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BIG INNOVATION CENTRE

Hub in a Day with GSK: "Disruption is the way for us"

Towards the 2030 Pharma Supply Chain and Manufacturing

For the Global Pharma Manufacturing (GPM) Team of GlaxoSmithKline

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This is a highlight piece based on the **Hub in a Day with GSK -** held on 1 May 2018 at Big Innovation Centre. The meeting was chaired by Professor Birgitte Andersen, CEO of Big Innovation Centre.

The evidence presented in the report is not exhaustive but reflects the highlights of what was discussed at the meeting, and the views and experiences put forward by the people providing stimuli. Written submissions by the individual experts in relation to this meeting are also included.

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Executive Summary

On 1st May 2018 the Global Pharma Manufacturing (GPM) Team of GSK came to Big Innovation Centre for a 'Hub in a day with GSK'. It was an opportunity for pivotal figures within GSK to explore different futures and roadmaps to best incorporate new technologies. The spirit of GSK for their vision in 2030 was perhaps summarised best by Regis Simard, the Senior VP of Global Pharmaceutical Manufacturing: **"Disruption is the way for us"**.

During the day, it was clear to see that the GSK team and the external experts share a collaborative and collective vision for the need to 'build in' adaptation to an extraordinary pace of change. The group started the day by exploring GSK's context within existing macroeconomic trends and moved towards discussing challenges ranging from technical, to cultural. **Through 'dreaming big and starting small', it was collectively decided that GSK would use disruptive technologies like Artificial Intelligence and Blockchain to enable better quality of product and service for its customers.**

Key Takeaways

AI, Blockchain and digitisation have transformed the way in which supply chain and manufacturing will work by 2030. The new supply chains are a part of huge digital networks across different sectors and countries, as manufacturing is becoming distributed and automated.

The linear supply chains of 'plan-source-make-deliver' are becoming transformed into a growing networked system. The ability of AI to automate, augment and enhance customer experience and decision-making is due to the AI, Blockchain and digital available today.

Within pharma, AI and blockchain and digitalisation can be applied across the supply chain activities, i.e. from early stages of planning to production, warehouse activities, distribution, communication and logistics, to enhancing the customer experience. The Hub in a Day revealed from use-cases how AI can optimise supply chains by providing problem-based specific solutions within these stages. The problems addressed via AI usually arise during data handling, analysis in finance, operations and logistics planning or managing inventories.

An important takeaway is that we don't need a huge infrastructure for data analytics, but we need simple diagnostic tools. Data mining is helpful, but we should not opt for the 100% solution when 80% is sufficient

in a fast-changing world. Also, we need to learn to trust data to take decisions – this makes us more agile!

AI and Blockchain enabled solutions are expected to assist the pharma supply chains with a streamlined process including: precision planning; efficiency in the process that shapes consumer markets; and near-perfect logistics and transport such as shipping. It will produce higher speed, better quality services at insignificant lower costs.

It is important to invest in experimentation and dedicate resources for this purpose. Other areas of AI and Blockchain investment should include three things:

- Enhanced productivity
- Enhanced customer value
- Risk management and trust

Combined, this will mean **automated quality control**.

"GSK has a long-standing and comprehensive commitment to delivering innovative medicines and vaccines and widening access to them; and GSK will support the ambitious global goals to improve health, prosperity and sustainable development by 2030.[1]"

United Nations General Assembly in 2016

Clarity of vision must be owned from both the top-down and bottom-up.

Leaders used to think in financial terms but now they need to think survival and vision. A shared vision for the future is important. When this happens, everything will follow:

- Where big pharma fits in ecosystem …
- Which data strategy is best …
- Which use-cases to develop …
- What the competition is about …
- How to be agile …

Looking at the evolution of supply chain management, it has come a long way from the 'creation era' of formalising supply chain activities among businesses (product quality and volume driven), to information communication technology (ICT) driven by 'globalisation' of supply chain management. AI, Internet of Things (IoT) and blockchain are now the next transformers of supply chain management in pharma which follows the customer-driven philosophy.

As future supply chains are AI driven and digital, businesses should not simply adopt the technology into their processes, as new technology co-exits with new specialised skills to manage, a reshaping of the organisation,

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[1] GSK. (2016, September 19). *GSK sets out further steps to address emerging global health security challenges*. [Press Release] Retrieved from https://us.gsk.com/en-us/media/press-releases/2016/gsk-sets-out-further-steps-to-address-emerging-global-health-security-challenges/

reconfiguring of supplier networks, and a lot more. An incremental or smooth transition is more likely to be successful, and we should be aware that 80% of companies fail in digital transition. It is also important to have an easy transition as a new AI enabled supply chain involves stakeholders from different organisations and different nations who will be affected in the process.

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Think big and Start Small!

Big Pharma thinks "big bang" transition, but this approach does not establish 'ownership'. Incremental change is better, as this involves everyone's tasks in the organisation who will gain domain-ownership of the issues. This drives more shared commitment and success. Also, being agile is not about IT, but culture, business structure and rules.

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Often the pharma sector adopting AI is faced by a weak roadmap for implementation, uncertainly on where to put investments, as well as capacity issues for handling the change new AI tool brings to the organisation. External factors include regulation issues. With the above-listed challenges, businesses are also resistant to implement AI as there is unavailability of usable data, lack of skills, the know-how of AI and sometimes there are too many choices.

Supply chain businesses achieve greater benefits when they have a comprehensive vision.

For achieving AI success in the supply chain, businesses should act fast and start designing AI roadmaps immediately and target the specific performance problem they want AI to solve (for example about capacity, capability, complexity and new opportunity).

We easily end up in a theoretical discussion of the future of pharma supply chains and manufacturing, but what we need is a more practical discussion.

We need real world use-cases, and simply bite off a chunk we can address and get on with it. Let us identify what we want and do it…

In summary, the Pharma sector needs to build AI readiness (skills, data handling and so forth), pilot and test use-cases, with the aim to achieve positive changes in customer experience. The ultimate aim is wellbeing and the challenge is what a patient journey will look like in 2030. The following sections will address the highlights of the Hub in a Day.

Although the AI journey has brought the pharma sector into uncharted territory, thanks to the "Hub in a Day" we are no longer dealing with the 'unknown unknowns', and genuine progress has been made.

Let's do it!

Stimulus 1 TREND SETTING

> **Industry 4.0 and other macroeconomic trends (e.g. health, energy, e-commerce): what are they and how do they change the future of pharma manufacturing/ supply chain?**
>
> 1. How will the future for pharmaceutical supply chains look like in 2030?
>
> 2. How will technology affect your supply chain management activities?
>
> 3. What will the physical and digital infrastructure underpinning pharma supply chain look like?
>
> 4. What will good look like?

HIGHLIGHTS

This section focuses on three main trending areas for future pharma supply chain: data, documentation and traceability.

1. Sharing data is essential

"If data is the new oil then AI is a combustion engine". Polina from Insilico Medicine mentioned that data should be more efficiently utilized in the future pharma supply chain to allow patients with new ways to control and profit from their personal data as well as with the incentives to undergo constant health monitoring.

"To build a secure and transparent distributed personal data marketplace, blockchain and deep learning technologies may be utilised to resolve the challenges faced by the regulators and return the control over personal data including medical records, back to the individuals", Polina said. The data stored on the blockchain is not readable due to blockchain's nature, making it easier for companies to meet the stricter data regulating demands. She also mentioned that development of the blockchain empowered the decentralised personal health data ecosystem allowing novel approaches for drug discovery, biomarker development and preventative healthcare.

Polina Mamoshina (Senior Research Scientist, Pharma.AI, **Insilico Medicine**)

"For the last couple of decades, the healthcare market has been showing steady growth. This growth is primarily driven by the implementation of digital technologies such as mobile communications, the cloud, advanced analytics, the Internet of Things and AI. **Particularly, the field of AI in healthcare is rapidly growing providing new solutions in almost every existing area of healthcare and generating new areas like wearables or lifestyle managing and monitoring**."

2. We need 'smarter' documentation

"According to a recent McKinsey & Company research[1], the biggest future impact on revenue and EBIT growth, is set to occur through the digitisation of supply chains, and yet, only 2 percent report that supply chains are the focus of their forward-looking digital strategies." Jason from Veratrak introduced this during his presentation.

He also pointed out that "when looking into the future for pharma supply chain digitalisation, there is currently no software solution for end-to-end (E2E) traceability of product, information, and cash, which can be queried and return information in a matter of seconds." Beginning with the document sharing platform which is cross-tier, cross-supply chain, Veratrack is working towards digitisation of the information chain. Jason forecasted that with the application of their documentation sharing platform:

"In 2030, GSK would be able to have a real-time performance overview of how their supply chain is performing with the complete end-to-end (E2E) value stream from API to dispense with metrics on process time, lead time, and % correct and accurate."

3. Traceability and identification deliver trust and efficiency

Jason Lacombe (CEO, **Veratrak**)

From speaking with Heads of Supply Chain at many of the largest pharmaceutical companies by global revenue, Jason from Veratrak has learned that the sharing of critical documents as products move through the supply chain can be a significant pain point. "Of 54 pharmaceutical companies surveyed, 53 of these companies currently share critical documentation through either email, fax, or the post with their third-party suppliers." Jason said.

"Using these current methods, the mishandling of documents and delays in the documentation and approval process can create significant costs to pharmaceutical companies measured in days or weeks of lead time, obsolescence of medicines, low working capital, and millions of dollars in avoidable cost."

"Moreover, with the rise of serialisation mandates across the globe, which by 2019, will see 40+ countries and 75% of all global medicines governed by track and trace serialisation laws, companies must urgently look at their IT and software strategy moving forward and begin to map out a comprehensive and forward-looking strategy beyond the Falsified Medicines Directive and compliance. Veratrak is the pharmaceutical supply chain software solution of the future. Working with our partners every step along the way, we create customisable workspaces for your unique needs."

Counterfeit tablets are a worldwide problem in the pharmaceutical industry. According to Reuters[2] (2018), one in 10 drugs in developing countries is fake or substandard, causing tens of thousands of deaths. 1 million patients die annually from toxic counterfeit pharmaceuticals and 450,000 preventable malaria deaths each year

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[2] Ben H. (2017, November 28). *Tens of thousands dying from $30 billion fake drugs trade, WHO says.* Retrieved from https://uk.reuters.com/article/uk-pharmaceuticals-fakes/tens-of-thousands-dying-from-30-billion-fake-drugs-trade-who-says-idUKKBN1DS1ZB

are caused by counterfeit pill. (PWC, 2017) [3] .Due to the complexity of the pharmaceutical supply chain, it is hard to trace counterfeit tablets.

Advantages of applying blockchain technology in pharma supply chain include: (1) transparency in pharma supply chain management, as you are not trusting just one supplier, you are giving trust to the whole group. Also, (2) the traceability of blockchain makes it possible for pharma industry to check the accountability during drug transportation. However, applying blockchain and other disruptive technologies doesn't necessarily mean humans will be totally replaced in pharma industry. Ashley Kemball-Cook from Qadre thinks that most technologies nowadays are existing to empower individual users to make better decision instead of firing the GP.


Ashley Kemball-Cook (Business Development Lead, **Qadre**)

Ashley from Qadre introduced an innovative End-to-End Tracking Solution based on blockchain technology to solve this traceability problem. "**It uses unique identity to be assigned to every unit combing with an anti-counterfeiting hardware product**. Each pharmaceutical medicine has an unique identifier given to it by a Near Field Communication chips – NFC has a very small form factor that can be packaged into drugs. When product is transferred, ownership changes hands through a smart-device and the new information is logged on the blockchain database, making the new party accountable."

4. 2030 is about fast, bespoke and distributed supply chains

"What will the pharmaceutical supply chain be like in 2030?" – was addressed at one of the tables during the Hub in a Day with GSK. During the table discussion, the team from GSK forecasted that physical drug-shipping may be non-existent. Instead, drugs might be inserted in-vivo or 3D printed out right after a doctor's prescription. Regarding the printing of medicine, one scenario mentioned was that a child could be diagnosed by a doctor over a phone camera. After receiving the prescription, the parents can order at the online pharmacy, thereby saving valuable time. By 2030, besides the printing of medicine, personalised medicine such as gene therapy might also be the trending sector in pharma.

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[3] Peter B., Dr. Marie-Lyn H., Dr. Fabian W. (2017). *Fighting counterfeit pharmaceuticals: New defenses for an underestimated - and growing – menace.* Retrieved from https://www.strategyand.pwc.com/reports/counterfeit-pharmaceuticals
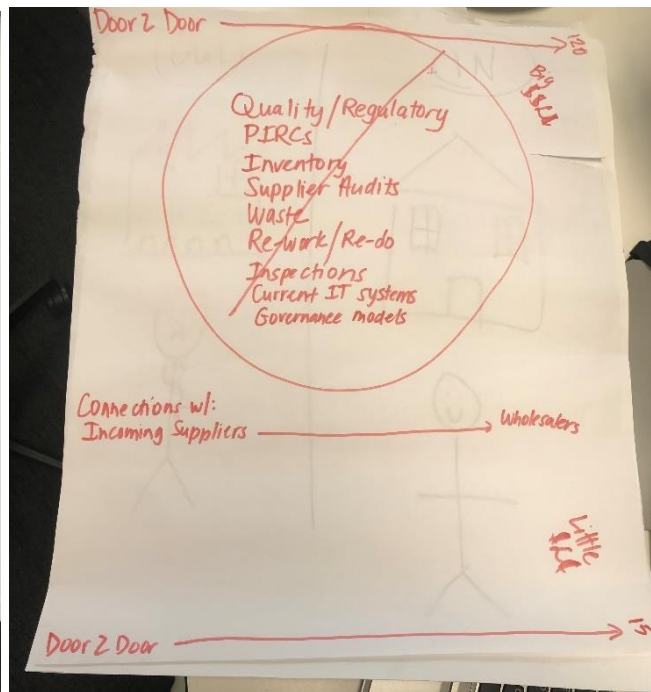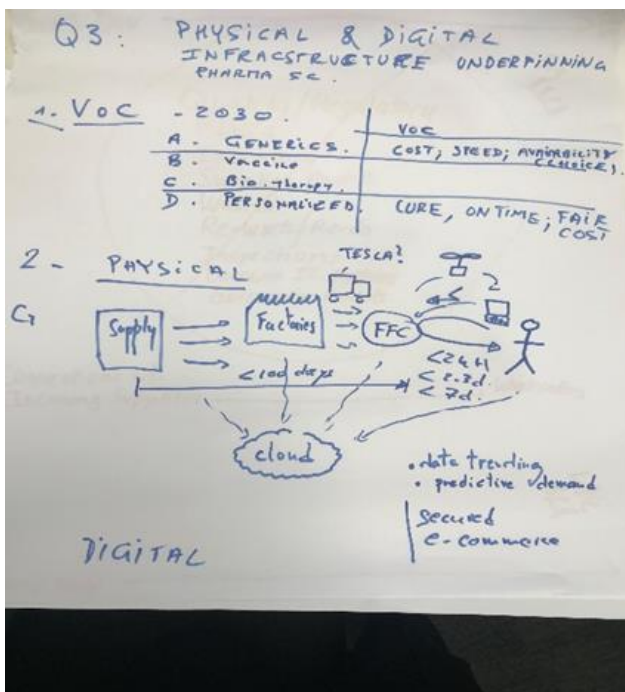
5. Readiness for executing disruption to supply chain management is not about technology

To have a more efficient pharma supply chain, technologies should be applied and integrated to make change happen. But when talking about how technologies can be utilised in a good way, we should always keep in mind that the best product is the one that solves customers' pain point.

By 2030, pharma will be mainly using blockchain for their data, as this brings increased data trust and integrity. Data must be stored correctly in the beginning – which is key to the technological application process. To collect better data in use, pharma companies should start by considering the demand of patients. To achieve that, a strong customer interface needs to be created to realise what patients want. However, pharma companies might be stuck in the process of digitalisation without the support of regulators. But regulators will be pressured to

accept the change if the price of drugs will dramatically go down with the benefit of new technology.

For GSK, the step that needs to be taken is to invest in and to adapt the right supply chain management systems connected to the current ones. Nothing is keeping us from the technology except execution.

6.What does good look like?

To answer what good looks like, we might need to discuss what the idea of 'good' is in the era of technology, followed by 'good' in pharma supply chains. In the ideal world, a more personalised facility such as the GSK App will give more convenience in future pharma supply chains.

For patients, an environment where their data is safe might be the ideal future for them. Patients' data and records will be their own property only. Patients will decide who they want to share this with as per requirement. They can diagnose themselves using the technology available.

As users have the option to opt-out, how can GSK build a brand where its users trust them to share their data?

Stimulus 2   E-SOLUTIONS

How will digital, data & AI shape the supply chain processes and the relationship pharma has with patients?

1. How will AI solutions help to choose where to be generic versus specific patients targeted; in marketing? in product design? in manufacturing?

2. As digital technologies (IOT, eCommerce, track/trace, intelligent agents like Alexa etc) enable us all to be more informed and connected, how will the pharma supply chain adapt to meet these new expectations of workers and patients?

3. How will smart products change pharma supply chain processes? Consider management of demand, delivery, quality, security, root cause analysis, others.

4. How do pharma companies address issues related to skills, ethics, data and other patient issues to ensure a better future for all? What does good look like?

Kumar Jacob MBE
(CEO, **Mindwave Ventures Limited)**

- In the future, **the trend is to provide services, not just a product** – that's a big difference between an e-commerce company and a traditional manufacturing company.

- E-solution enables better quality of service and product.

HIGHLIGHTS

1. Forecasting the future pharma industry is about digital health, wearables, IoT, and mHealth

Dmitry from Deep Knowledge Ventures, an investment fund focused on Deep Tech and advanced science projects gave a presentation based on their recent analytical report "AI for Drug Discovery, biomarker development and advanced R&D / landscape overview 2018 Q1" (http://www.deepknowledgeventures.com /analytics).

Dmitry explained: "Considering the ratio of progress in the digital health, wearables, IoT, and mHealth sectors, the relations of healthcare corporations with consumers in the next 3-5 years will be able to be transformed into very personalised, participatory, predictive, preventative and close to real-time mode of reaction. **Considering the accelerating progress in the sphere of AI for advanced R&D, biomarker development and drug discovery in recent years, it is obvious that in the next 5-10 years there will be possible significant shifts from treatment to prevention**."

"However, convergence of these emerging technologies and megatrends can accelerate the dynamic of the progress even further, and shorten the timespans associated with even the boldest of predictions", Dmitry suggested. "Therefore, the Biopharma corporations willing to stay at the forefront of healthcare business should work on a better forecasting of these technological megatrends, and transform themselves into AI and data-science driven mathematical healthcare corporations."

2. Know your ecosystem

Dmitry Kaminskiy (Managing Partner, **Deep Knowledge Ventures**)

"The biopharma and healthcare corporations of the future will be unlike those that emerged 50-100 years ago, and will be chiefly operated as IT corporations focused on healthcare, data science and AI driven innovations. There will be no room for old bureaucratic giants lacking real-time reaction. There will be no space for those unwilling to sit on the bleeding edge of biomedicine, no room for outdated management nor a lack of willingness to absorb new innovation."

Leading IT-giants nowadays are already in most cases data-analysis driven corporations. The case will be the same for healthcare companies 10 years from now. Taking into consideration the significant recent developments in biomedicine and the prospect of extremely advanced AI, the HALE and QALY that companies can add to their users will become a reliable basis for their valuation. The biopharma companies of the future will become mathematical corporations driven by data science, AI and quantitative health parameters including HALE and QALY.

"At the same time, given the increasing interest of IT-giants such as Google, Amazon, Apple, Tencent and Alibaba in healthcare, we can expect that in 10 years' time they themselves will become global healthcare corporations and their capitalisation will eventually depend on measurable and quantifiable parameters associated with QALY and HALE they can provide to their users. Just as Facebook's capitalisation is linked to the profit that one user can provide to the company along with the total number of users."

3. Lack of global data and cost constrained environments are key obstacles

"One of the main existing obstacles in the AI in Healthcare sphere is the lack of advanced data scientists on a global scale and strong AI specialists particularly in the niche of AI for Drug Discovery and advanced R&D",

Dmitry stressed. "It is notable that on average AI companies consist of 55% administrative staff, 30% biotech specialists and only 15% of AI specialists."

According to the analytical report conducted by Deep Knowledge Ventures (referred to earlier), the UK is one of the most active spots specifically for AI in Healthcare. It is home to many AI companies and a lot of activities are progressing here, including government support with very clear interest in this topic. "Therefore, we can predict quite a good future for further positive progress of this industry in close coming years in the UK, and GSK most likely will be able to maintain leading positions in this arena in the UK, and also one of the leading positions on the international level", Dmitry said.

When discussing how technology transforms operating models, Dmitry explained that "AI in conjunction with mHealth, IoT, Blockchain, Digital Health solutions will bring multiple tools to transform operating models to data science AI-driven consumer-oriented solutions with a significant shift to preventive medicine, not only on the technological side, but also on the side of transformation the business models for Biopharma and Healthcare corporations. When discussing how technology transforms operating models, Dmitry explained that "AI in conjunction with mHealth, IoT, Blockchain, Digital Health solutions will bring multiple tools to transform operating models to AI-driven data science.

Zahid Latif (Innovation Specialist, **Life Sciences Organisation, Department for International Trade**)

"As customers, digital technologies have changed the way we shop, bank or enjoy entertainment dramatically. The potential for digital technologies to change healthcare has been explored for the past 10 years, while their impact has been limited at best." Zahid from Life Sciences Organisation, Department for International Trade said. He also explained that "From the governing perspective, global healthcare markets and governments recognise the issues of delivering healthcare in cost constrained environments. **The opportunities for digital technologies to improve access to healthcare as well as a gradual move to greater opportunities for 'self-care' will change the patient experience to being more of an informed/engaged consumer**."

"The impact on the supply chain is yet to be understood", Zahid pointed out. "Rapid changes in product development and innovation will be needed in order to match customer expectations and key to the manufacturers will be identifying and understanding the channels of communication from the marketplace and creating agile but regulatory compliant methods to enable product innovation."

Stimulus 3 AUTOMATION AND PRODUCTIVITY

What robotics and automation are/will be available to help accelerate our productivity and support more efficient capital investment?

1. How will advanced analytics, AI and machine learning change processes and jobs in pharma manufacturing and supply chain management?

2. How will robotics change processes and jobs in pharma manufacturing and supply chain management?

3. What is the impact of blockchain on pharma supply chain (operations, management, etc.)? (like a smart contract, distributed ledgers, chain linking, Decentralized Autonomous Organisation and others)

HIGHLIGHTS

1. Supply chain management must be de-orchestrated

Jens Munch Lund-Nielsen (Head of Global Trade & Supply Chains, **IOTA Foundation**)

"Today supply chains are driven by actors pushing information to the next actor and requesting updates and status on events such as: are the container stuffed? Is the tax paid? Are the goods inspected? Is the certificate approved? Emails, phone calls and uncertainty are the daily details of moving goods. Information is delivered peer-to-peer and retyped into new systems with loss of data integrity and authenticity.

The vision of tomorrow is a supply chain supported by a distributed ledger where the original documents and events are reported in real time and made available to authorised actors. It will provide transparency to the process, better clarity on current status, and allow everyone to piggy-back on the original data (and not a diluted version from being re-keyed into different systems).

Core to this vision is data integrity of the data shared. That the data provenance is cryptographically secured so we have authentic data and audit trails of immutable records of historical events and data. Secondly, that authorised users can collect and share data and events, so we have full chain of custody."

Jens continues that "IOTA (www.iota.org) is the most advanced DLT technology. It offers all the features as open source, there are no transaction fees and it is the only technology that scales to handle the millions of transactions that global trade consists of. The technology is developed by the IOTA Foundation, registered as a non-profit organisation in Germany as the first of its kind. Technology is still in beta-version and we are currently engaging with industry to co-create pilots, advance the technology and build experience on the business models."

Where Artificial Intelligence becomes relevant in an industry to certain processes, the whole ecosystem of the organisation changes.

Jens from Iota, who previously worked with Maersk said supply chains could be considered as 'Black boxes' – if you look at the full supply chain – it is like considering small black boxes that don't have a holistic understanding of how each link relates to another. (Figure 1) Distributed ledgers are different from blockchain technology.

"A distributed ledger is a database of transactions that is consensually shared and synchronised across networks spread across multiple
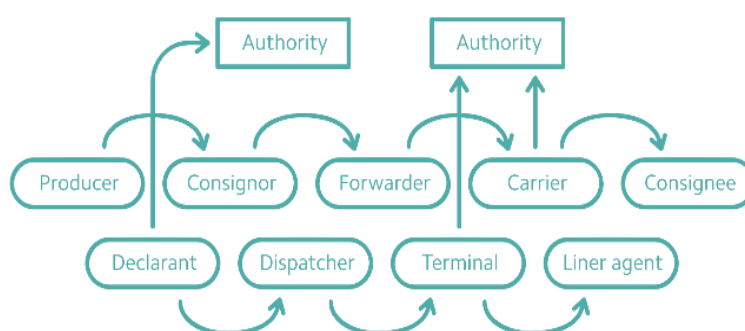
Figure 1: Peer-to-peer Communication

sites, institutions or geographies. In other words, the "truth" is uphold by consensus between many databases and not vulnerable to one (or few) central database(s). Where the centralised system needs trusted actors in the middle such as banks, authorities etc. to manage the ledger, the distributed ledger can potentially eliminate such actors and provide immutable, tamper-proof and secure information. Distributed ledgers are built "on top" of the internet. Thus, accessible through browsers, API's etc. Applications can be built for smart phones, laptops and directly machine to machine." Jens explained.

In distributed ledger technology – distributed databases around the world agree on what the truth is – once you have millions or thousands of these nodes a consensus mechanism can be put in place. (Figure 2) This is an important feature of distributed ledgers – as it can allow features such as digitisation, data collection, and automation. They do, however, need to be digitised in a 'trustful' way. Once you have a distributed ledger – you use that information, so you can start to collect the information – on top of that comes 'de-orchestration'.
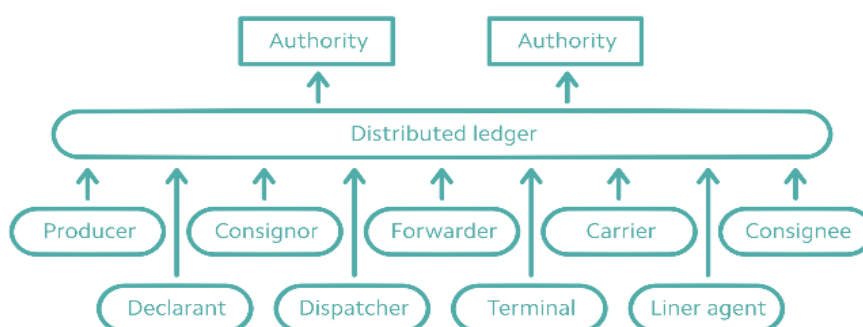

Figure 2: DLT Communication

2. New business models will create efficiency gains

"Applying the technology on supply chains will enable better orchestration and synchronisation of assets, replenishment plans and generally improve execution management. This is enabled by more precise track & trace features, visibility of different inventory levels and ability to monitor conditions (temperature, humidity etc.) across the supply chain." Jens mentioned.

He also forecasted that "Equally important are the many new business models that will be enabled. Users can sell or share their data, banks can use performance data to provide better risk profiling and thus trade finance, payments and invoices can be settled instantly with no transaction fees, etc. Consumers can check a product's authenticity to avoid counterfeit and companies are offered new models for direct engagement with end-consumers as well as handling reporting requirements to authorities."

3. The fusion of government and healthcare providers is now

Government and healthcare service providers are currently merging. The examples such as fit bits are used – there are more collaborations between pharma and tech – conservative and cost constrained markets. There isn't enough of a platform for a lot of the voices in these technology bases. People seem unwilling to invest and we end up seeing banking, shopping and entertainment moving along. There is a different evidence base being created however, and the UK government has been dropping money in this space. Another operational case study is iPlato, who message two million people to give them appointment reminders.

Alexander Zhebrak (Director of Product Development, **Insilico Medicine**)

"Machine learning and deep learning techniques, in particular, have been widely adopted in many fields of today's life. However, these methods can be applied not only to common tasks like internet search, recommendations systems, language translation or image/speech recognition. We can also use these models to power up research and development.

Insilico Medicine is utilising modern deep learning techniques for drug discovery and biomarker development with integrated end-to-end target ID and drug generation platform. Combining automatisation with smart algorithms, we can go from idea to in vitro validation in a matter of hours."

Stimulus 4   HOT TOPIC DEBATE ON LEADERSHIP

Operating Models and Leadership – What do future operating models look like? How do leaders need to change?

1. What does the pharma workplace look like in 2030 – in factories, in warehouses, in head offices?

2. How will the disruption change the behaviours/style/approach needed by management teams?

3. How does the pharma sector best get leaders ready?

HIGHLIGTHS

1. New leadership models must be ecosystem based
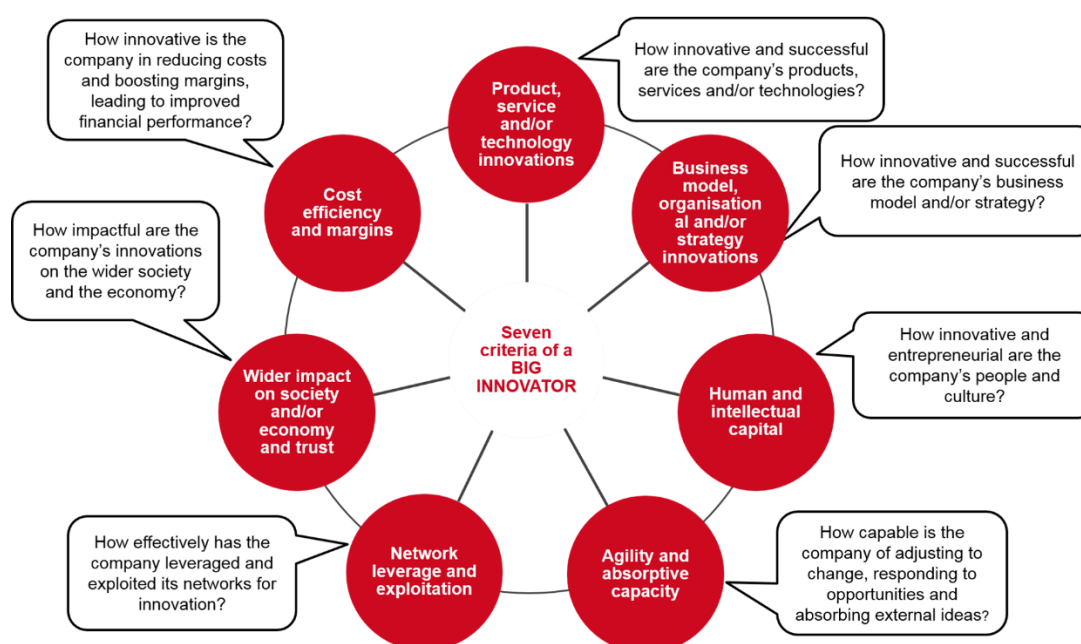
Prof. Birgitte Andersen (CEO **Big Innovation Centre**)

Leadership performance within innovation management hardly look beyond **traditional science, technology, product or service innovation perspectives**, such as number of patents or R&D spend. But, one also ought to focus on organisations' innovative capability in the areas of **business model strategy** and **innovative ways of managing cost efficiency**. The focus should also be on the **innovativeness of the people within an organisation**, and how well an organisation **adapts to change**. Finally, how innovatively an organisation **exploits its network** and how it has an **impact on society and the economy** at a whole are also key.

During the Hot Topic Debate on Leadership, the participants agreed that leadership need to make sure that there is clarity of vision amongst employees and amongst the leadership.

People and strategy also need to be proficient at making sure they aren't simply 'using technology for technologies sake'. 80% of organisations fail in digital transformation[4] – an agile operating model needs to provide a foundation for which employees can 'dream big' and 'start small'. This can be done through prototyping in agile teams. We discussed how big pharma ought to move away from monolithic investments and adopt a more flexible operating model to build in change over time.

2. A platform approach can increase agility

We must make sure that agile is implemented properly. Employee satisfaction must be kept as high as possible and increase productivity and employee satisfaction. Waste can be minimised inherently by addressing redundant meetings, repetitive planning, excessive documentation, quality defects and low-value product features. Team members from multiple disciplines must be engaged.

The efficiency in the pharmaceutical industries is of concern too. Potential areas for sourcing this new investment in research and development must be addressed in the future.

Alpesh Doshi (Founder, CEO, **Fintricity**)

The players in a platform ecosystem – a platform provides the infrastructure and rules for a marketplace that brings together producers and consumers. The players in the ecosystem fill four main roles but may shift rapidly from one role to another. Understanding the relationships both within and outside the ecosystem is central to platform strategy.

Alpesh Doshi discusses the platform infrastructure and rules for a marketplace that brings together producers and consumers. The players in the ecosystem fill four main roles but may shift rapidly from one role to another. Understanding the relationships both within and outside the ecosystem is central to platform strategy.

Potential model ecosystems are:
1. Moving from resource control to resource orchestration
2. From a focus on customer value to a focus on ecosystem value
3. From internal optimisation to external interaction
4. From the power of network effects

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[4] Minter Dial and Caleb Storkey (2017), Futureproof: How To Get Your Business Ready For The Next Disruption, FT Publishing International

APPENDIX: Bios of speakers and hosts

Hub in a day HOST **Prof. Birgitte Andersen** (CEO, **Big Innovation Centre**)	Professor Birgitte Andersen (PhD Economics) is CEO of Big Innovation Centre - a business-backed *do-tank* in London. She is an international expert in business innovation, IP governance and the intangible economy. During the internet boom, Birgitte launched and ran (2000 to 2010) probably London's biggest interdisciplinary postgraduate programmes on E-Commerce and Business Innovation at University of London (Birkbeck College), where she holds the title Professor of Economics and Management of Innovation. She has led several pan EU programmes on markets for IP and intangible assets and has advised economists and policy makers of national governments in and beyond Europe including OECD, UN and WIPO; and large firms. Birgitte serves as an expert defence witness in the UK courts on matters of IP use on the Internet. She was the Rapporteur for the EU Commission representing the EU Expert Group on Knowledge Transfer and Open Innovation, and currently sits on the EU Expert Advisory Panel for Horizon 2020 - Societal Challenge: Europe in a Changing World – Inclusive, Innovative and Reflective Societies. With Big Innovation Centre team, she currently leads the Secretariat for three All Party Parliamentary Groups on 'Artificial Intelligence' and 'Blockchain'.
Hub in a Day RAPPORTEUR Michelle Miao (Strategic Analyst, **Big Innovation Centre**)	Michelle is responsible for delivering the Hub in a Day programme at Big Innovation Centre, designing bespoke fast tracks for international delegations wanting to know about the UK, and corporations wanting to re-innovate or raise their innovative capabilities. She leads on facilitating strategic alliance with Chinese stakeholders. As the Strategic Analyst at Big Innovation Centre, Michelle also designs diagnostic tools for data analytics and researches on regional economic development through innovation ecosystems. Michelle holds an MSc in Business Innovation of E-business at Birkbeck, University of London, and a BSc in Financial Management from Southwestern University of Finance and Economics, one of the top-tier business schools in China.

Global Pharma Manufacturing (GPM) Team of GlaxoSmithKline

Andy Baker	Vice President, Procurement for GPM
George Beres	Vice President, Speciality Franchise
Kirk Brown	Biopharms and Steriles Supply Chain Head (VP)
Urbain Bruyere	Vice President, Environment, Health and Safety for GPM
Ruth Gibson	Vice President and HR Business Leader for GPM
Freek Jongen	Vice President, Finance for GPM
Wendy LaRoche	Vice President, Quality for GPM

Graham McCauley	Vice President, Information Technology for GPM
Franck Morineau	Respiratory and HIV Supply Chain Head (VP)
Virpi Oinonen	Chief Illustration Officer
Denis Paris	Head of the GSK Production System
Joe Power	Global Primary Supply Chain Head (VP)
Andy Ross	Vice President of Respiratory and HIV Franchise
Regis Simard	Senior Vice President of Global Pharmaceutical Manufacturing, Global Manufacturing & Supply Executive and ViiV Board Member
Caroline Stewart	Global Performance Lead for GPM
Lynn Tarini	Head of Communications, GPM
Chris Vos	Vice President of Global Pharma Supply Planning
Joanne Walsh	Head of Technical for GPM

SPEAKERS providing stimuli

Stimulus 1: TRENDING SETTING

Polina Mamoshina (Senior Research Scientist, Pharma.AI, **Insilico Medicine**)

Polina Mamoshina is a senior research scientist at Insilico Medicine, Inc, a Baltimore-based bioinformatics and deep learning company focused on reinventing drug discovery and biomarker development and a part of the computational biology team of Oxford University Computer Science Department. Polina graduated from the Department of Genetics of the Moscow State University. She was one of the winners of GeneHack a Russian nationwide 48-hour hackathon on bioinformatics at the Moscow Institute of Physics and Technology attended by hundreds of young bioinformaticians. Polina is involved in multiple deep learning projects at the Pharmaceutical Artificial Intelligence division of Insilico Medicine working on the drug discovery engine and developing biochemistry-, transcriptome-, and cell-free nucleic acid-based biomarkers of ageing and disease. She recently co-authored eleven academic papers in peer-reviewed journals.

https://www.researchgate.net/profile/Polina_Mamoshina

Jason Lacombe (CEO, **Veratrak**)

Jason Lacombe is the CEO of Veratrak. Jason first became interested in blockchain technology as a founding member of the blockchain society, while he was reading for a PhD at the University of Oxford. Before Veratrak, Jason served as an Expert Advisor to the European Parliament, member of the World Health Organisation Collaborating Centre for Non-Communicable Disease Prevention, and worked as a health economist for the pharmaceutical industry.

Matthew Wilson (Chief Product Officer, **Veratrak**)	Matthew Wilson is Chief Product Officer at Veratrak. Matthew is responsible for devising and managing the implementation of Veratrak's product and technical offering. Prior to Veratrak, he worked as a digital product management consultant across a variety of industries. Matthew has experience on a variety of blockchain projects in the pharmaceutical and healthcare industry, and holds a BSc in Physics and a MSc in Theoretical Physics from the University of Oxford.
Ashley Kemball-Cook (Business Development Lead, **Qadre**)	Ashley Kemball-Cook is Head of Business Development for Qadre, a blockchain product development company with products in a number of sectors including: supply chain management, anti-counterfeiting, and identity. Ashley is an Advisor to Disberse, a blockchain enabled fund management platform for humanitarian aid. Using blockchain it drives the transparent, efficient, and effective flow of humanitarian aid funds. Ashley has worked on blockchain projects with industry leaders across finance, energy, healthcare, Magic Circle Law Firms, and UK regulators.
Lucie Munier (Legal & Business Associate, **Qadre**)	Lucie Munier is a Law graduate with experience working across Asia in the High Growth Technology and Innovation Group within KPMG. Lucie has also worked within high growth companies in cybersecurity and corporate advisory in Geneva before moving to London to join Qadre as Legal and Business Associate. Lucie combines her experience in cybersecurity and law and passion for high growth innovation to lead Qadre's work on regulation and Business Development.

Stimulus 2: E-SOLUTIONS

Kumar Jacob MBE (CEO, **Mindwave Ventures Limited)**	Kumar Jacob is the CEO of Mindwave Ventures. Mindwave develops digital products and services for the health sector, health charities and leading academic research centres in London and across the UK. Mindwave is a team of designers, developers and user researchers, who are all committed to creating inclusive, intuitive and flexible user-led designed digital tools and experiences. Working alongside clinicians and academics, the team is currently creating technological solutions in a number of key areas. Kumar has been an executive and consultant in games development for over 20 years and is a founder director of Dream Reality Interactive, a developer specialising in immersive virtual and augmented reality experiences. Kumar is also a non-executive director for the online sexual health service, SH:24.

	He chairs Age Exchange, a charity committed to improving health and wellbeing among people with dementia using reminiscence arts and serves on the board of the University of Greenwich. Kumar was awarded an MBE for charitable and voluntary service.
 Zahid Latif (Innovation Specialist, **Life Sciences Organisation, Department for International Trade**)	Zahid originally qualified as pharmacist and then went on to do a PhD in Pharmaceutical sciences before embarking on a career in industry in drug discovery and development. In 2007 he joined Innovate UK (Technology Strategy Board), overseeing programmes in regenerative medicine, assisted living and stratified medicine. He was involved in the set-up of the Cell and Gene Therapy Catapult and Medicines Discovery Catapult as well as being a Board observer for the Stevenage Bioscience Catalyst. He joined Cancer Research UK in 2016 as Director of Population and Early Detection Research. He is currently the Innovation Specialist for the Life Sciences Organisation at the Department for International Trade.
 Dmitry Kaminskiy (Managing Partner, **Deep Knowledge Ventures**)	Dmitry Kaminskiy is an innovative entrepreneur and investor who is active in the fields of BioTech, Precision Medicine, BlockChain, and Artificial Intelligence. Mr.Kaminskiy is a co-founder and a managing partner at Deep Knowledge Ventures, an investment fund focused on DeepTech and advanced science projects. Considering the significant growth of interest to the Longevity industry, Deep Knowledge Life Sciences has increased its activity in 2017 and will actively expand its portfolio to catch the wave edge of the rising trend "Investing in Longevity". Dmitry Kaminskiy is a frequent speaker on the topics of AI and Longevity. During the last year, he spoke at conferences organized in London by The Economist "Aging Societies and The Business of Longevity", Financial Times "Global Pharmaceutical and Biotechnology Conference", at the "Precision Medicine World Conference" in Silicon Valley, as well as several others at Oxford and Cambridge Universities. In addition to his business experience, Dmitry is involved in several scientific endeavors. He strongly believes that humans should live longer healthier lives. He has a major interest in anti-aging and healthy longevity which is reflected in his business, research and public activities.
Stimulus 3: AUTOMATION AND PRODUCTIVITY	

Jens Munch Lund-Nielsen (Global Trade & Supply Chains, **IOTA**)	Jens Munch Lund-Nielsen has built a life and career on bringing together different professional fields and sectors, thereby creating new types of partnerships. By carefully and deliberately mixing diverse experts and interests, he has built new ventures and created impactful partnerships—especially within the field of supply chains and global trade. Prior to joining the IOTA Foundation, he held different roles within A.P. Moller—Maersk including launching a new e-trade platform for Africa, forged a partnership with a large bank to develop financial trade services with focus on emerging markets, co-founder of a public-private partnership (Global Alliance for Trade Facilitation with five governments, the ICC and the World Economic Forum). Jens holds a Master in Philosophy and a Global Executive MBA from INSEAD.
Alexander Zhebrak (Director of Product Development, **Insilico Medicine**)	Alexander Zhebrak, Director of Product Development at Insilico Medicine, background in computer science and mathematics, previously worked for large IT company, Mail.Ru, as an infrastructure and software engineering lead. Leads R&D team in Insilico Medicine.
Prof.Dr.-Ing. Werner Bick (Chief Representative, **ROI Management Consulting**)	Prof. Dr. Werner Bick has been teaching at the Technichal University of Applied Sciences Regensburg since 1995 in the area of supply-chain management, and since 1999 he has been Chief Representative of the ROI Management Consulting AG. Prior to that, he worked in several management positions at Knorr-Bremse AG. He started his career as a consultant at ifm Prof. Milberg GmbH. Prof. Bick has many years of experience in the areas of product development, operations, and supply-chain management. In these areas, he has provided substantial support to numerous well-established enterprises in technology. He has been concentrating on the digitization of industrial companies for several years and is a much sought-after sparring partner and coach for IoT/Industry 4.0. He is the technical director of the "Industrie 4.0 Award" and has written several publications on the topic.

Stimulus 4: HOT TOPIC DEBATE ON LEADERSHIP

Alpesh Doshi (Founder, CEO, **Fintricity**)	Alpesh is a globally renowned thought leader in how organisations can transform and future-proof their business using emerging technologies, particularly around digital, big data & analytics and blockchain. He is focused on innovative thinking and practical strategies to add value for his clients fast and often, introducing the agile approach of working to digital transformation.

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