SCENARIO		OPTIMUM SCENARIO
Refrigerant Management	1	89.74	2	96.49	3	96.49
Wind Turbines (Onshore)	2	84.60	1	146.50	1	139.31
Reduced Food Waste	3	70.53	4	83.03	4	92.89
Plant-Rich Diet	4	66.11	5	78.65	5	87.86
Tropical Forests	5	61.23	3	89.00	2	105.60
Educating Girls	6	59.60	7	59.60	8	59.60
Family Planning	7	59.60	8	59.60	9	59.60
Solar Farms	8	36.90	6	64.60	7	60.48
Silvopasture	9	31.19	9	47.50	6	63.81
Rooftop Solar	10	24.60	10	43.10	13	40.34

Source: Project Drawdown

Vox

<https://www.vox.com/energy-and-environment/2017/5/10/15589038/top-100-solutions-climate-change-ranked>



SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



But we do need a roadmap to conclusion, and you're probably very familiar with some of these technology roadmaps which look at where our emissions can work their way down to zero, and these are of course absolutely crucial, but they need to be supported in turn by roadmaps that are related to finance. We happen to be big supporters of the Sustainable Development Goals, but there are other roadmaps out there. This one *on the left* from Project Drawdown actually talks, I think this is interesting, where the sixth top solution to climate change is actually educating girls.

So we're going to see a multiplicity of the ways to achieve our targets, and that's what markets are very good at: trillions of decisions within an overall price framework, with some competition, can see enormous amounts of change, in a way that awareness or behaviour change can't.



Multiple Views



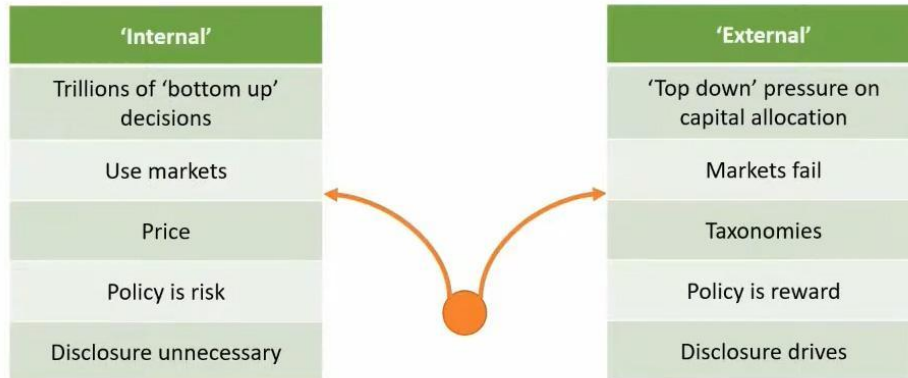
Need Economics - Plandemics Are Insufficient

We need to move from the bottom two quadrants, regulation and ESG. There's nothing wrong with either of those, and they need to be maintained perhaps, but we also need to charge, and that can be via taxation or via internalised costs, and, frankly, auctioned permits that are tradeable tantamount to attacks, if in fact people are paying for them upfront. So I would argue we need economics; plandemics are insufficient.

After 'Awareness' What Next?

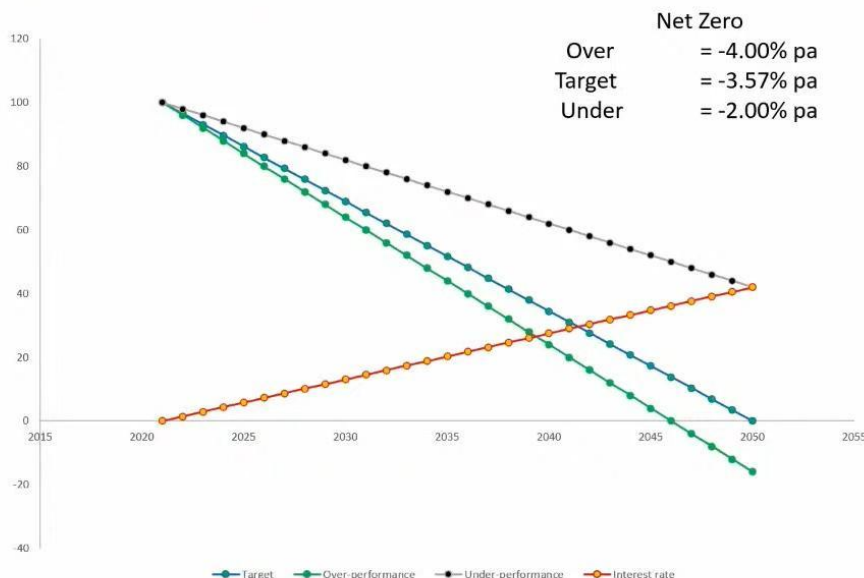


Need Economics - Plandemics Are Insufficient



And when we look at these things of where are plandemics happening, it's really about trying to add to a lot of this top-down talk the bottom-up mechanism of hard financial decisions made day-to-day.

Policy Performance Bonds



And to put those financial decisions into a much stronger framework, one of the things that was proposed, both at COP in Copenhagen and at COP in Paris, was the idea of government policy performance bonds. We've seen performance bonds

emerging in the private sector since 2018, and a government equivalent would basically be that a government issues a bond that pays an interest rate that rises, if it fails to meet its target.

With the proliferation of 2050 net-zero carbon targets for example, a government might issue a bond of say US\$10 billion, and if in 2025 it hasn't decreased its emissions by 14%, which is exactly what the straight-line projection is at 3.57% reduction a year, then the bond would pay the difference. So if it hasn't gone down by 14% but it has gone down by 10%, the bond would pay 4%; if it hasn't gone down by 14% but it's gone down by 5%, then the bond would pay 9%; if it's actually gone down by 14% or more, the government effectively gets a free loan, and those people who felt that they didn't trust government policy had been able to hedge it appropriately, and ensure convergence here, between the private and the public sectors. If governments want us investors and private sector entrepreneurs to invest 25 to 30 years ahead, well then it too needs to put some financial skin in the game, or it is being hypocritical.



Governments Need Policy Bond-Cuffs



- Policy performance bonds - (aka ESG 'linked', sustainability 'linked', 'performance incentive')
 - Natural policy hedge to bring follow-on investment
 - Mechanism for open trade, e.g. link issuance (% of government debt) and price to tariffs, if any

Danone (2018), Louis Dreyfus (2019), Nokia (2019), Enel (2019), Wilmar International Limited (2018), Bunge Finance Europe BV (2019), WSP (2020), MásMóvil (2019), COFCO International (2019), TRIG (2021), ...

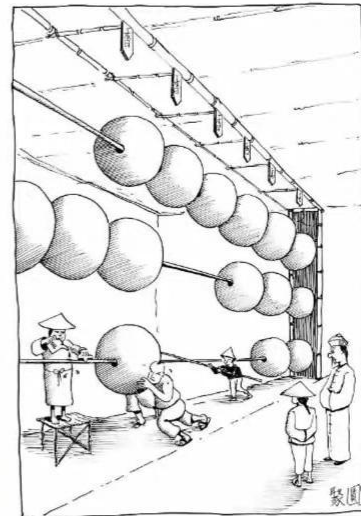


So I would argue that governments need these policy bond-cuffs. They are known in the private sector as ESG linked, sustainability linked, performance incentive, and you can see here *at the bottom* that a huge number of firms have issued these just in the last few years, and it may constitute something like a third of the green bond market by value.



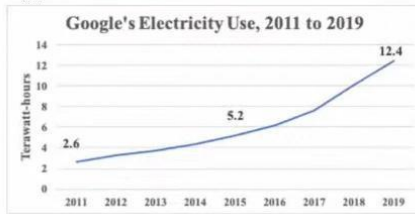
- Trillions of decisions – if people made better decisions every day the world would be a better place
- First benefit - better economic decisions on sustainability
- Second benefit – automatic supply chain tracking, including capital supply chain

In 2013 US drivers drove 4% fewer miles per capita. That wasn't because the message of the Sierra Club finally got through. It was because petrol prices rose by 32% that year.

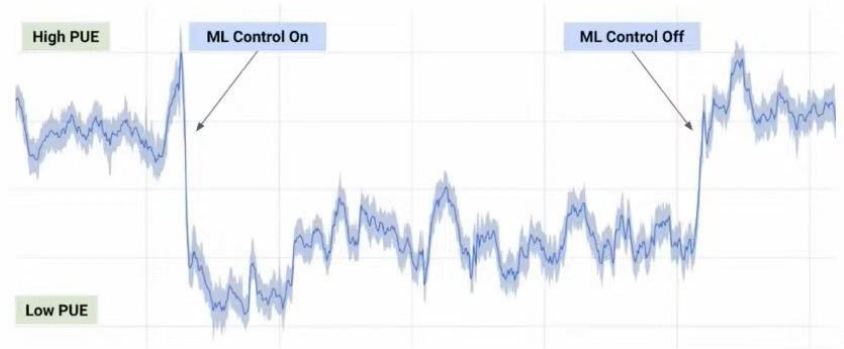


**"Get a big picture grip on the details."
Chao Kli Ning**

I think we keep talking here about recognition of the obvious. Carbon pricing matters: if we get different people to make different decisions every single day, the world would be a better place, and these better economic decisions need to include externality. In fact, carbon is no different ~to any other~ [~2], ~once you~ charge for its use and its emission. I might point out that price really does matter: the example I love to use is that in 2013, US drivers drove 4% fewer miles per capita, and it wasn't because they'd finally got the message of the Sierra Club; it was because petrol prices rose by 32% that year.



“DeepMind AI Reduces Google Data Centre Cooling Bill by 40%”



<https://deepmind.com/blog/article/deepmind-ai-reduces-google-data-centre-cooling-bill-40>

And these trillions of financial decisions will turn up in the systems that all of us love building in the fintech world. A good example was how DeepMind, using its machine learning and AI, reduced Google’s data centre cooling bill by 40%, and that was, frankly, millions and millions of little tiny decisions at every point along the way.



Economy	time reduction	fewer geographical sites or travel	fewer steps	less material or time
Efficiency	greater throughput per period	load balancing geographically	load balancing between functions	more output for given inputs
Effectiveness	on time for customer	right place	correctly performed	most appropriate
Innovation	radical time change	unexpected location	elimination or automation	elimination
	Time	Place	Function	Consumption

Big opportunities for Dynamic Anomaly & Pattern Recognition (DAPR) & financr, in:

- Carbon markets
- Energy storage markets
- Smart transport and logistics markets
- Smart energy markets and grids
- Smart land use management
- Smart cities, urban planning & design

So this is where fintech really does have a strong role to play in the climate wars. There are big opportunities out there for AI, machine learning, [~3] pattern recognition and finance in areas like the carbon markets, energy storage markets, transport markets, really combining economy efficiency, effectiveness and innovation with reductions in time, eliminating some of the problems to do with different locations, combining functions, and reducing consumption.



- Market measures essential - competition, open data, better regulation, and voluntary standards markets
- FinTech should lobby for:
 - costed carbon
 - policy performance bonds - financial handcuffs on government policy
- Implication for FinTech – shift from transaction & savings product focus to trading & IoT markets – from lipstick on banks to mini-eco-Bloombergs for the masses



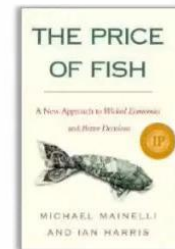
"Get a detailed grip on the big picture."
Chao Kli Ning



So we can save the planet one bit at a time, but market measures are essential, not desirable. It is not about awareness; we need competition, open data, better regulation, and voluntary standards markets of course, a well-rounded market, and fintech should be lobbying both for cost of carbon, but also for policy performance bonds, to ensure that there really are financial handcuffs on government policy as well. And the implication for me and for fintech should be a shift from the idea that we're labelling saving products as green or transactions as green, but that we're really moving to a much stronger focus on trading and the Internet of things markets, moving from putting little lipstick-type applications on the pigs of banks, to creating mini echo Bloombergs for the masses, so that all of us have got the tools and the power to make those trillions of decisions much better.



"Get a big picture grip on the details."
Chao Kli Ning



Thank you!



I would conclude by saying thank you very much to the team at Mattereum for allowing me to share some of my thoughts with you today. I hope that you're enjoying COP, I hope that you are thinking hard about how it works. But when you return home, do remember that markets are going to be the way that we will solve climate change, and that we need, as people in finance, to work extremely hard at convincing government that it too needs to put some skin in the game financially – thank you! [applause]

Anton: Thank you very much Professor Mainelli – that was fascinating, informative, and a strong proposal.

I'd like to introduce now a friend, a colleague, mentor, thought leader, author, CEO and founder of Mattereum: Vinay Gupta. He will tell you about his background in planning for emergency situations, and working for many years, decades, to address climate change. He is here today to talk about how the blockchain can enable a net-zero economy.

Building Net-Zero Commerce for a Circular Economy

Vinay Gupta | CEO

Vinay:

The first thing I'll mention is we have just announced a partnership with Z/Yen, to produce a set of services which will give people easy access to the emissions trading markets, both the EU standard and the UK standard. So over the next few months we're actually going to stand up some technology, so that when have something to offset, you could call a set of APIs to basically buy carbon directly from the UK and the EU markets at your preference, and actually retire those carbon credits then and there. There are systems like that which are in play for different kinds of tokenised carbon products, which you see being produced by a lot of folks in the blockchain market; this is going to provide the same sort of ease of use, but it will be going directly to the main international and national carbon markets. The details of that are on the Z/Yen blog, and I've just tweeted them out from the Mattereum account from my account. So we're doing something concrete, it's a nice little step, and I think that will get integrated into a lot of products over the next year or two.

What we will cover today

1. **Our Journey:** Mattereum's conceptual origins
2. **Building the Mattereum platform:** Preserving value to protect the planet
3. **Why blockchain:** Building unbreakable
4. **Working with Mattereum:** How we can engage

This is going to be a long trek, because what I'm going to try and describe is a fundamentally new way the world can work. The world as it currently stands, there are a set of things that are just the way they are, and that includes how we think about our relationship with physical goods. Does anybody remember the sort of transformation that occurred when we started to get digital mapping in cars and then on phones? I remember 20 years ago, somebody would invite you to a party in some weird corridor of London, and you would carry a physical A-Z, and you'd be guessing about bus routes to get there, and consequently you tended to only go to places that you knew, because getting anywhere else was difficult. Then came the Maps, then came Uber, and now at this point as long as you know roughly how far away some place is, generally speaking you never wonder about where it is, the robots know that for you.

What I'm going to be talking about is a transformation like that and at that kind of scale for our relationship with physical goods: the microphone clicker, the shoe, the bicycle, the car, the house. Really, really deep into the fabric: what happens when you start using computers to assist our ability to own and use physical matter as a category?

Our origins: Planetary scale decentralised thinking

- 30+ years high technology background
- Recognised thought-leader in the blockchain space
- 15+ years complex systems and policy analyst with military and civilian resilience think tanks
 - Rocky Mountain Institute
 - US Department of Defense
 - Institute for Strategy, Resilience & Security @ UCL
- 20+ years in refugee sheltering design
 - Inventor of the *hexayurt*, a highly scalable open source sheltering solution
- Release co-ordinator for Ethereum's 2015 launch (\$545BN mar cap)
- Mattereum founded in 2017 to be the "One Ring"



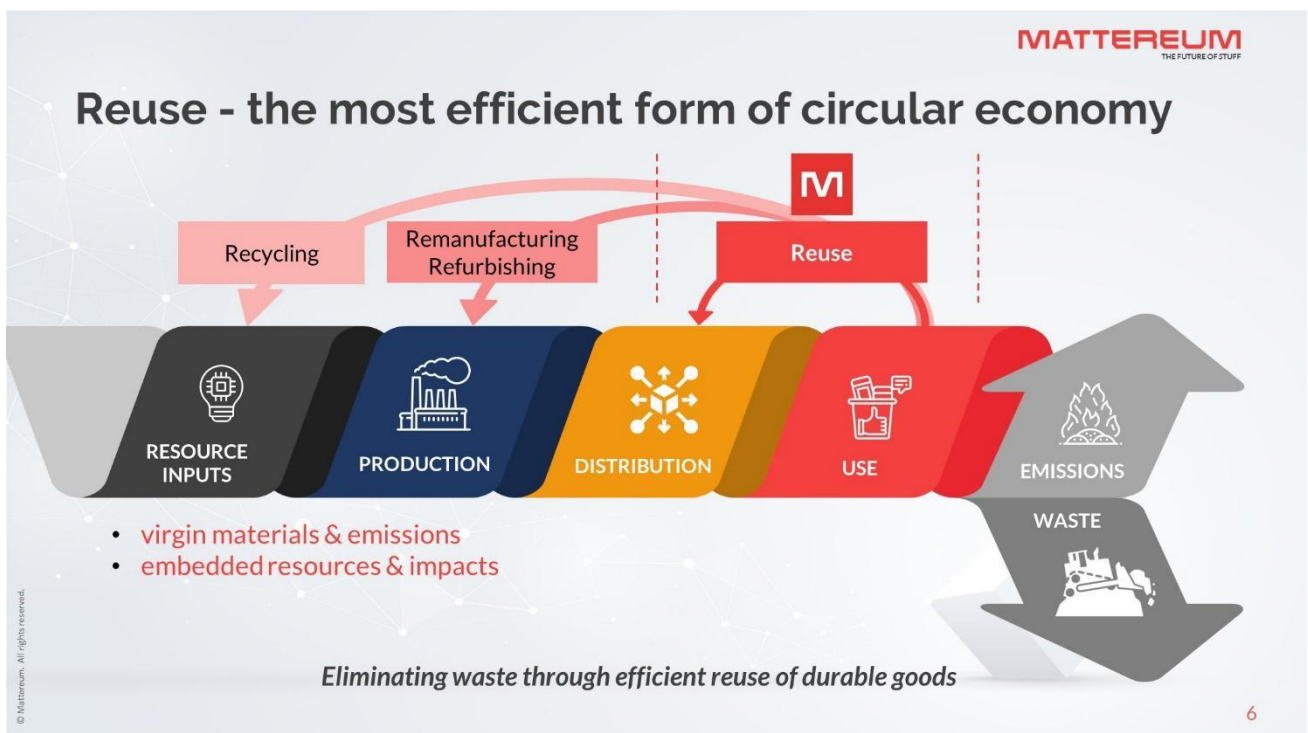
Vinay Gupta
Founder & CEO

Mattereum itself comes out of me basically being a disaster relief guy. I kind of got religion on this in 2002, and I cooked up a 30-year plan for handling hundreds of millions of climate refugees. I'm not going to talk about that planning work, I'm not going to talk about the various technologies that I've shipped towards that goal, but Mattereum is one of a series of things that are pointed towards this goal. Because Mattereum's structure is useful both for cutting carbon emissions in the economy as it stands, but also, critically, for running a very, very tight supply networks, for managing hundreds of millions of climate refugees. It starts as a developed-world economy tool for reducing carbon, and increasing [~3] goods, but then it can also have disaster relief applications on the same technology base, or a very similar one.

My background is basically after 9/11 I got very heavily involved in defence, security and resilience, then in 2014 I left to join the Ethereum team, project-managed the launch of Ethereum, then shortly after that started Mattereum, and here we are – that's a fair summary. I should also mention the book which you have in front of you, called *The Future of Stuff* [1], was written during the pandemic, and it directly addresses a lot of the topics we're going to talking about today, in terms of transparency about our physical goods.



Let me namecheck here Bruce Sterling's *Shaping Things* [2], that's a very important book to the Mattereum work. Bruce is one of our colleagues now, and that is another thing which is massively worth reading.



The circular economy basically comes in multiple scopes. This doesn't exactly fit the Scope 1, Scope 2, Scope 3 carbon emissions, but it's pretty close. The majority of thinking on circular economy is Scope 3 circular economy: you take your plastic object, you throw it into the trash, it is taken away to a recycling centre, they melt it down, then they turn it into another piece of plastic which you buy in a shop and you take home, and you use it and you throw it in the trash. So the goods are going all the way back out into the remanufacturing process, and they're coming all the way back in again, and that long loop means you're paying to manufacture them again, and

you're paying to distribute them again, and you're paying to haul the stuff out there in the first place. That loop has a lot of friction on it, and one of the reasons that the circular economy has gotten off to a kind of slow start, even though the idea is perfect, is because there is specifically so much friction on that circular loop.

What we're talking about here is a very low-friction version of the circular loop, where rather than the goods going all the way around into remanufacturing back out again, you simply take the laptop that you have replaced to your neighbour next door who buys it off you. You take the bicycle that you've decided you had enough of riding, because it's just cold and wet out there and it's winter and you don't really want to bike in that, and you simply sell that bicycle to somebody younger and fitter who decides they are going to bike this winter, and you just pass it on to them. That kind of circularity, rather than the goods going into the trash and being torn to pieces, the goods are simply handed to somebody that wants them. And in a world with eight billion people, a billion of whom live in absolute poverty, there is always somebody that wants the stuff. We're not short of mouths, we're not short of feet: why is it that we can't just take the things which are useful, and pass them on and pass them on and pass them on and pass them on? A lot of the answer to that is we can't figure out who wants them.

Has anybody seen these videos of the places in Africa, where the container-loads of used clothes wind up after they've fallen out the back end of the charity shops, and about half of it is just winding up in these enormous, gigantic hills of clothing? That's not happening because nobody wants to wear those clothes; it's happening because the people in that specific city don't want to wear those clothes. If you put those clothes in the places where people do want them, they will go, they will be used. Very little in this world is so broken that nobody wants it, given how much poverty there is.

To be able to get this kind of circularity in place, what we have is a routing problem. "I have a thing, I no longer want it. Could you figure out who wants or needs this most? And could you sell it to them, or could you give it to them?" and for this we need an ontology of things, and we need an ontology of needs, and we need some way of matching. This is all basically a data problem, and if you solve the data problem, as digital mapping did for navigation, Mattereum will do for ownership, it changes the relationship between people and things.

We live in a world that is being buried in its own rubbish



Humanity generates
**2.5 BILLION
TONNES**
of solid waste annually
500kg/person (EU)

Increasing to
**4 BILLION
TONNES**
by 2050

Only
**20%
RECYCLED**
80% waste

I think we have adequately covered the amount of rubbish in the world – it's a lot.

Our goal is to create a world where nothing is ever made to be thrown away



**OUR
MISSION**

Build a global circular economy by enhancing the tradability and liquidity of the world's physical assets

Critical concept: in this vision of the world, nothing is ever made to be thrown away. This is just absolutely the critical concept: when you buy something, the intention that you have is that you will resell it. You might be reselling it to somebody that will then melt it down and recycle it and reuse it and it will be used as a raw material, but for the vast majority of the stuff in this story, what's going to happen is that you will buy the thing, with an explicit plan for selling it again when you're done with it. "I buy the bicycle in spring, I anticipate selling the bicycle again in autumn, I accept that the bicycle is worth a little more in spring than it is in autumn, but at the end of the day that's the cheapest way for me to own a bike, and in the next spring I will buy another bike."

This model of everything you buy you intend to sell again, this would apply to furniture, clothes, consumer electronics, transport vehicles, and the vast majority of the stuff that you actually personally own is in one of those four categories, that's just about all of our stuff. Every single one of those things has dramatically inefficient, ineffective resale markets right now, the resale markets are terrible. Has anybody ever sold anything on eBay? Is it not really time-consuming and annoying? That right there, the time-consuming and annoying nature of selling things leaves us with a kind of difficult quandary, because we wind up with huge piles of stuff that we don't want, but it's too much trouble to sell it, it feels morally wrong to throw it in the trash, you feel like you're losing too much money if you give it to a charity shop, and so you wind up just leaving it, filling up a closet or an attic or the back of a car. That problem is happening because capitalism has made it incredibly liquid and easy to buy things, but it's made it really, really quite difficult for individual consumers to sell them again, and there are a number of obstacles on that path to being able to sell again. As a result, when other people want to buy the thing that you have, you're probably not putting on the market right now, and as a result they tend to buy a new one, and now there are two: there's the one clogging up your attic, and there is the one clogging up their attic, and now we have two problems.

Getting rid of this asymmetry between buying and selling for individuals, this is kind of a peer-to-peer decentralised vision. Rather than you buying the vast majority of your things from stores, the idea is that you will buy new things when you need a new thing, but the rest of the time you're going to buy things second-hand, or you're going to buy things that are fully embedded in this model of circularity. And that is a tech problem: sort out the technology, sort out the marketplaces, sort out the logistics, and it's entirely possible to create a world in which things are bought and sold and moved around just as easily from consumers to other consumers as from Amazon to other consumers – it's a circular economy, rooted in decentralised commerce.

Commodities achieve high liquidity

- Almost as old as human civilization (~4000BCE)
- Centralized, highly liquid marketplaces for professional traders
- Derivatives ensure price-discovery and spreading of risk among market participants
- Prices may fluctuate wildly but the *specification* of the commodity is never in question

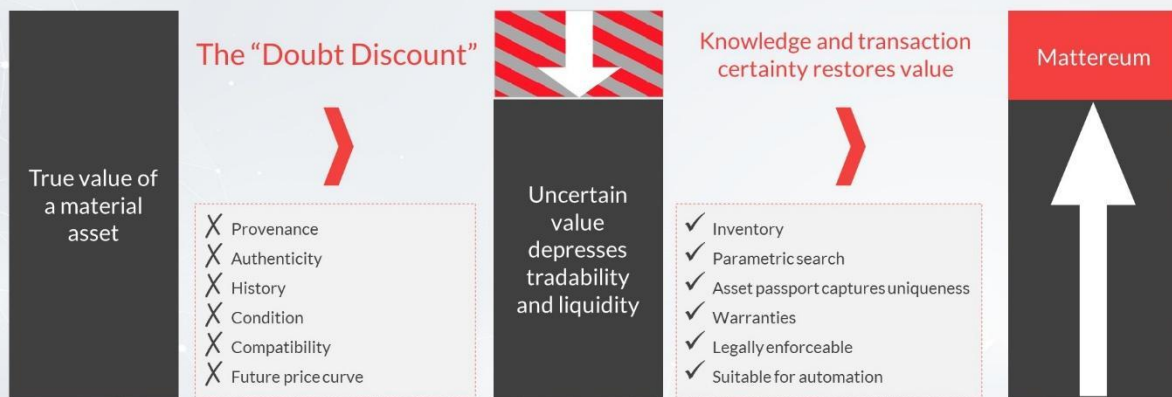


KEY TO LIQUIDITY

All market participants have a standard specification
Doesn't work for real-world goods, because each is unique

Places where this is already done are international commodities markets. This is your futures for steel or food, corn, all these massive things where one tonne of corn is much the same as another tonne of corn, and there are very carefully-defined specifications which give you a sense of how these two sets of wheat differ. “*This* wheat is a little damper than *that* wheat, it’s gone from 1.4% humidity to 2.3%, that means you have to use it a little sooner,” there are these kind of fine variations that are well-documented, and the commodities markets run incredibly efficiently. If you have something to sell that fits into the commodities framework, you have no problem of identifying buyers for it – it just works.

Much of the world's *manufactured* goods are “stranded”



The circular economy depends on precision around specification and legal enforceability
precise specification → agreement on value + enforceability → willingness to transact

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On the other hand, we’ve got the goods which we are dealing with day to day, the things that we own, and they are not at all like that. The biggest single economic drag is the thing we call the doubt discount: you have a thing, you want to sell it, the person who buys it doesn’t believe you when you say this thing is in great, new condition, they’re kind of like “Maybe it is, maybe you’re lying,” they lowball the offer to you. You think the thing is worth \$1,000, they think it’s worth \$1,000, they think there’s a 20% chance it’s broken and you’re not telling them, they offer you \$800, and then you think “I’m not going to sell this for \$800, I know it’s worth \$1,000, and I know that it’s not broken,” and that asymmetry in information between the buyer and the seller causes the prices to get pushed apart from each other. The seller has very good information and says, “It’s worth \$1,000, I’m not going to take a penny less,” the buyer is like “Maybe \$800, maybe \$1,000, maybe \$800, maybe \$1,000, I don’t really trust this,” they depress the price, and the result is that the trade doesn’t happen, and the seller is stuck with the illiquid stuff clogging up their closets again – this is the hard path.

If we get equal information between the buyers and the sellers, it takes away the expectation that they’re going to pay two different prices for the same object, and at that point you can have a deal. “I think it’s worth \$1,000, you’ve got excellent, third-party reviews that tell you that this object is in great, new condition, it’s definitely worth \$1,000,” you pay \$1,000 for it, it leaves my basement – problem solved. And all of the CO2 and other environmental damage that would have been done by making another one, we got rid of all of that.

Value uncertainty is measured in trillions of dollars annually



Kobe Steel scandal sparks car and train checks

12 October 2017



Car, train and aircraft makers are investigating whether they have used any sub-standard materials made by Kobe Steel.

"On 13 October 2017, Kobe Steel admitted to misleading more than 500 companies including Ford, Toyota, Nissan, General Motors, Hitachi, Boeing and Mitsubishi Heavy Industries with potential safety implications for their vehicles."

Forbes

Fake Wine Is A Billion Dollar Market And Here Are The Ways To Identify Them

Journalist Chip Liao Former Contributor to @

This article is more than 7 years old.

I spent two full days at Wine Fraud's wine authentication training classes in Hong Kong in early February 2017. I walked in vaguely aware of how serious a problem wine fraud was around the world, but I walked out with a very clear picture of how easy it is to fake wine and why it is so prevalent. The total value of fake wine according to Maureen Downey, one of the foremost experts on fake wine who was leading the wine authentication classes, is around \$3 billion. The value of just one fraudulent, Rudy Kurniawan, currently serving time in jail, is valued at around \$500 million. Then, if you add others such as Robert Mondavi, Bruno and Nicole Lenoir and Alex Akinin who were caught and whose wines are also circulating in the market, you can imagine how quickly this number can grow.



"The total value of fake wine according to Maureen Downey, one of the foremost experts on fake wine who was leading the wine authentication classes, is around \$3 billion."



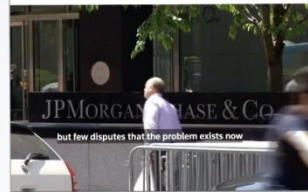
REUTERS

Exclusive: Fake-branded bars slip dirty gold into world markets

By Peter Hudson

14 MIN READ

LONDON (Reuters) - A forgery crisis is quietly roiling the world's gold industry.



"Bars worth at least \$50 million stamped with Swiss refinery logos, but not actually produced by those facilities, have been identified by all four of Switzerland's leading gold refiners and found in the vaults of JPMorgan Chase & Co., one of the major banks at the heart of the market in bullion."

This question about resolving value uncertainty, although it seems like a kind of weird, boring technical mechanical question, the actual fact of it is that the reason that we don't have a circular economy is value uncertainty. The reason that eBay and the charity shops and second-hand dealers and antique dealers and used car dealers and all the rest of that, the reason that that system has not solved consumer capitalism is because nobody can figure out the condition of the goods or what anything is worth, and that's literally the thing that is causing us to have these gigantic, avoidable environmental footprints. It's amazing when you bring it down to this level of simplicity, but it is literally this problem of "I don't want this anymore. Would anybody like it?" and if we could efficiently solve that so I wasn't losing so much value every time I sell the second-hand thing, all of these problems dramatically reduce.

C2C e-commerce today: expensive, poorly incentivised

- No parametric search: you can't find it
- Items explicitly listed for sale
- Poor specification/verification
- Expensive listing fees
- Fraud / error prone → low trust
- Manufacturers do not participate



Today's mainstream commerce incentivises the first sale only, then disposal

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C2C e-commerce: literally, this is the question of how do we buy and sell things from each other. The existing infrastructure for this is dramatically less efficient than the infrastructure for buying new stuff, and the table stakes for solving that problem are enormous.

BIG IDEA: Trust communities



- **Experts effectively create “mini DAOs”** around the assets they warrant
- **Combined expertise maximises certainty**, which increases value of goods
- **Environmental impact data** is now a critical component of any product
- **Experts**, not sellers, provide digital warranties around the facts in the NFT
- **Warranties are secured cryptographically** and may be backed by insurance
- **Trust** is spread across a network of actors in the d-commerce NFT

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So, how do we solve this? Let us suppose that I want to sell *this* clicker to Anton. I wind up with this thing because I accidentally took it home after a talk, and now it's sitting in my basement because I have no idea where it actually came from. Anton

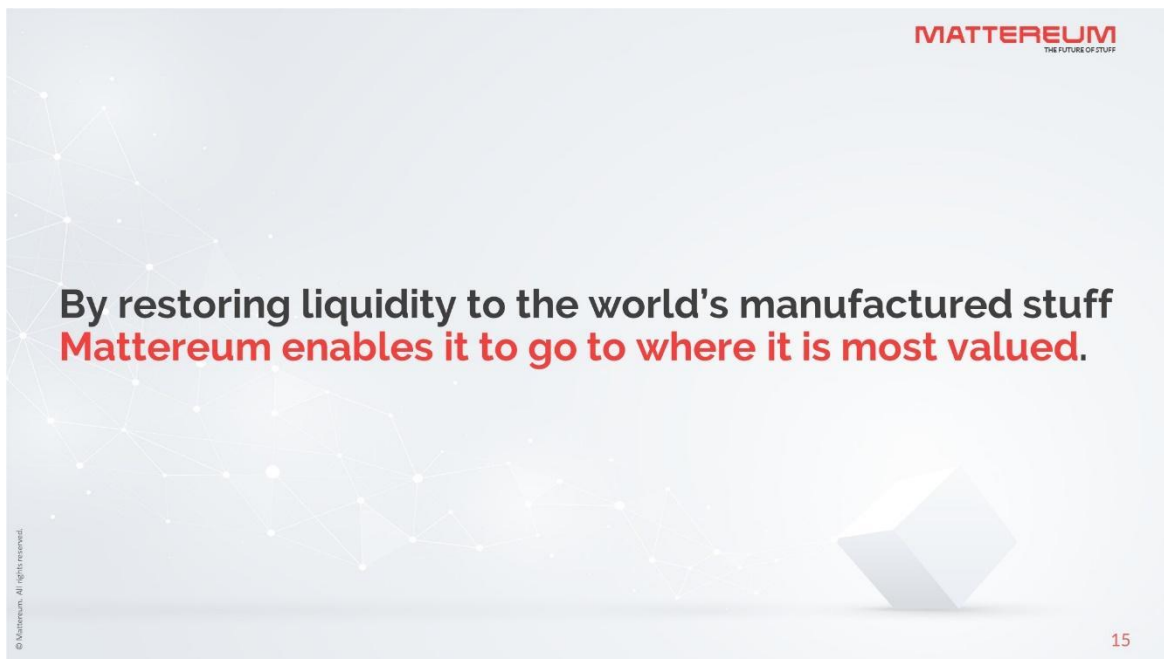
wants a clicker, but he's got to figure out whether this clicker works with his A/V setup. Question one, does this clicker work with his A/V setup? Well, I don't know anything about clickers, other than it came home with me by accident, he doesn't know anything about clickers, we're just people that want to do talks and have performances and do things with slide decks.

Somebody that knows about clickers is somebody from an A/V department at say university or high school. That person sits at home, I send them a picture of the clicker and say, "Hey, will this work with his setup?" and they say, "Yes," or they say, "No." If they say yes, they write a warranty. "If you pay me 50 cents, a dollar, then if you send him the clicker and it doesn't work with his setup, I will pay you \$12.50," which is the cost of replacing the clicker. Now, that warranty, it's not just a warranty on the clicker, it's a warranty about the context in which the clicker has value. "I know that this thing is valuable to him because it solves his problem, even though it is not valuable to me." And this is the critical part: we are generating wealth by attaching information to objects.

I'm going to take that very slowly, because it is a weird concept: in my care, this thing is useless because I don't have the equipment that it plugs into. I can't just send it to him, because he doesn't know if it works and he's not going to buy it; I need somebody to add information to this before the thing has value, and that person has specialised knowledge about clickers. So they take the clicker, they verify it will work with his setup, immediately this has gone from being a worthless junk to being worth \$12.50, and at that point I sell it to Anton, and Anton takes it – have a clicker! At that point, he doesn't have to buy a new clicker, which involves mining oil to make plastic to cast into a thing and so on, I have rid of this thing which was cluttering my house, and the kid in the high school A/V department that gave me the expert opinion that the clicker will work with Anton's rig has just made 50 cents for a piece of knowledge that was right on the top of their head.

What we have here is an alchemical process: we take knowledge, which is currently not being used to generate value, we take the goods, which are currently costing people money to store, and we take unmet human need, and we alchemically combine these things. I am benefitted, I got rid of the clicker and I made some money; the kid with the knowledge about the A/V stuff is benefitted, they made some money for having expertise; and Anton has benefitted, because he didn't have to pay carbon and other taxes for generating a new clicker that actually, when actually he could have had a used one and it would have been just fine. And that mechanism we call a trust community, you have multiple parties: a buyer, a seller, and a set of independent experts. What binds the trust community together is knowledge about an object, and financial interest in an object, and the financial interest is represented as warranties and insurance. The buyer, Anton's position, buys the clicker, but they also buy the warranties associated with the clicker, and that's how we bind knowledge to matter to reverse entropy.

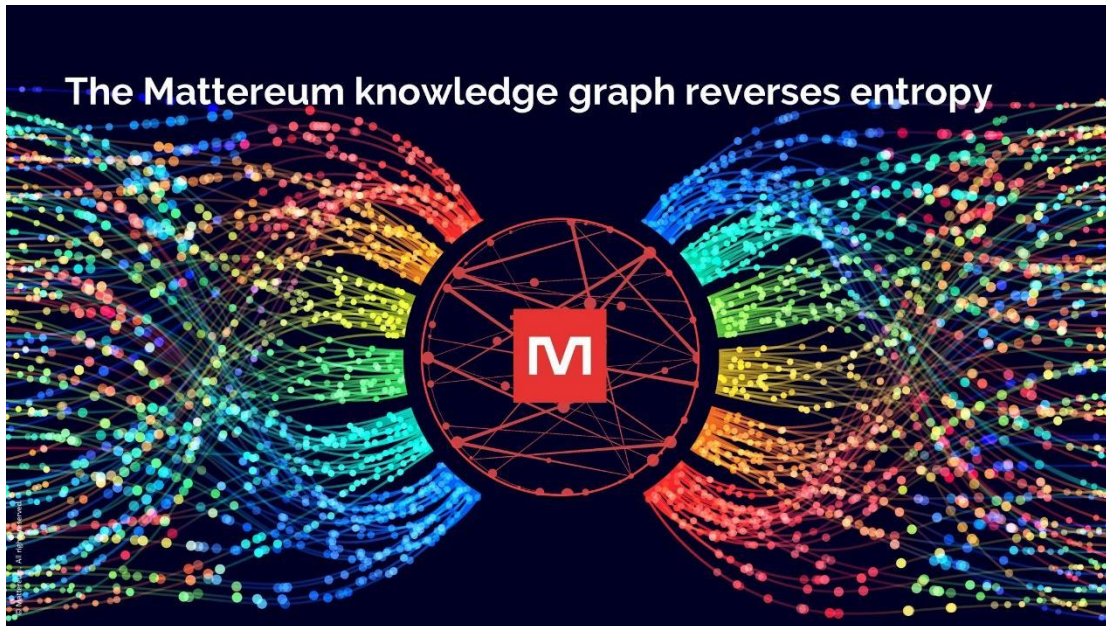
So rather than having this extraordinarily chaotic vortex behind the consumer economy, where all of the stuff in the world is piled up in this enormous kind of junk pile, in basements and in thrift stores and on eBay, rather than having this kind of entropic destruction of value because we throw away the knowledge about things, and then the stuff is left as brute physical matter with no intelligence, what we're doing is we're maintaining and upgrading the intelligence that we have about physical objects, in a way that dramatically increases their utility and value. And this is literally money from thin air, it's wealth from thin air, because by rebinding an object to its story we take it from the status as trash in the bottom of some bucket back into the position of being a product – it is an elevation of physical matter.



And it's done by arranging humans and knowledge and money in a way that, as the slide says, enables the object to go where it's most valued.

Now, let's think about the categories here: we have clothes, we have furniture, we have transportation vehicles, and we have consumer electronics; practically every single thing in this room, other than the plants, is in one of those categories. So if we could do this for those four categories, we can generate a circular economy, where it becomes possible to do things like match chairs. You have three of a four-chair set, because the last chair got lost when you moved house, you'd like the fourth chair. "I took a picture of it, it got scanned, somebody checked it against the database, we identified other chairs which will match, somebody will sell you one of those chairs, it's only 75 miles from where you live, and a truck is going between those two locations in three days. Do you want the chair? – Yeah, that would be great – thank you!" and everybody in that deal is benefitted. Because what use is one chair of a matching set? Well, it's way more valuable to me, because I have the other three chairs, than it is to the poor person whose house its cluttering. And that mechanism is

basically reordering all of the physical matter in the world to generate value, by putting the objects in the hands of the people that want them the most.



There we are: the Mattereum knowledge graph reverses entropy. It's a really, really simple idea, and if you carry it out competently and you get the details right, the world changes, as much as it changed when we got digital mapping.



There are an enormous number of benefits from fixing a fundamental process like selling the things that you no longer need. The benefits are universal, because the

process of consumption is universal. This stuff is metabolic, it's core to what makes human beings human beings: making things and exchanging things.

Durable goods: if we have goods which are going around this circular economy again and again and again, you're going to tend to buy things which are more durable, because if you buy everything with the intention of one day selling it, you will get a much better price if the thing is in good condition when you sell it. So you buy quality that will last, and when you sell it, you sell it for a higher value than if you bought junk. I don't know how old these jeans are, I don't know how many people had them before I did... Vintage denim on eBay seems to have peaked about 25-30 years ago, and the denim made in that era never ages, it's amazing! I have no idea how old this watch is, I don't know where it came from, I bought it from a friend who is a watch collector in London, I've worn it, it could have had 10 owners, it could have had one... Probably it will work for another 50 or 100 years, probably won't even need maintenance.

It just turns out that good stuff lasts forever, and if you don't need it to be particularly shiny... I mean, life is good, right? Do we really care whether these kind of objects... These chairs you're sitting on, do you care if that's the first time somebody has sat in them? There are very few things we're really particular about, very few things we really care about. Like, you're going to want new socks, we understand that, but for everything else, particularly for fun things... If you want to go skiing, or you want to take up roller-skating, do you need new roller-skates? No. I just need really good quality, old roller-skates, I'm going to try it for three months, and if I don't like them, I'm going to pass them on... 151 people have tried these roller-skates, and they have been running perfectly successfully since the 1980s.



Key features of the Mattereum platform

Ricardian Contract	Immutable & Secure	Force of Law	Custodian	Warranty	Asset Passport	Arbitration/Court
 • Smart contract • Both human and machine readable	 • Hash stored and contract executed on-chain • Independent of chain	 • Legally-enforceable • Resolution via court or arbitration	 • Fully-automated	 • Policies cover losses • May be backed by insurance	 • Defined physical asset • Ontology • Backed by experts	 • Settles and enforces legal disputes

Mattereum is the first-to-market smart contract ecosystem that comprehensively enables the sale, lease and transfers of rights of physical assets

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Now, this raises some other questions. The critical thing about this is what about innovation? If we're going to have people continue to generate amazing, new things, we need to find a mechanism which allows people to continue to innovate while we're in this kind of circular economy paradigm. And the way that that works is at very top-end you have pros, sometimes you call these folks *prosumers*, that's another category, but you have the people who by definition want the best-available thing. You're a professional photographer, you want the best-available camera, because if you don't have the best-available camera, the shots that you take will look like you didn't have the best gear, and that will make you look like you're an amateur. So at the top-end of these circular marketplaces you have the entry point of the new goods, and the entry point of the new goods is for the people that are going to extremes. They are the professional photographers, they are the mountain climbers, they are the cross-country skiers, they are the bicycle racers, they are the people that need to have the best stuff, because they are extraordinarily driven by function, and they're pushing the equipment to its very limit. They need the greatest not because they are greedy; they need the greatest because they're pushing right to the limit of human performance, and at that point the equipment enables them to reach further.

If you think about brands like North Face, North Face sell to the pros, at least that's their advertising. The vast majority of what they make is outdated technology, five-year-old machines that produce Gore-Tex, which was really great five years ago and now is a little behind the curve. They have a pro market where they sell stuff for \$400, and a top-end North Face jacket has cost \$400 forever, because this is the price the pros will pay for the best-available gear, and their tolerance to put that money on the table hasn't changed much over time, North Face charges it because they can.

That approach continues to run unchanged; the difference is that rather than having a whole bunch of machinery that is producing sort of long-out-of-date Gore-Tex, stuff that really nobody is going to use if they have an alternative, but it's being sold for cheap, all of that stuff becomes filled with the gear which was pro gear five years ago. So you sell way more pro gear to the pros, because they know that they'll pay \$400 for the jacket now, they will sell it for \$375 in a year, and they will buy next year's pro jacket. So what we're doing is we're cutting the price for the pros to acquire the very latest and greatest gear, but in return for that far more of the pros will upgrade every single year and get every single upgrade.

So the projection here is an economy where pretty much the entire pro category for whatever it is – musical instruments, posh cars, catwalk fashion, whatever it happens to be – the pros will all upgrade every year, and they will start to make a living by having excellent taste. They buy the new stuff, they sell it on in a year, if they bought something which everybody thinks is amazing they'll get a slightly higher price, if they bought something which is considered to be a failed experiment they'll get a slightly lower price, but they will continue to be able to subsidise their purchase of the best-available stuff effectively, because the second-hand markets will take up the slack. So if I'm North Face or Apple or Canon or Nikon or any one of these brands, if

I'm Porsche or BMW or Fiat or whatever it is, what happens is that every year I sell a lot more of the high-end product, and I service a lot more of the parts and maintenance and spares for the things which I made 10 years ago which are now in continuous use, because we figured out how our second-hand markets really work.

So the suggestion here is that the innovation engine not only continues to run, but it runs faster and harder, and what we get rid of is the manufacturing of things which are kind of substandard, because technology has moved on, and kind of nobody is coming in to fill in the gaps. It's a differently-structured market, but it is not a kind of circular economy which kills innovation, and it's not a kind of circular economy that kills mass production. Instead, rather than these amazing goods that we're making only really existing for a small, rich elite, that is constantly under financial pressure to upgrade... Instead, what we're doing is we are spreading the wealth, tier by tier by tier by tier by tier. Because if the goods are durable and they age well, 15-year-old digital cameras that run on AA batteries are being played with as toys by kids in Mexican towns. "Hey, it's your fifth birthday – have a digital camera! It cost \$2.50, it's really, really fun, and you're five years old, and maybe it will get broken, and maybe I can fix it, and maybe I can't. – Hey, now I'm a five-year-old with a digital camera! I am happy, I don't care it's 15 years old!" It kind of looks like a phone, it takes pictures, I can't call anybody... This is made of win. And when you're a kid, do you care? I don't know how much Lego I had when I was a kid, but there was a lot of it, and I guarantee a lot of it did not arrive in my house new – I never noticed.

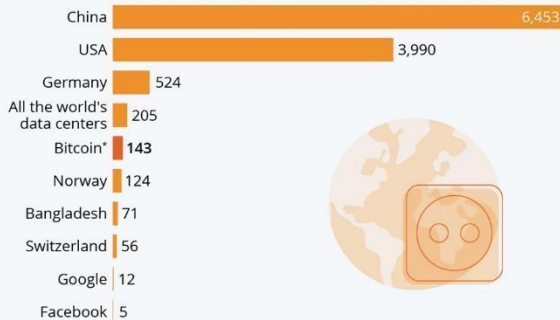
And that question, do we need the new thing, or do we just need the thing... Imagine clothing if it came in enormous fleet libraries in the cities. "There are 13,800 pieces of clothing in your size available today, tomorrow it will be a different selection because some things would have been sold into the pool, and some things would have been bought out of the pool." A constantly-shifting panoply of things which fit you perfectly, because we've got digital sizing, and you could wear them anytime you like," and that as a model... More consumer choice, lower environmental footprint. When was the last time you heard about a thing which was going to increase your quality of life, and also dramatically cut your environmental footprint? It's not a common model. I got very excited when we figured this out, let me tell you, it made my little energy policy heart jump!

Using the blockchain – the right way



Bitcoin - the new “coal”

Annual energy consumption (TWh)



* Bitcoin figure as of May 05, 2021. Country values are from 2019.
Sources: Cambridge Centre for Alternative Finance, Visual Capitalist



AVALANCHE

- ✓ Open, programmable smart contracts platform for decentralized applications.
- ✓ Fast
- ✓ High throughput
- ✓ Interoperable with other blockchains
- ✓ Proof-of-stake
- ✓ Low energy consumption
- ✓ Fully-offset



Then we get to the hows, now we're going to do the gory technical bit. Using the blockchain the right way: we took last week the Avalanche blockchain, which is probably the fifth largest blockchain in the world, and we took it to net-zero. We talked to them about it, we told them that we needed it to do our circular economy thing, we couldn't do the circular economy thing on a blockchain that wasn't net-zero, and we basically were like "Please, please!" and they said, "Okay, fine. It's COP26, have your Christmas present early, we are now net-zero." And they did it, they bought the carbon offsets and, boom, they're now net-zero.

That gives us a blockchain, and the reason you want a blockchain for this is you want the data about the goods to last longer than the goods do. You want the data to be as permanent as possible, because the data is what gives the goods the value in the second-hand markets. No data, no second-hand sale, the thing becomes landfill, you take the environmental impact, everyone is miserable; you have to keep the data alive. If I have 300 bicycles made from some little bicycle startup which then folds out in year three, they made great bikes, they couldn't make a living doing it, the bikes are now second hand, all of the engineering data about the bikes is perfectly alive on the blockchain, even though the original manufacturer is gone. That's why we use a blockchain, one of the several reasons – publication of what something is, durable recordkeeping.

A secure, distributed, ownerless, permanent database

Four key data items that require immutable capture

Publication of
what
something is

Change of
ownership

Guarantee
payments

Dispute
resolution

Change of ownership: if we have kind of digital tags on these objects, and we have a partnership with a very nice digital tag company, then when the objects change hands, we always know who the owner is, and that really helps figure out whose property is what, if you're turning these over at a very, very accelerated rate.

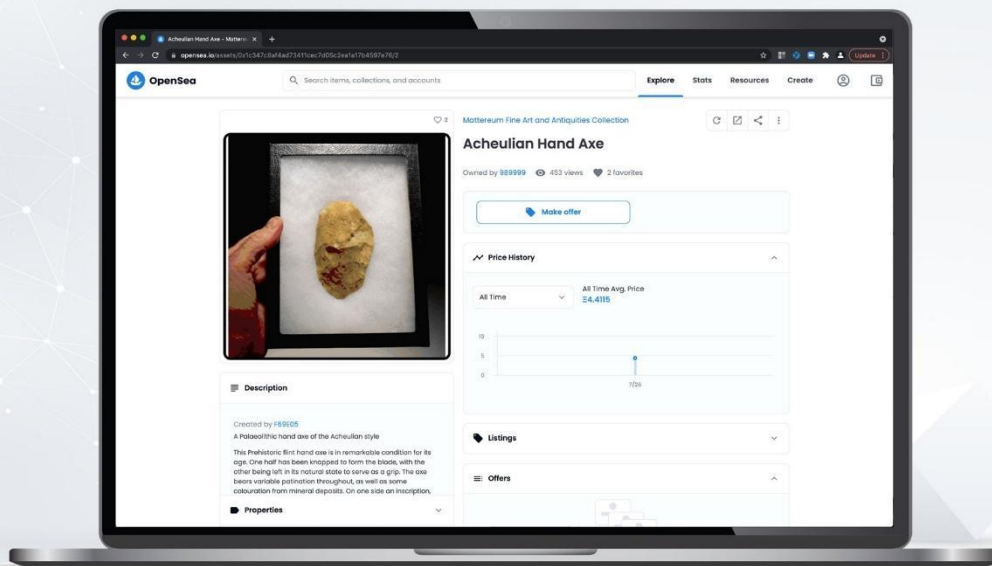
Guaranteed payments: again, all of these systems where you have a third party in the trust community who is adding value to the object by telling you about it and giving you its attributes, they have to be paid, and they have to guaranteeably be paid, because the legal warranty that they're selling is not going to kick into place until the payment has gone to them and it's guaranteed. So because we've got these very, very hard records of ownership, that allows us to make sure that we have constant legal coverage for the information about the objects. It protects us from errors where somebody has credit card chargeback happen because they made a payment that didn't work, then they lost their warranty on the deal, then the goods went through the process and they bought something that they had no insurance on. Permanent payment is really important.

Finally, dispute resolution: all of the facts about all of these transactions are stored on-chain, and the result of that is that the system is constantly prepared for litigation. You do a transaction, something goes wrong, you make the claim on the warranty, if there is a dispute with the person offering the warranty you can immediately go in and figure that out – it's a very, very powerful mechanism.

Working with Mattereum

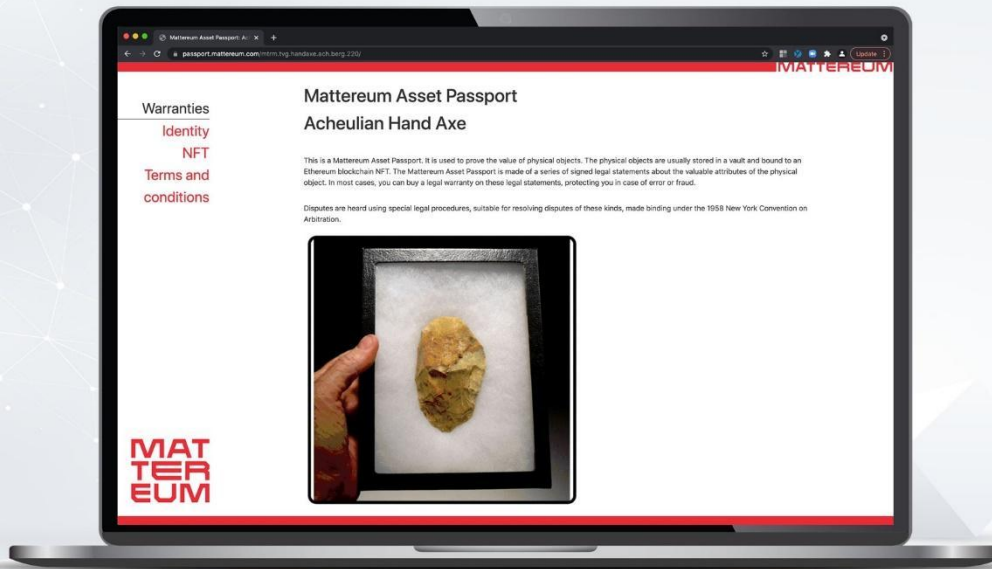
How we can engage

Live platform today with POC items



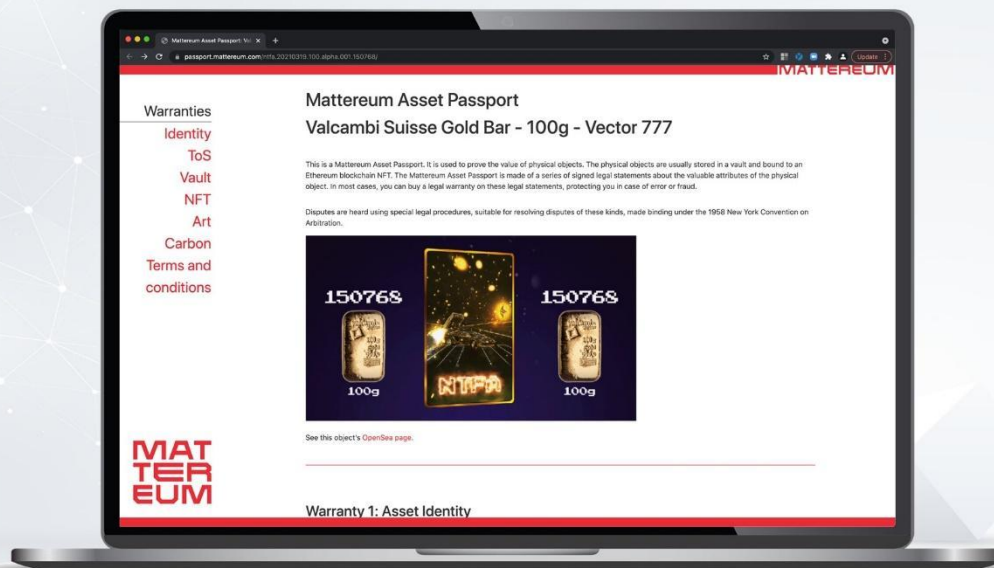
The final part is how do we get involved. The platform is live today. We built the first version of the platform for handling appreciating assets: antiquities, fine art, collectibles, gold bullion, we're doing gold bullion... It's a weird story, but we're doing carbon offsets for the mining of the gold, so you buy the gold as an NFT, it comes with carbon offsets – very clean system.

Corresponding Mattereum asset passport



It's up and running right now, it uses the OpenSea system, which is the absolutely standard way of buying and selling NFTs. We also just took it on to a platform called Polygon, previously called Matic, so we're now able to issue these things on an L2 solution which has low transaction costs, low carbon emissions. The version which is running on Avalanche I think is probably three months out, might be less – yeah, that's a long story!

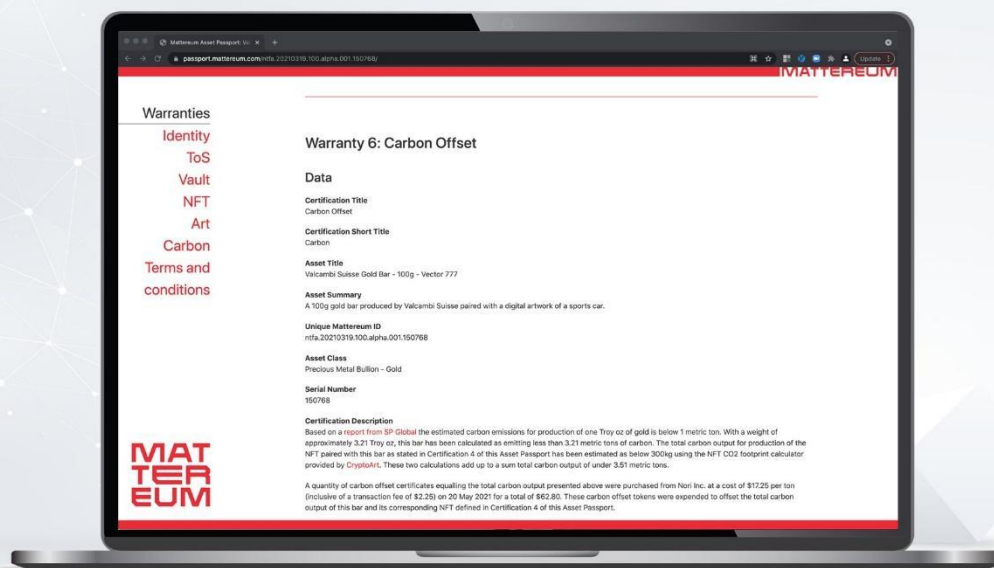
Carbon offset capture



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The asset passport itself is a series of legal warranties committed by different people. That's the trust community structure, it's called an asset passport, each page of the asset passport has a different set of information guaranteed by a different party... I just mentioned the gold with the carbon offsets, we covered that...

Carbon offset capture



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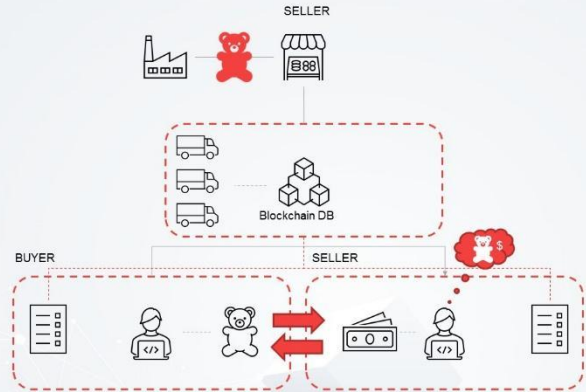
A new commerce model for manufacturers to work with

amazon - the next "coal"



A model that is fundamentally incompatible with a sustainable future

MATTEREUM



Mattereum knows customers' inventories and needs

- Drive redistribution and inform what should be manufactured
- Improving vendor profitability and reduce the world's waste

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And basically, what happens if you run this kind of circular economy is that the take-make-waste economy begins to look like the oil or the coal economy. It's just another outmoded artefact of fossil-fuelled capitalism, where we ran the economy basically straight from the oil well or the coal mine right into the garbage. And in that context, you don't really want something like Amazon, which is a one-way economy that basically has just accelerated take-make-waste; what you want is a system in which there is a genuine ability to get the goods around this circular economy.

Mattereum's ambition is to become the world leader in the net zero transition of our customers.

Partner with us.



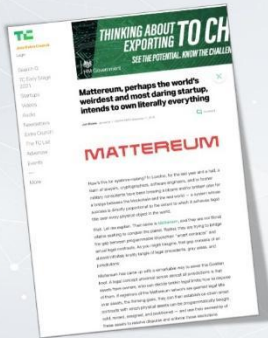
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Mattereum is generating significant momentum

TC TechCrunch

coindesk

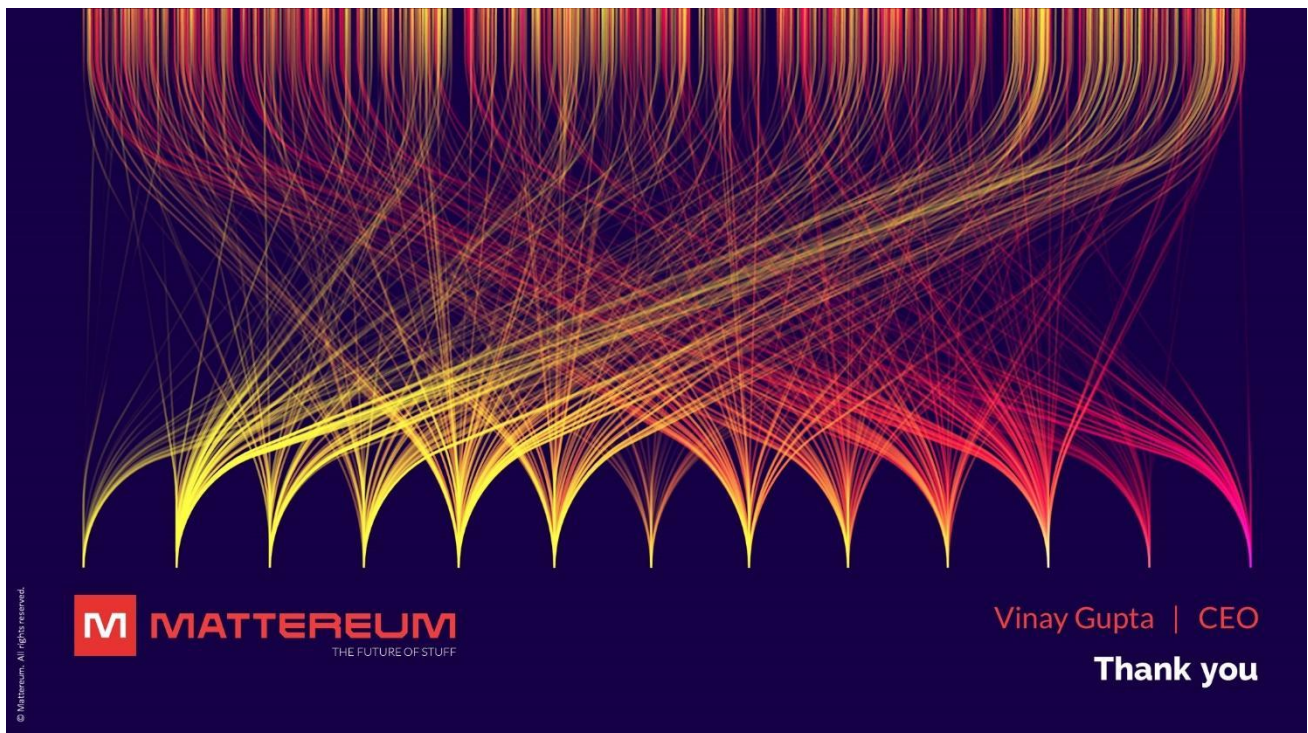
Forbes



The grand vision of Mattereum | Interview with Vinay Gupta | William Shatner interview | Whitepaper

More on our Vision





So, that's it, there you are – that's how the world could work. [applause]

And the reason that we're doing it this way is that I spent 20 years banging my head against policy, when I was working in energy policy think-tanks and defence security and resilience contexts, and I just could not find any way of getting government to change [~5]. 10 years ago I was a mask activist: we had H5N1, it was the flu pandemic, it was extremely scary, and I spent a lot of time banging my head on government's door, saying, "Could we not get things like a national reserve for masks done?" ~I had a site called Flu Code~, which was all about "Wear masks, masks are super important!" 10 years later the pandemic arrives... The masks that you're wearing are the masks which are really, really, really well scientifically tested to prevent airborne infection spreading, they have really good data to back them up! The cloth masks that we used to wear during the pandemic? Not such great data, really not so effective!

So, this notion that market activism works, if you want to solve the problem you can do it commercially, but you have to turn up and you have to get involved and you have to raise capital [~4] capital and you have to build systems... I'm trying that because I kind of lost faith in the other approach. So I'm kind of looking forward to our discussions, because, like, I have opinions – and on that note I will stop!

Anton: Thank you Vinay. [applause]

Our next panellist is one of my oldest friends, I am very happy that he's joined us here today. I've known him for I think about 25 years, which is a terrifying thought! Katie was saying to me earlier, our team member Katie, that this is the ultimate

version of a circular economy, how sort of our relationship and our friendship has come full circle! James Golding is Technical Director at Epic Games, which is a very large technology company; whilst Mattereum is a startup, the company that James works for is very big. And James, even though he represents one particular segment of the technology industry, I think he's going to share some thoughts with us about how tech can drive climate action.

James: Thank you very much, Anton. Just a few thoughts today around technology, and obviously technology is a huge, broad topic. I'm not someone who knows about inventing new kinds of concrete and steel, or capturing carbon, but what we do at Epic is build virtual worlds, called real-time 3D worlds, based on data, based on all kinds of things, based on creativity, and I feel that there's lots of opportunity there to couple that with climate change, which is obviously a very real-world problem. But, like Vinay was talking about, there's amazing things you can do when you couple the real world and the digital world. You can just look at recent headlines around some US companies, and what they're thinking around the metaverse – and that's the last time I'll use that word today – but it certainly shows that there's a lot of interest in this real-time, 3D world.

I think in terms of technology and politics and diplomacy... Politics is not something that a lot of tech companies spend a lot of time necessarily thinking about, but it's very interesting... Bill Gates' book that came out earlier in the year, his sort of conclusion there is that technology does need to be more involved in politics, and I think that the root to solving these major problems around climate change is going to be a collaboration between the technology and the diplomacy and the politics that go on.

I think it's much easier to put policies in place when people are willing to do those things. Phasing out petrol cars in favour of electric cars is much easier when people want to buy an electric car; whatever you may think about companies like Tesla, I think they've done an amazing job in making that desirable. And there's lots of other areas that we can imagine... What's going to be the Tesla for heat pumps, that gets people really excited about changing their heating technology? That seems like a major challenge there.

So, I think that sort of combination of push and pull is going to be very important in making these big changes, and I do think that technology, particularly the sort of technology that I work in, has a role to play there in engaging the public, and getting people excited. And building optimism, I think that's a real area that technology can take a role in.

I think as well, if you look at technology like this, it's about virtual worlds, it's about artificial versions of the real world, but just because they're artificial doesn't mean they don't have value to a lot of people. I think you can certainly see the trajectory of the last few years is that people's virtual goods are increasing in value, and a lot of the things that people spending money on now are virtual: whether that's outfits in a

game, and that's one of the things that we do, to other things that they're buying online that have value.

There's a few examples I want to talk about briefly today. There's a very popular TV programme called *The Mandalorian* that came out on Disney+, and the backdrop for that are not largely physical sets but they're virtual sets. They're built in *Unreal Engine*, which is our product for building real-time 3D environments, and it's allowed them, through virtual production, to film on a set, with all the sort of control that you normally get but can change it very quickly – the director can see the background, the actor can see the background – you don't have to go to as many sites. This is the kind of thing which allows the production of things like TV shows and films to be done much more rapidly, with much less international travel, with other benefits, like being able to take those assets and potentially put them into other sorts of experiences for people.

We can also look at virtual events. With the Covid pandemic, of course there's a lot of interest in different ways that we can get together, different ways to meet; maybe there's something better than just Zoom calls. There's lots of companies working with Unreal and other engines, trying to build these sorts of 3D interactive experiences. Can we do better than just a big room full of stands when it comes to explaining some new concept or some new technology? I think that's a really exciting place that we might go.

Even things like cars. Obviously racing cars around a track is an exciting thing to do, but it's been interesting to see the explosion of simulated racing that a lot of people got into over the pandemic. As we start to phase out fossil fuel cars, you can see a surge in interest in virtual racing, even Formula One has an esports event that runs alongside it. Again you can see these parallels between the real world and transitioning over to the virtual world, where these things have value, have interest, people are really engaged, with a much smaller footprint.

One area that I've learnt a bit about recently that's very interesting is virtual fashion. Fashion is a really important industry, but it can also be a very wasteful industry, and the circular economy is massively important there. Vinay just spoke about that, this idea that you can circle things around, and I think there's two areas that this sort of 3D technology can play a part. One is in facilitating that circularity of real-world objects, when you can see what something looks like on you before you buy it, when you can make sure you're buying just the thing you want, these things have a massive impact on the way that that market works. But also entirely digital clothes: there's a number of companies now that are just digital-only fashion houses. If you want to wear a different outfit on a Zoom call every day, rather than having to physically buy one, wear one, and maybe pass it on, even if you've got something very clever like Mattereum to do it, but there's now technology available that would let you real-time apply clothes to you on a call. And so if you're an influencer, if you're making a statement, if you have an important call to do, you can buy a digital piece of

clothing and apply it to you. Again, these things seem very interesting directions that we can go with this sort of technology.

And then also the way that these sorts of digital and virtual worlds can overlap with the real world. There's this concept of a digital twin, which I know Vinay has some hesitation about, but I think it is a very interesting direction that we can explore. Buckminster Fuller had this idea of the *Geoscope*, this huge, 200-foot dome that was going to project information so that we could all understand the state of the world and make decisions. And at the end of the day, that's what a lot is going on in Glasgow right now is about. And so I do feel like there's an opportunity here for engines like Unreal, these 3D game engines, to take all this different information, to present it in a way that is accessible to a broad audience, and also to allow people to collaborate when they make decisions with the most up-to-date information.

There's a really interesting project in Wellington, in New Zealand, where they've taken all the data around the city from lots of different sources, they've combined it together into a digital twin of the city, which is accessible to all of the citizens, so now they can go on there, they can see the state the city is in, they can see potential planning changing the city, and so now they're having an informed conversation. It's much more interesting than trying to go to a planning office, or find a PDF online that explains in very technical jargon; now I can walk around that new station before it gets built, we're informed citizens. And with the nature of the way the world is going to have to change in the next 10 years to hit these net-zero targets, people have to be on board, we have to engage people and get them excited and knowledgeable about what's going to happen.

I also think education is another area, sort of following the same idea of engagement. We've told stories as a way of educating for as long as people have been around, whether it's around health or around religion, lots of different topics. Storytelling is just part of who we are, and a lot of stories these days are told on digital platforms, they're told as a group, together. And so I think empowering people to tell stories, and to teach people in that way, through these platforms, feels like a very natural extension of the way we've done things for a long time. And I think making those platforms more accessible to lots of different people, it feels like there will be a very powerful opportunity there.

I've been speaking recently to some people at the University of Washington in America, they run a course on green games and also poop games, which is to teach around sanitation in third-world countries, they have a class that builds games around these concepts. And I was asking them "When you're doing these green games, is it around awareness for these young people?" and they said, "It's not so much awareness for them. But for an older generation that's part of the idea. But for them, it's about empowerment, it's giving them the feeling that this isn't just a foregone conclusion, that they have agency in these situations, and that they can derive their own solutions to these problems," and I think again that's a really important consideration.

Also, things like games access a very broad audience of the population. There's a recent report by the OKA charity in the UK talking about games as an opportunity to reach underrepresented parts of the population that other means of medium might not get into. People are maybe spending more time playing something like Fortnite or Minecraft than they are watching the news.

We can also talk about education not just for people but for systems. We talked earlier on about machine learning, and how this might allow us to solve some of these problems. We're already using real-time 3D to train things like self-driving cars, or environmental monitoring, so that we can get very up-to-date information by using synthetic data to train these models, which allows us to understand the world that we're in all the more efficiently, using some of these mechanisms.

I think as we learn more and more, and specialisms get narrower and narrower, the final thing that I'm really excited about is that these virtual platforms, these digital representations of the real world allow us to collaborate more efficiently. Rather than just having people who are an absolute expert in just one field, maybe we can start to learn a little bit more broadly, and have that sort of autodidactic thing that Buckminster Fuller was so keen on, where we can all learn a little bit more about other fields, and look for opportunities where different fields come together, to solve some of these pressing problems. Because we're running out of time, and so anything we can do I'd like to think would be a big benefit there.

I'm going to stop there. We've had a lot of really good ideas today, and it's just been very interesting to hear everything that's been said, and I look forward to maybe some more questions later on – thank you so much! [applause]

Anton: Thank you James, that was wonderful and informative and engaging.

Vinay: Yeah, that was great – thank you!

Anton: And I hope there will be plenty of questions for everybody later on. We've got two more speakers, and right now I'm very happy to introduce Dr Martin Bartos, a Glasgow City Councillor, who is a very senior and very experienced local politician, to talk about what local political action can achieve.

Martin: Thank you very much indeed, Anton. I was planning to just sit so that we can all have a relaxed conversation, if that's okay with everybody.

What can local politics achieve? Well, at this point there's a real risk that I slip into quite a cynical pathway... But what I think I might want to talk to you a little bit about is kind of why we're here. First of all, thank you very much all for coming to Glasgow, I hope that the city is treating you well, and let me welcome you on behalf of the city.

We're all here clearly because we're concerned about the way the world is, and what faces us in terms of trying to fashion some kind of future, and trying to get us through this climate emergency, this climate crisis. I suppose the panel discussion theme is really around these different, parallel options of politics, technology, diplomacy, how these different things might deliver a better world for us. And as Anton was saying, politics is, in the end, frequently local, or principally local, and it's about achieving things. But I have to say, with COP, and looking back at 20 years of involvement in green ecological politics, and the traction it has, or rather hasn't had... It's not an entirely optimistic setting, frankly. We have to admit that the phrase which has had the most traction in the last week or two has been three words, or rather one word repeated three times: bla-bla-bla. And the reality is that one of the problems in politics at the moment is that there's a lot of talk, without much clarity and without much certainty of what is going to achieve action.

I suppose that opens up this kind of wider question, which is how do we achieve some kind of successful action on climate emergency. I appreciate we've had some very information-rich discussions so far: amazing stuff from Professor Mainelli, in terms of the financial constructions which might be able to help shift the world; amazing stuff from my old friend Vinay Gupta, in terms of completely reengineering and rethinking how the life of objects can change, and how we can magically change information into things of value; and then from James, in terms of the value of information itself, and the way that actually experience may well become valuable, and may well allow us to shift in terms of what people's lives are like and where people gather value experientially into things which are lower-carbon because they're virtual.

What I'd like to do is maybe suggest to you a way of thinking about how we engineer or how we solve an emergency. As Anton mentioned, I'm a doctor by professional training, as well as being a politician for some 20 years, and that set me thinking. Because in medicine we're concerned about what actually delivers, what actually gives a result for the patient. Not necessarily always what the patient wants or kind of might think they want, so much as what actually helps keep them alive. And that left me wondering, how do you deal with climate emergency? You know, if you've got a heart attack, there's a clear list; if you've got a fire, there's a clear list, quite high up there on the list is call somebody to help you. If we've got a global climate crisis or any global emergency, who are you going to call?

So, that left me wondering: how do we address any emergency? And let me give you something to take away with you, a quick recipe for how you deal with any emergency, and then we can think about whether or not politics or tech or diplomacy are going to work. So, here's a quick way of dealing with any emergency you like, it's basically four steps with a fifth wrapper. The first thing is you need to determine that you've got an emergency, not just spot there's a bad thing happening but you need to make a determination in your mind "There is an emergency! I'm in a building, and it's on fire! This isn't just bad; this is something I need to determine to do something about." So the first step in dealing with any emergency is determination to act.

Then afterwards, it kind of seems obvious, but you need to have options for meaningful action, and inputs into the meaningful action; you need to have things that you can choose to do, as well as the resources to do it. And that means plans, clever ideas which might help put out the fire, or might help give you breathable atmosphere, or might get you somewhere else – options for meaningful action. But it also requires inputs: people, resources, money, skills. You will need all of these things to get through your emergency, whatever that emergency is. And then the fourth thing you need is you need timely, effective action. So if you worked out what you could do, if you've found the means with which to do it, then you need to do it, you need to do it on time, effectively.

So, those are the kind of four key elements: determine to act, options for meaningful action, inputs for meaningful action, and timely, effective action. And then the wrapper which wraps around the whole of that is positive culture. Now, where did I come to this? This came from actually what happens in an emergency room, or in an A&E department in this country we call them, there there's no uncertainty: the patient comes in, you determine there's an emergency, you have options, very clear options for action, you have inputs, you have the staff, you have the medicines, you have the resources, and you do timely, effective action. That's how you get through it, and everybody is positively, collectively aligned around the interests of the patient, you have positive culture, and that gets you through it, and that gets you good results.

If that's the way in which we fix any emergency, how are we doing with global climate and ecological emergency? Have we got determination to act? It's maybe coming, with some people more than others, with some societies more than others, with some companies more than others, with some politicians more than others, with some governments more than others. That's actually the key area where the likes of Extinction Rebellion make a big difference, and where activism, it's about trying to persuade the determination to act. But on its own it won't work. Because you can decide that a patient is sick enough to require resuscitation, but if you haven't worked out how to resuscitate them, if you don't have the tools to resuscitate them, if you don't take actions soon enough to resuscitate them, it doesn't matter if you go shouting into the A&E department, that patient will die; you need those other elements. So, determination? We may be getting there.

Options for action? This is where I'm worried. Options for measurable, meaningful action. How good are we at knowing what will make a difference? How good are we at knowing what the carbon footprints are of anything in the manufactured system? Oh, governments will give you some statistical analyses... Look deep: they're not reliable. So, options for meaningful action? How well are we doing?

And then inputs, how efficient are we at using the carbon budget, which is finite, before we need to get to net zero? Are we all aware of our carbon budgets? And we've heard today already about things which may help reduce carbon budgets. Going more virtual may well help reduce carbon. Let's face it, virtual F1 racing is

going to be a hell of a lot smaller footprint than real F1 racing. But more importantly, circularity in our economy: if we reduce the footprint of what we're making, because we're not making as much because we're using stuff longer, that's going to have a profound, profound effect.

So, options? Maybe. Inputs... Are we tracking it? Timely, effective action. Are we seeing governments doing that? And positive culture, are we all on the same page? Like in that emergency room, are we all getting everything done together, because we realise that fixing the planet's problems is vital for all of our futures? I don't know, I don't know. Are politicians doing a good enough job? We probably need everybody pulling together. We need the politics to smooth away. We need the engineering, because without the engineering nothing will happen. We need the inputs, which is also politics. We need timely, effective action... I'm not sure if that is the politics or not, because I'm not sure if government is capable of doing it quickly enough. But one way or another, we need to have some hope, because we need to get it done. So we need to collectively get that positive culture. And maybe that's something that we achieve a bit with diplomacy? I don't know. Maybe that's the point at which I stop and leave you with that thought. Thank you. [applause]

Anton: Thank you so much Dr Bartos, that was extremely motivational, and very analytical and very robust – thank you. Our concluding speaker today, we're very glad to have her with us in Glasgow, is Barbara Dietrich. She is the COO and Editor in Chief of the hugely respected publication Diplomatic World. Barbara knows a lot about diplomacy, because she spends a lot of time with very senior world leaders, as well as officials, civil servants, diplomats, and she really understands how those relationships work, and I guess how they don't work. So, Barbara, please tell us about the role diplomacy can have in solving the climate crisis.

Barbara: Thank you so much that we are here together. I'm very happy with what I have heard here, and I am 100% with you. What we need is we must rethink diplomacy, we must rethink the political thinking. I think that after the time of diplomacy, cultural diplomacy, diplomatic economy, we need climate change diplomacy, that we must change in the time of mental health problems and fragility of all people, we must change our thinking in diplomacy. We must look to the people, we must look who we can change, and that we must begin working very seriously. What I loved hearing is that we need hope, and we must create hope ~always over trust~. In coming here, I see so many young people on the street, and young people have no hope, people ask us so many questions, and we have no answers. And I think that diplomacy, climate change diplomacy must explain, must help, and must be very busy with change and to inform, and make no alone decision on highest level, but that diplomacy must be for all people, to make this understandable, and this is very, very important.

We meet here so many people, we see people from ~the Maldives~, from Uzbekistan... I was in Uzbekistan, and I stood on the ground of the Aral Sea, and I saw what has happened here. For 60 years, the Aral Sea was a wonderful sea, and at the moment it is only 10% of what it was. And I stood the ground, I stood ~out

under the sun, and I could not~ understand how this could happen. People talk about climate change, but no. What has happened? Some countries built dams, some countries built canals – we made this. And what happened was that the leftover, exposed salt is carried around by the wind, in all the places in the world, and Uzbekistan has problems that people cannot plant because everything dies because of the salt. We need to take action on this issue.

In the past, people made some program with the United Nations, and people planted trees, but in one moment this stopped. But this small tree needs no water, the water comes from the air, ~and this small tree can~ stop this, and all the salt stay on the ground, and we must continue this. I think we must call the people of world to go to the Aral Sea, and plant trees for maybe two or three weeks. We need this, we need some action, and we must help these countries. ~The Maldives need help, the Seychelles need help~... We must think of the people. We have so many plans, but are we doing, really? We must help, and we must bring hope, we must understand, and speak with all the leaders in another way, and talk about what we need. And we must go to these places and understand this, and not in the intellectual, academic way of “Yes, we know this,” but going to the place, spend time, be with the people, to understand what the world needs, if we are really, really interested. And I think, yes, we need climate change diplomacy. We must rethink diplomacy, we must rethink politics, and we ~soft diplomacy is a way~ to make some changes – thank you. [applause]

Anton: Thank you very much, Barbara. We have about 30 minutes for questions. I think all of the presentations that we heard today have thrown up a lot of questions. Who would like to start? Please also say who you are and where you're from. Who would like to start?

~Ryan~: Hi there, my name is ~Ryan~ [~2]. My question is directed at James. Obviously over the past 18 months there's been a lot of discussion about how much of our life is digital and virtual, and concerns around that. I'm wondering what are your concerns for life becoming more virtual, particularly for our interpersonal relationships, and also for our relationship to nature?

James: I think that's a totally fair question. I do share those concerns, it's something that I think you can only... Having been cooped up indoors, I think a lot of us during the pandemic, or staying in one place, I've certainly appreciated... I've been very lucky that I can walk to some green space from where I live, and that's been hugely important and valuable.

I think it's really about finding the places where it makes most sense, and using it there. The opportunity to maybe collaborate with people without having to fly across the Atlantic for a meeting, that seems like a great opportunity where using a virtual approach is very important. Or not having to create 25 clay versions of a car, but being able to use virtual tools to develop that more quickly and more cleanly, that seems like a really great opportunity.

You're right, I think these experiences of purely virtual completely supplanting physical ones... Yeah, I certainly have concerns around that. But I also think you can see how quickly people came back from the pandemic, where things had been more virtual, and how important physical interactions were. So I don't think that's going away, I think that's pretty hardwired. I think it'll really be about finding... You know, just like we use concrete and steel, because one is great under compression and one under tension, and we've developed architecture to take advantage of those pieces, and we can sort of reduce the overhead by using the things for what they're best at. I think the physical world and the virtual world have their strengths and weaknesses, and we'll build a society that takes advantage of the strengths and weaknesses, and overall reduces the costs, because we're using things in the best ways. That's my hope anyway – I'm optimistic.

Question: Vinay, I really love the chart where you had the Amazon against Mattereum concept. Doesn't that scare the crap out of Jeff Bezos, and won't he fight these alternative business models?

Vinay: The only way to fight that business model is to adopt it. And if our role in the economy is that we are a kind of medium-sized enterprise, 500 employees, and everyone else has to basically copy our approach, otherwise we eat them alive... We'll do fine, and the world will change very, very quickly. I mean, businesses can have enormous catalytical effects by spurring the incumbents into transformation, and those companies are often extremely successful, they wind up with a market cap of a few billion dollars, and then the world changes around them and everybody adopts their innovation. That's one of the possible outcomes for Mattereum; although, frankly, you ought to see what we have coming up after this! [laughs] This is the beginning of the story: three or four years from now, the things that we'll be talking about will assume this kind of circularity as a building block, and by then I will be able to tell you my secret masterplan.

Because these things are all components. The housing system that I designed is a component, the critical infrastructure mapping tools that I designed are a component, the physical asset handling is a component, the governance work that I'm doing is a component, the identity work is a component. And what happens when you put all these things together, with the other things that I don't yet talk about, is we get the ability to do scalable life support for hundreds of millions of people, on practically no money and practically no environmental footprint.

So, if we spur a bunch of competitors and a bunch of people who copy our ideas, it would be fantastic to see this kind of circularity become standards based and global. But I have no fear for the company, because once we have this running there is more.

Kiran: Hello, I'm Kiran, I'm from the south of India, and my question is towards Vinay. I would like to know, having physical products registered in blockchain, does it have

legal right of ownership for the person who is owning it, and is it valued in all of the countries around the world. Or is such a law on the horizon?

Vinay: Anton, that's kind of your department. Do you want to talk about that?

Anton: Sure. So, a very important component of the Mattereum system is enforceability of legal ownership, and enforceability of the warranties, the information which is provided about the object, and recourse, if that information is proved wrong. So the system must be enforceable, it must be robust. To that end, the ultimate conclusion of a dispute must be arbitration, it must have a very strong arbitration component.

We worked very hard to codify a system which would be effective, and one of the great tools afforded to our community is the new UK Jurisdiction Taskforce Rules on Digital Dispute Resolution, which essentially enable legally-binding decisions by arbitrators around disputes, and their ability to make awards to the party in whose favour they find.

Another very important piece of international law is the New York Convention on International Arbitral Awards, which most countries are signatory to, 160 jurisdictions are signatory to that, which makes awards. If there's a dispute between a party in say in France and a party in Mexico, it means that both of those countries are signatories to that Convention, the award is equally recognised.

Another important thing to note is when you have a system which records information so precisely and so fully, and records the transactional facts, the transactional relationships, that really helps arbitrators. Because much of an arbitrator's job at the moment is determining the facts. And if the facts are recorded, and they are recorded in an immutable way, then the arbitrator's role becomes more about determining in whose favour they should find, rather than spending a long time finding those facts.

I hope that answers your question. Vinay, do you have anything to add?

Vinay: No, that's a very comprehensive answer. I mean, the bedrock for all of this is contract law. Contracts plus very good evidence, it provides a tight framework which will be recognised almost anywhere. We put many years of work into making sure that the laws would fit cleanly inside of categories like international arbitration, to get this kind of international enforceability. That said, it's a very different situation if you're dealing with for example clothing or furniture than if you're dealing with real estate or jet engines or these kind of things. So there are definitely some questions of scale – small things, medium things, large things, different ways of handling disputes – but it all roots in contract law.

Anton: If I may ask the panel a question, something which Barbara said struck me: the Aral Sea is a terrible, entirely human-made natural disaster, and I think Barbara said people should see the Aral Sea, to understand the harm that is being done to the environment, but of course we can't all travel to see the Aral Sea. Martin also talked

about being able to make the determination, and James talked about education. I guess my question is how can we enable people to make that determination, if we can't all visit the Aral Sea, which would be a very heartbreaking sight for all of us? Barbara, would you like to go first?

Barbara: I think we must rethink the media too, that not everyone must travel to the Aral Sea. We can make some projects, we scan what is nice that informs people, educate people, train people to learn things and open their eyes I think is interesting too. And we can act with political parties from all the world to understand this, that we not just think in small departments, but that we think really worldwide, and if something happens in small village, this has impact all over the world. I think we must change our thinking, and we must rethink the role of media too, and we must stop with fake news, and we must bring really correct, informed news that are valuable, and this is I think the way too.

Anton: Thank you. Vinay, you've spent two decades or more trying to get people to come to the realisation that we are in trouble. What else can we do? Is it about the best way of delivering and codifying and recording information, or is there more to it?

Vinay: I think it's a series of funerals. I think what's happening is that the politicians and the kind of power holders who were not raised with climate change as a reality are gradually ageing out. If you think about the kind of oil politics in America, we're on the last handful of oil politics people, we're almost out of classical era Cold War heirs. The folks whose consciousnesses were shaped by the discovery of the nuclear bomb, and then the rapid assembling of massive arsenals and mutual assured destruction, those people had a kind of posttraumatic stress disorder, because it was they were the first generations of humans to be responsible for managing their own apocalypse. You know, that old line from Oppenheimer "I am become Death, the destroyer of worlds," the generation of political leaders that had that as their lived experience were not really able to do anything about climate change. The scientific data wasn't strong enough, but also they'd kind of had their crisis, and if it wasn't thermonuclear war, then they were finding it quite hard to care about.

So I think that as those generations age out, what we're getting are people that are in power now have... Climate change has been real for their entire life, at least their entire adult life. The next generation of political leaders, climate change will have been real from the age that they were very small children, and they will find it much easier to act. When Greta Thunberg becomes the elected prime minister of, I don't know, let's say half of Europe, you could very easily imagine that you will get radical climate transformation, because the population that elects her, for four or five countries simultaneously, will wind up having the popular support to push the agenda, which will bring their economies in line with reality.

Anton: Thank you. Martin, you talked about determination, making the determination, and you said that we are partially there.

Martin: Yeah – unfortunately, we’re also partially not. So, that kind of do-it-plus framework that I sketched out for you all is actually something that you can apply at different scales: you can apply it to an individual, you can apply it to a community, a household, a company, a state, a region, however you want to do it. And you can have degrees: you can be a bit more determined, or you can try and get a sense how determined is this city, how determined is this room to act.

I suppose, Anton, the starting point of this was Barbara’s observation to do with the Aral Sea, and the determination to act. We can all get overwhelmed with how big a problem there is, and we can lose sight of our ability to have traction on a problem, and one way of addressing that is to reframe what part of the problem you’re dealing with. I don’t think that we need to determine, each of us individually, to reform governance structures, that might be a little bit difficult to start with. What we might do though is to determine that there is an emergency that I need to act upon, and for me to then think about what are the options for meaningful and measurable action that I can do, and what are the inputs that I can bring to bear, and what constitutes timely, effective action for me? And then as you build the capacity and do more, you think about what you can do collectively with others, and how you can help collectively for there to be determination, and collectively for options which are meaningful, and inputs and so forth.

And so I think for me, the Aral Sea isn’t a problem that I’m going to focus on. And that’s okay, if I’m helping the possibility that people will focus on it, and I’m helping drive forwards a determination for people collectively to be going “What the hell are the options which are meaningful for us to do?” and that I’m helping drive forwards that people are going to provide those inputs of money, skills, and using the precious resource of our time to get stuff done, and that I’m going to help drive forwards timely, effective action, and actually be part of a positive culture.

So, I think that all of us in this room, both individually and with all of the organisations that we touch on and all of the groups that we touch on, can do this. We can improve our determination, improve our options, find the inputs, and take action, and that’s my suggestion. And my challenge to each and every one of you is you take the do-it-plus idea, think about it, talk to somebody about it, and work out “How do we make that happen more?”.

Anton: Thank you Martin. James, the technology that you talked about, could it show people the horrors of the Aral Sea as it is now? Would people really respond to it in a visceral way?

James: I think that’s a great question, and some great answers. Roger Ebert said that movies were a machine for generating empathy, and I think that interactive experiences can be that even more so, but I think there’s some really important things there. One is we’ve got to make sure that those tools are accessible to everyone, and that’s certainly not the case today, but I look forward to a future where that is the case, and I think people are figuring out both the hardware and the software aspects of that, so I

do hope that that will change. And then we also need to find a way... You know, it's one thing to have those resources available, I'm sure there's videos on YouTube that will document this, but getting people to actually engage with it and take notice of it is a huge challenge.

I think that thinking about how we decentralise some of these platforms of discovery to discover this content, and not make it just the algorithm that is choosing what people see, I think that's a really big challenge, and I don't have a solution to that. I think that's going to be one of the defining challenges of developing these sort of online platforms, is what parts are centralised and which parts are decentralised, and I think representative voices from all different parts of the world is going to be a really important aspect to that. I wish I had more answers.

Anton: Thank you, James. There was a question from a gentleman at the front there.

Question: I have a question for Vinay. I'm from Aspen, Colorado, I represent the Global Warming Mitigation Project. I was an intern at the Rocky Mountain Institute... I was just trying to think of the numbers, I believe it was 37 years ago, believe it or not, and that's where I learned about climate change, from Amory Lovins and Hunter Lovins, and I couldn't help but notice that the Rocky Mountain Institute was on your resume there, where you've worked. I was wondering if you wouldn't mind speaking briefly about your experience there.

Vinay: Sure – oh, that's a crazy story! The trouble really starts on the Farm: Stephen Gaskin, Tennessee, big farm, biggest of the hippie communes in the 1960s, I think they got started in maybe the early '70s, they went out in a couple of hundred school buses from San Francisco, trying to find a new place to live, because they thought that Haight-Ashbury was destroying itself – heroin had arrived.

So, I was super interested in the 60s when I came to America, I went to the Farm as soon as I could, got there, and a fellow by the name of Albert Bates, who runs a thing called ~World Watch Institute~, completely destroyed my life in a weekend. "Question one: can you figure out how to make a geodesic dome with no waste? Because we're building the Buckminster Fuller designs, and they're hard to build," and that set the entire direction of my life in terms of refugee shelter and refugee management and all the rest of that. "And then the second thing, there's this thing called the environment, and we're kind of running out of it, and by the time you're grown up it's all going to be really screwed up. You should do something, if you can."

I kind of sat on that for about five or six years, and then 9/11 happened, and it was like a signal flare, it was just like "Oh, it's show time!" and through a series of unlikely coincidences, involving a Tibetan lama, and a book without an editor and an editor without a book, I wound up on the editorial team for *Small is Profitable* [3] and then *Winning the Oil Endgame* [4], and about midway through that somebody said, "Hey, could you figure out how to make a refugee shelter that could pack flat?" and I took that question home with me one day, and literally said to myself this engineer's

question of “What’s the simplest thing that could possibly work?” and 15 minutes later I had the first *hexayurt* drawn out on a piece of paper, made some little cardboard models of it, and I was like “Oh wow... Okay, there goes my future!” Because we figured out how to do geodesics with no waste. We currently have maybe 10,000 of those things being built a year for Burning Man, they’re being deployed for homeless people in America, there’s a variant called the shift pod, which is foldable and goes in the back of a trunk, they’ve got those things deployed in I want to say maybe Jordan... I think they’ve got quite a large ~refugee centre~ in Jordan... there are a few countries which are selling them.

The critical infrastructure mapping stuff that I did: RMI had this model which was the pipes-and-wires model, autonomous buildings, here are the pipes that come in, here are the wires... I spent five years trying to figure out why that model didn’t solve my problems, and eventually I decided that the answer was critical infrastructure is what keeps you alive, and then that became a new model, which was too hot, too cold, hunger, thirst, illness, injury, and a technique called simple critical infrastructure maps. [5] And I just have piles of this stuff, which is built very much on the Rocky Mountain Institute perspective, and that shaped the entire rest of my career.

I keep actually trying to repatriate a whole bunch of that knowledge base to Rocky Mountain Institute, like “Hey, do you want the refugee sheltering, do you want the critical infrastructure mapping? I got the circular economy too... Come on guys, let’s do this thing!” but it’s become so big and so confusing, and nobody really remembers the old days... I haven’t yet figured out how to have the conversation where I’m like “Look, this stuff is directly genealogically descended from this Buckminster Fuller, Amery Lovins, Bill Browning, who went off to do Terrapin Bright Green...” There’s this kind of education that I got when I was working at the Institute that’s resulted in these innovations, and the Institute is way more set up for scaling that innovation than I am, and I’m trying to repatriate this stuff over, like “Come on, take this and do something with it, guys!”

So yeah, it was hugely formative. I mean, RMI is like the finishing school for environmentalists in America: you go there, you work for three years, you burn out, you fall over, and then you go off and do something else, at least that’s how it was in my day. But yeah, it’s... There’s nowhere else like it on Earth, it really is like the Ark of the Covenant for the Buckminster Fuller transmission.

Anton: Thank you Vinay, that’s a fascinating history. Did I see a hand up there?

Question: Hi, thank you – I’m [~2] from [~3]. Thank you for the talk, I’m very glad that I’ve caught your tweet earlier today and decided to come along to hear you speak, and it was very interesting to hear about Mattereum. My question kind of relates to something that Anton said a little while ago about the element of recourse about the dispute resolution layer in Mattereum, and I noticed that you explained you were using the traditional legal system. I noticed in the slides that you kind of flashed through that you had a great emphasis on decentralisation and on DAOs, and I

wondered if you had plans to decentralise the dispute resolution layer as an eventual thing, or if you were going to try and rely on the traditional legal system, with all its capriciousness.

Vinay: Here we've got to be philosophical for a second. The question is what is property, and our answer to what is property when we're dealing with physical property is property is anything that the state will use violence to return to your ownership. And this is a very hardcore definition of property, it comes out of really fundamental libertarian and anarchist thinking, but if we define property as that which the state will use violence to return to you, that defines who owns what.

Our mission with Mattereum is to find a way of taking the digital reality of the blockchain and representing it to the state, in a way that will enable the state to take the status of the blockchain as being an accurate record of who owns what, and then it will use whatever violence is necessary to maintain those property rights. Now, to get there you need to use a lot of contract law, and you need to use very careful construction of things like the evidence base for arbitration to get rulings, to get solid rules. In that process, if we insert any elements that the state doesn't understand or doesn't trust, we lose the ability to control physical property, because the state will simply refuse to enforce, and then the system begins to fail.

So, what we refer to as the hard path or the unhappy path always uses constructs that the state is fully familiar with and fully recognises and fully understands: contract law, evidence, arbitration, digital signatures, all things that have enormous weights of law and prior experience behind them. That system... It's not that it isn't innovative, but it's a bunch of very, very standard components put together in a slightly unusual configuration. None of the actual components themselves are controversial, and the configuration took us several years to design, and an enormous amount of legal work.

On the other hand, if we have two parties that are in a dispute... I say, "Hey, you told me this clicker worked, and actually it's not compatible with Anton's rig and we have a problem," and I make a claim, and then you refuse to pay the claim... At that point, there is a persuasion period that comes before we get to the fully unhappy path, with arbitrators and state involvement and lawyers coming out of our ears. In that period, that's where the decentralised dispute resolution comes in. There are tools like ~Clearos~, where you have the potential for saying in the contracts, "At this point, before you get to the next step of arbitration, you have to mount a case using *this* decentralised dispute resolution forum," and at the end of that they will give you an opinion. If you agree with the opinion and settle, all good; if you don't agree with the opinion and you choose to contest, you now have to carry 70% rather than 50% of the resulting legal bills – these kind of mechanisms. That isn't exactly the mechanism we have written into the contracts, but that's for example.

That ability to use persuasion at the decentralised level to get people to settle the disputes without going all the way to arbitration is a critical part of the engineering that we're going to be doing over the next few years. To get that to work, we need a base

of experience with the disputes, we need enough volume of disputes, that we can start sort of saying, “Okay, for *these* disputes we tried *this* and that worked pretty well, but for the really high value disputes we really need a different thing because it’s causing a lot of friction, maybe we should try *this*.” So the process of kind of interactively designing those dispute resolution pathways, the hard path is not likely to change very much and we designed the hard path first. The soft paths that route around the hard path and persuade people to settle, that persuade people to be reasonable and get people to say, “Okay fine, you are right, I did make a mistake, I apologise, I will pay,” those kind of mechanisms, I think a lot of that will be quite decentralised.

Anton: It’s also very important to note that most civil justice systems have a strong preference for dispute resolution before a case comes to them, and they don’t look favourably on cases where that has not been attempted.

Moreover, certainly in democratic societies where citizens have recourse to the justice system, for civil disputes, the courts are choked up with high-volume, low-level disputes. As I mentioned previously, a large amount of the work that the arbitrator, that the decision-maker, magistrate, etc. does – depending on which system you’re in, what they’re called – is fact-finding. So if you can combine a very solid recording of undisputed facts, and the ability to resolve disputes before they enter that arena, you will get justice systems looking much more favourably on that kind of proposal.

Question: About the property rights, the example with the clicker: let’s say I had loads of different items of property that have contextual value for people. Can that then be used as collateral that then someone else gives you like a loan on or something later down the line?

Vinay: Yes – in a nutshell, yes. We think there’s a lot of room for preselling objects. If somebody was going to take a building, you could take for example the windows and the beams and other reusable components of the building, and you could simply have an agreement with a third party “You will buy *this* object at *this* price, when we decide we’ll demolish the building,” and at that point you know that you’ve got \$35,000 worth of reusable components, they’ve already been sold, they’re insured and some other stuff to make sure it doesn’t get complicated if something gets damaged, etc., there are details. But that as an approach, rather than necessarily using lending, because lending, collateralised or not, there are a lot of obligations that go with that, it’s a messy system...

Rather than lending, the presale end of life, and kind of options like a put option or a call option might get a lot of the same goals of lending, but without the complexity that comes from using objects as collateral. So I think that there’s quite a lot of room for getting away from the dependence on credit and the credit risk estimation by using contracts which handle things like sale of goods, in contexts that solve the liquidity problems that lending solves, but without having interest-bearing payments on the back of that. I think there’s a ton of room for engineering there.

Emily: Hello – thanks for such an engaging panel, it's been really interesting to hear everyone's insights! My name is Emily, I'm a PhD researcher looking at climate solutions. I'm also working for a climate startup that's seeking to develop a new global system of decision-making, and I'm a ~US~ delegate at COP. It's been really interesting to hear from some of our panel members who say that they've been working in climate politics for 20 years, and also from other panel members who have grown so tired of attempting to encourage environmental policy change, that they've moved past that to developing a different system entirely. I think that was the point that I really wanted to touch on, was in terms of working within our existing institutions and our existing systems – such as COP, such as multilateralism – and the effectiveness of that to achieve change or timely, effective action, versus putting all of our efforts into developing an alternative system, I was wondering if any of the panel members could touch on that point please.

Anton: Thank you very much. Shall we start with Martin this time?

Martin: Thank you. If you don't know what's going to heal the patient, it can be a really difficult decision what to do. And we have a very complicated patient, and we have a lot of people wanting to help heal the patient, which is a good thing...

Vinay: And the patient has at least two different diseases.

Martin: The patient has so many different diseases: the patient has hypercapnia, which is too much carbon dioxide; the patient is developing pyrexia, going too hot; the patient is experiencing probably multi-organ failure...

Vinay: Malnutrition?

Martin: Yeah, absolutely – the parallels between human illness and what ails the planet are disturbing and numerous.

Coming back to the kind of fundamental question, which almost feels like existing institutions or a new system... What worries me is that I'm not sure we have time for either as an exclusive option. Existing systems don't seem to me to be responding very quickly. They get better at dealing with more acute crises, and those are probably coming down the line, so maybe they'll get a bit faster at being a bit more radical when things get worse – I don't know if that's an optimistic thought or not.

The alternative, trying to create something completely separate and radical? I think the reality is we're all so interdependent that you can't make something completely separate. I think maybe the kind of canny, to use a good Scots word, the canny approach might be to be trying to create the systems which will become useful when they can be used.

So, my expectation is that governments will start... Governments have been getting their heads around the fact that there's a really big problem they haven't been solving. The public are getting their heads around the fact there's a really big problem which governments haven't been solving. We see this represented through XR, and increasing kind of shouting, louder shouting, to determine "We need to determine to act!" Where I worry that there isn't enough happening is on all of the work for the options. Because we will need the options, whenever people decide that they're determining to act, and we'll need the inputs whenever.

So, I think... If I was suggesting what you might do or what people might do is do more on the options, do more on the inputs. Because the determination is building.

The timeliness and the effectiveness of the action? Who knows. But if you're building options, if you're helping work out what's a meaningful, measurable action, if you're increasing the number of inputs – with people, with knowledge, with financial resources – then you're giving the patient the best chance.

So, don't make it an either/or; make it a kind of both, but focus on options and inputs and timely, as well as the determination. There's a lot of people shouting – shouting won't be enough though.

Anton: That's an excellent answer, thank you. Barbara, Diplomatic World of course documents existing institutions, existing systems. What would you say to the questioner?

Barbara: This is a time for change, and we must have possibilities for doing. But we need time to understand this, and all institutions need time understand what change requires. All systems speak of reforms, but what are the right reforms? I think we have no time, but we need time, and we must make the time, yes.

Anton: Thank you, Barbara. James, technology companies often don't engage with politics, but they often create systems which are alternatives to what already exists, until sometimes they get regulated or they don't get regulated, and those alternatives kind of become the new normal I guess to use the phrase. What do you think of that question, and how do you respond?

James: I'm not sure there's a lot I can add to our esteemed panellists here. The only thing I would take away is it's interesting when you see private companies and technology companies pushing governments for more stringent regulation, that makes you feel like maybe something is changing at that point. And I think that has been very interesting to see, that there are... As you say, these corporations are very large, as large as some countries in some cases, but they maybe have a longer time horizon than some elected governments do. And so I think they're seeing where things are going, and saying, "Well, we want to continue to be operational, and that requires a habitable planet, so we really need these changes to come about." So yeah, I don't think I have much more to add.

Anton: Thank you James. Vinay.

Vinay: Yeah. I've changed my mind on this several times over the last 10-15 years, maybe longer, largely by trying things and not having them work. 10 years ago, I thought the hot plan was piling in behind progressive incumbents. My model was that there were basically progressive and regressive forces inside of the institutions, and if the kind of opinionated public piled in behind the progressive incumbents, we could tip the balance of power inside of the existing institutions, and get faster action as a result. And I think there's some room for that, I think it's somewhat successful.

Now I have come to a kind of different conclusion, which is we just have to stop anybody over the age of 30 voting. [Martin laughs] The existing democratic machinery is fine, but we're in a position where because the younger generation is much smaller than the older generation, the younger generation have lost control of their futures. Society is reflecting the interests of the people that will be dead before climate change really hits: they're very numerous, they're very wealthy, and they've corrupted democracy for their own benefit. And the problem of democracy is always democracy is two wolves and a sheep discussing what's for dinner.

So, the old are destroying the futures of the young as a way of maintaining their enormous pension pots, and their five-bedroom and three-car-garage houses. And inside of a constitutional democracy, if you don't have some kind of civil right or human rights argument that says a piece of legislation is illegal, you can't do anything about democratic representation. In America you have constitutional rights, and the constitutional rights limit what the democracy can do, but unless you have a constitutional amendment that says, "You as a young person have the right to grow up in a world where the climate works and nature works in the manner that it did for your ancestors," if we don't have that as a constitutional right, you can't make a constitutional argument that the old don't have the right to destroy the future of the young.

So, on one hand new civil rights, new constitutional rights, extensions to the constitution to manage the rights of the young, and protect them as a minority class. If the young outnumbered the old by the ratio that they did say a hundred years ago, you wouldn't have these problems with climate change, because the youth vote would be so large and so numerous and so powerful that you'd simply not be able to say, "We're going to ruin the world in 50 years, don't worry, we'll all be dead." But that "We're going to ruin the world, don't worry, we'll all be dead," is the default negotiating position of all of the political parties, because the main... What's the median age of a voter these days? Do you know offhand, Martin?

Martin: I don't. There are some other things I'd respond to, but...

Vinay: Sure, sure. But that median age of a voter being just way too old creates a situation where what we have is gerontocracy: societies being run for the benefit of the people

that will be dead before the bills are paid for climate change, but also for national debt, and the bankrupt pension systems, and every other damn thing in this situation.

So I think if we were to say, "The young are a minority and they need minority protections, as they would get if they were a member of any other protected class," we can start talking about using constitutional machinery to protect the future of the young. And I think it's that kind of radicalism... Like, there is no reason that the democratic machinery cannot work, but you have to intervene at a high enough level to address the real problem, and the problem is we are treating young people as if they have no right to a future. And that can be changed, but you have to figure out some way of making a constitutional-level argument, a human-rights-level argument, to say, "*These* are the rights of the young, you cannot pass a law to take away those rights, that's unconstitutional or it breaks human rights obligations," and you have to rebuild the structure from the constitutional level down.

Now, what will it take to do that? That's an open question. Maybe that requires revolution, maybe that requires massive, massive grassroots movements, maybe it requires general strikes... I don't know what kind of pressure you have to apply to governments, to get the kind of bipartisan cooperation you need to pass a constitutional amendment in America, but I think that it's a constitutional-amendment-level work in America, and equivalents are needed in the UK, Europe, China. I think you have to go in at that level of human rights, to be able to say, "Okay, the young have this right to a future, and the machinery of government does not have the right to act in ways which take their rights away."

Anton: Thank you very much, Vinay. Martin, did you want to respond?

Martin: I love Vinay's capacity to both expand our horizons, and also to kind of provoke us to think hard about things. There's a lot in there which I completely agree with, in terms of the extent to which the older political generations have failed the future, the future both for the young, but also the future aspirations and hopes of people who are older who care about the future of the young. And actually that's the only little bit which I would sort of worry about or disagree with, is that fundamentally there are a lot of people who've been worrying about this for a long time, and doing stuff for a long time. Although, on average, the young are a hell of a lot better educated about the significance of the problem, actually there are problematic actors at all ages who don't understand. In the end, humans are messy, and are motivated by the same kinds of messy things that make them unreliable for taking action. So, it's not quite as simple a fix. But yeah, it's a really, really big mess.

Vinay: And I think the notion of just amputation as a cure for this particular medical problem... I mean, we already say there are people who are too young to vote... We could very easily say there are people who are too old to vote. It's a very small tweak, for a lot of radical change.

Martin: Sure, sure. But be careful, if you amputate, that you're amputating the limb and not the head.

Vinay: Well, you know... We'll see how it goes.

But this is an example of the kind of opening up of political horizons. When it struck me that... We say that people who are under say 18 are too irresponsible to be allowed to vote... What is the argument that if people who are over let's say 70, and are on average voting for total destruction of the future, that they are not also too irresponsible to be able to vote? Once you frame that question and say, "What are the requirements for franchise?" maybe the answer is not to remove the vote from anybody over 30, maybe the answer is to drop the age of democratic franchise to five.

Martin: There's a much wider problem though with democracy, which is that the outcomes of democracy are not necessarily defined on polling day. Because actually on polling day you are simply getting to pick between the plates which are put in front of you; you're not actually in the kitchen, defining what the recipes are, and the dishes which are being taken out, amongst which you have to choose. And actually, democracy... This is a really long, other evening conversation, folks, the problems with democracy... Yeah, maybe that's for an after-session conversation.

Anton: Indeed – I'm being reminded that we are already over time, so please come and speak to the panellists after this event. Tomorrow there is going to be one more event convened by Mattereum, here at five o'clock, entitled Green Blockchain, Green Democracy, and we'll hear from Avalanche, and we'll hear from a fellow of the Alan Turing Institute, and others – it'll be fascinating.

I would like to thank our panellists: Barbara, Vinay, Martin and James. Thank you very much to Hub Culture for hosting this wonderful space. And I'd also like to thank the Mattereum team – Katie, Jeremy and Andrew – for helping run this so wonderfully and so smoothly. Thank you so much, and we hope to see some of you tomorrow at five o'clock.

James: Thank you Anton! [applause]

[03:03:00 – End of Transcript]

<https://www.amazon.com/Future-Stuff-Vinay-Gupta-ebook/dp/B08B4F5QK3>

[2] *Shaping Things*, link to Archive.org version:

<https://archive.org/details/shapingthings0000ster/mode/2up>

[3] *Small is Profitable*, link to PDF file:

https://library.uniteddiversity.coop/Money_and_Economics/Small-is-Profitable.pdf

[4] *Winning the Oil Endgame*, link to PDF file:

https://rmi.org/wp-content/uploads/2017/06/RMI_Winning_the_Oil_Endgame_Book_2005.pdf

[5] Simple Critical Infrastructure Maps:

<http://resiliencemaps.org/>