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Redefining supply chain agility through cognitive automation

Implications and use cases for Life Sciences & Healthcare companies

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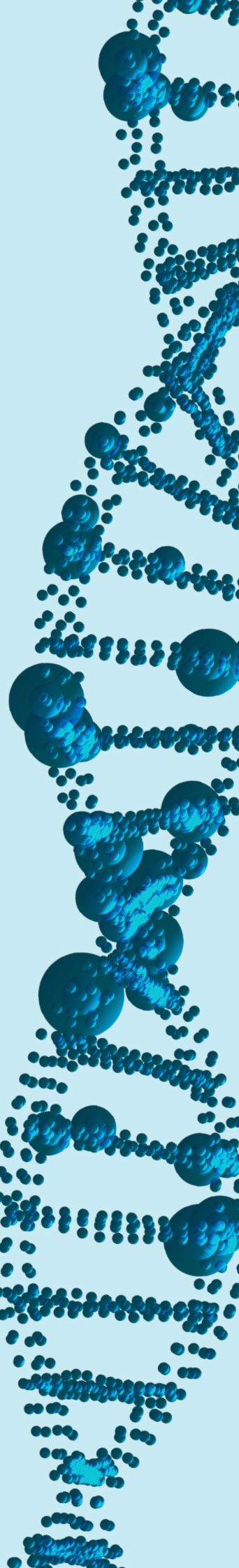
Redefining supply chain agility through cognitive automation

Implications and use cases for Life Sciences & Healthcare companies

Within this paper, we will see how the shift towards cognitive automation capabilities is expected to radically accelerate the transition from "people doing the work supported by machines", to "machines doing the work guided by people".

In particular, we aim to uncover the potential of cognitive automation for Life Sciences & Healthcare companies in their quest to develop more responsive and cost-efficient supply chain networks, with concrete use cases coming from the industry.

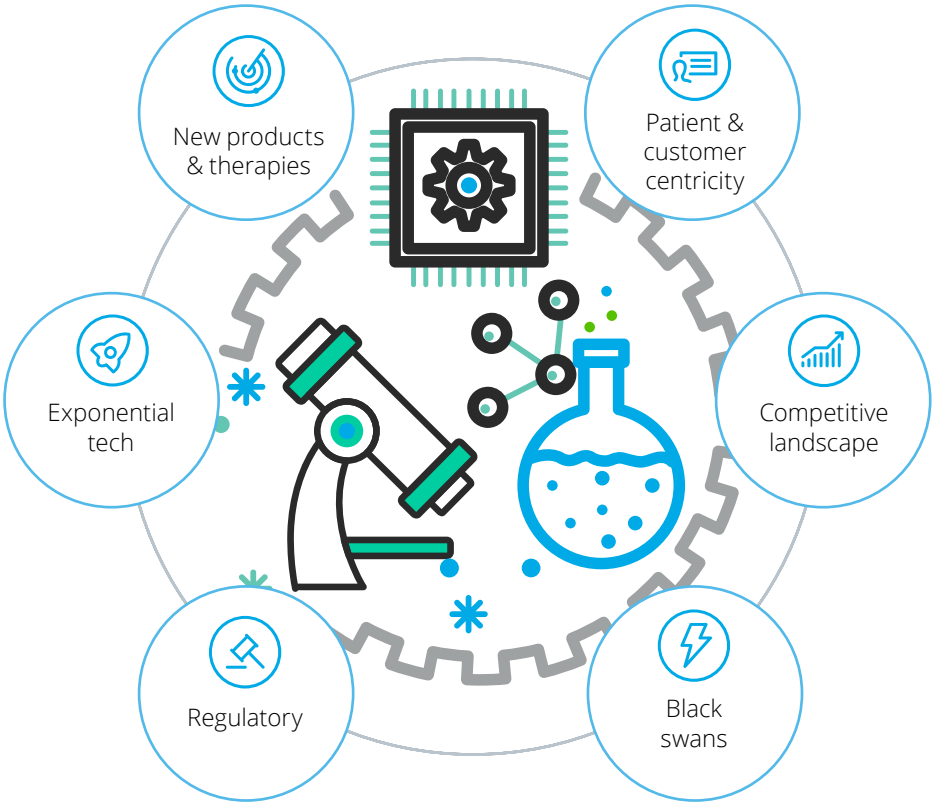
The paper does this over the following sections



Outside-in perspective: major trends impacting the Life Sciences & Healthcare industry

Amidst an era of global disruptions and technological innovation, markets and industries from all over the world are subject to faster and more impactful changes than ever. Many of these changes play a critical role in how LSHC organisations remain successful by harvesting new competitive capabilities and bringing value to their workers, patients and ecosystem partners. Levering insights from global trends and evolutions within the LSHC industry more specifically, we identified a series of some more general and industry specific trends changing the landscape today, towards the future of tomorrow.

Summary of trends impact Life Sciences & Health Care (LSCHC) supply chains



Patient & customer centricity

- **Rise of customer-driven supply chains:** This rise of customer expectations is putting a lot of pressure on the delivery capabilities of LSHC providers to obtain competitive service levels. Organisations need to re-think their distribution strategies, while realising that the concept of distribution is not just a supporting supply chain function, but rather a critical capability which has stepped forward into the spotlight of the customer experience. As a result, new ordering platforms and distribution channels need to be designed, allowing for a wider range of delivery channels and capabilities to provide maximum patient flexibility. These platforms need to be agile enough to support the increasing dynamic order behaviour of patients around the globe, whilst being well-integrated within the other supply chain processes to accommodate for smooth on-time and in-full deliveries, in a cost efficient manner.

34% of respondents say better customer service and engagement is the number 1 outcome they expect as a result of digital transformation (Source: Deloitte Analysis, 2020)

Competitive landscape

- **Rise of new players in the market:** New players enter the LSHC industry market on a continuous basis. Whereas some of the new players compete with very similar products and services (generic products, biosimilars, etc), others will completely disrupt the current way of working (Amazon in the prescription drug market as an example). When new players enter the market offering new products and services, innovation will be the main differentiator. Organisations will need to scan their radar continuously to spot and double bet on the competitive capabilities of tomorrow. These capabilities won't only take the shape of more familiar new types of products within the LSHC industry (bio-chemicals, gene therapy, etc), but also of products and services originating from other conventional industries (technology providers, distribution services, patient connectivity). Decisions will have to be made on where to in-source and invest, versus where to out-source and search for strategic partnerships.

- **Consolidation of players in the markets (M&A):** With the accelerating rise of (bio-) technological capabilities, new realms of life-science and healthcare are unveiled, leaving a vast sea of possibilities. This creates an ideal breeding ground for niche-players, start-ups, bio-tech companies and more, exploring new uncharted territories. Once these explorations prove fruitful, mergers and acquisitions are a common result for LSHC players to extend their capabilities in a competitive environment.

Innovation in the digital health startup space is booming globally, with over **20** countries housing digital health startups with more than **$100M** in funding. (Source: Deloitte Analysis, 2020)

Black swans

Observations in the field:

- **COVID-19:** The global pandemic is by far one of the biggest disruptors of the global economy and supply chains of the past decades, without exception for the LSHC industry. Whereas the vast majority of LSHC providers is dependent on the international flow of goods across different countries and continents, the impact of national lockdowns, travel bans, temperature check-points and other types of disruptions has rocked the foundations of many corporations. On top of that, employees falling ill at much higher rates than ever has put enormous pressure on production capacity as well.
- **Ever Given incident:** Disruptors of the international flow of goods can take many shapes. As an example, a single ship managed to bring about 8% of global trade to a standstill when it got stuck in the Suez Canal due to heavy winds. Needless to say, keeping any other ship from passing a main artery in the global flow of goods has dire consequences on organisations all around the world.

Nearly **90%** of healthcare providers plan to invest in a more agile and resilient supply chain over the next two years. The main strategy (81%) for achieving this is to work with key customers and suppliers to share data, align incentives and mitigate risk. (Source: Deloitte Analysis, 2020)

Regulatory

Observations in the field:

- **Rise of new industry rules and regulations:** The LSHC industry is subject to a long list of strict rules and regulations. This can be understood, whereas the organisations within the industry are dealing with valuable and sensitive assets: the health and wellbeing of their patients. In line with this, we see more and more pressure on the compliance of these regulations, with potential severe consequences should these be ignored. Some examples of these regulations can be found in the GDPR to protect patient sensitive data & information, or the serialisation of healthcare products to safeguard their authenticity.

Exponential tech

Observations in the field (examples):

- **Sensors:** The rising capabilities of sensors within supply chain processes have opened a doorway to new types of available data, generated continuously at real-time. Think about temperature sensors monitoring the conditions under which environment-sensitive products are stored and transported, or manufacturing sensors monitoring the performance of equipment to spot and highlight any inconsistencies which might lead to machine downtimes.

- **Connected patients:** The increase in data availability and data diversification is not only linked to the activities and operations within the organisational sphere, but it expands far outside into the environmental and demographic sphere as well. Every day, people are generating more and more data themselves, from participating in social media platforms, shopping for their favourite items online, to measuring their heart rate and blood pressure with smart appliances.

47% of the healthcare providers expect increased investment in consumer/user experience (Source: Deloitte Analysis, 2020)

- **Software as a service:** Over the last years, the capabilities of cloud computing have evolved drastically, changing the way technology and service providers bring value. Traditionally, major investments were required to install large and fixed on-premises servers to be able to capture, process and use all kinds of data and information throughout the different supply chain processes. This however is moving rapidly to focus more on cloud-based services which allow for flexible scaling based on the volumes needed by the organisation.

Impact on supply chains:

- **Need for integration and synchronisation:** The fact that these new technological capabilities can bring value is clear, but the exact way how this value can be realised however can prove challenging. Very often, these capabilities are part of a series of different applications or solutions which focus on rather specific and isolated problems. With hundreds or even thousands of different solutions available and all designed by different providers, it is a very complex exercise to select the right ones, integrate them smoothly within your end-to-end supply chain processes, and synchronise them all with one another to let them work as a seemingly single solution.

Digitalisation initiatives are accelerating with nearly **30%** of life science and healthcare organisations actively pursuing revenue growth associated with digital business models (Source: Deloitte Analysis, 2020)

New products & therapies

Observations in the field (examples):

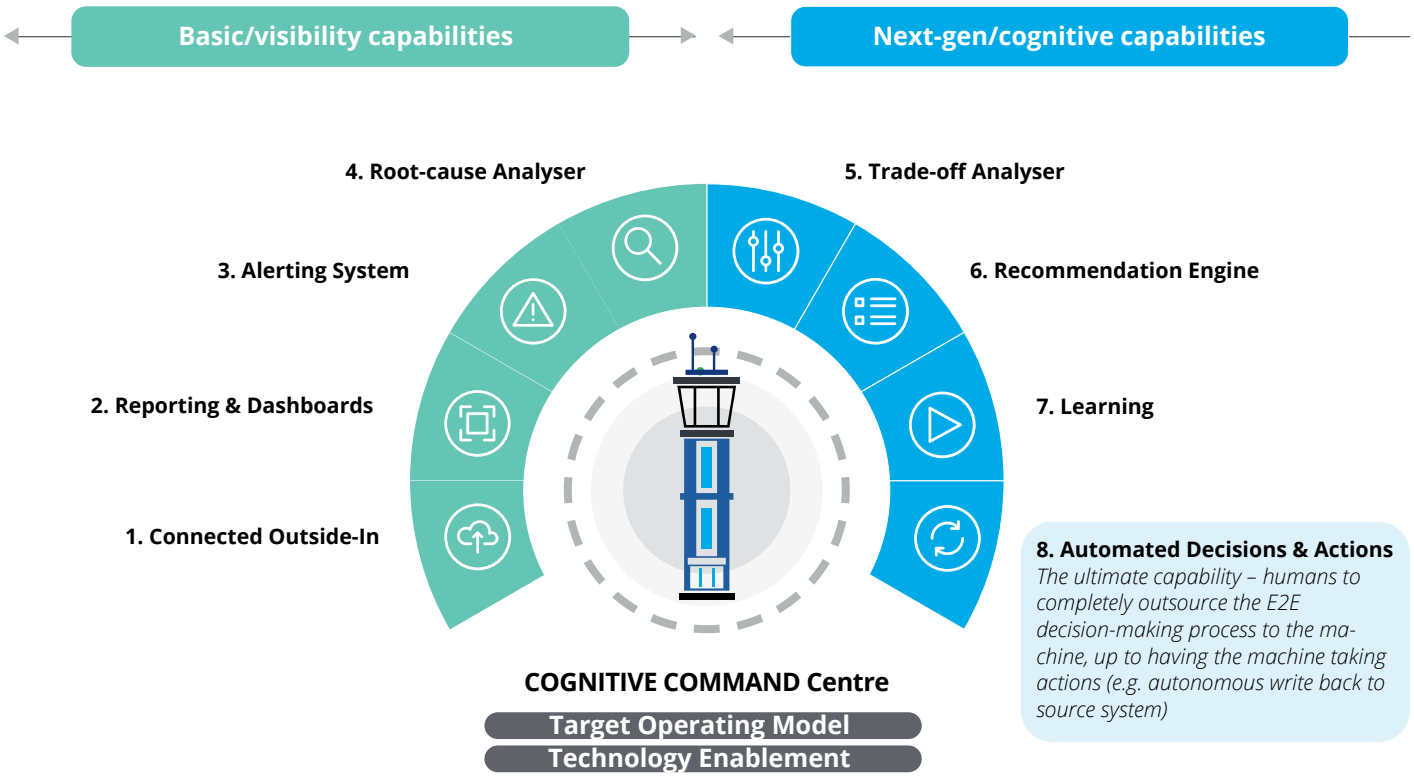
- **Rise of patient-centred therapies (e.g. CAR-T):** With the advancements in medical technologies and therapies, more personalised products and services are developed for patients. These patient-tailored therapies are mostly applied to rather complex and/or advanced stages of diseases and illness, where other more traditional forms of medications have failed. Although these new forms of therapies bring new hope in rather challenging health conditions for patients, they also require a new way of working, and collaboration. Compared to more conventional LSHC products and services, patients and other stakeholders (hospitals, laboratories) come to play a more important role within the end-to-end delivery and transformation processes. An example of this is the CAR-T Cell Therapy (*see example use case #1).
- **Rise of late-stage customisation (e.g. 3D printing):** Another example of patient-tailored products can be found in the rise of 3D-printed prostheses and other forms of medical devices. With the capabilities of 3D printers significantly increasing, this technology can be applied to a wider range of products, with far greater accuracy and suitable for all sorts of different use cases.

With more than **900** companies globally focused on such advanced therapies, the industry expects to have as many as 10 to 20 new therapies per year starting in 2025. (Source: Deloitte Analysis, 2020)

The rise of the Cognitive Command Centres

We have seen in the previous section that today's traditional supply chains are being challenged and put under pressure. Contexts, players, products and regulations are changing, providing no guarantee that the organisations which are successful in the world of today will still keep their competitive advantage over the years to come. Leveraging advanced cognitive automation technologies such as data crawling, data analytics, machine learning and workflow optimisation and automation, the Cognitive Command Centre is an enterprise capability which allows the ecosystem of stakeholders to proactively identify and resolve exceptions from day-to-day and business-as-usual transactions. Here, organisations gather data from operations and transactions across their end-to-end supply chain (or "Digital Supply Network"), centralise and structure the information in a "digital core", and use the output to increase visibility into key performance indicators and metrics, complex decision-making processes.

Cognitive Command Centers: a platform combining existing and next-gen supply chain capabilities



Watch our video: Deloitte and the future of 'Self-Driving Supply Chains' here.

Up next in this article

In that context, Deloitte has identified a wide spectrum of tasks and use cases that can be "outsourced" from traditional teams (e.g. customer service agents, planners, transportation specialists) to smart agents belonging to "Cognitive Command Centre", and that are responsible to autonomously drive:

- End-to-End Supply Chain Visibility
- Demand Forecast Optimisation
- Production Yield Optimisation
- Supply-and-Demand Balancing
- Smart Procurement
- Capable-to-Promise
- Customer Service Assistant
- Pro-active Logistics Execution
- Touchless Master Data Management

In this article, Deloitte chose to highlight three specific, real-life use cases coming from the Life Sciences & Heathcare industry, and for which the concept of the (Cognitive) Command Centre is particularly relevant and beneficial to their supply chain.

These three use cases in the spotlight are:

Use case #1: Enabling the Command Centre Eagle Eye for emerging cell and gene therapies

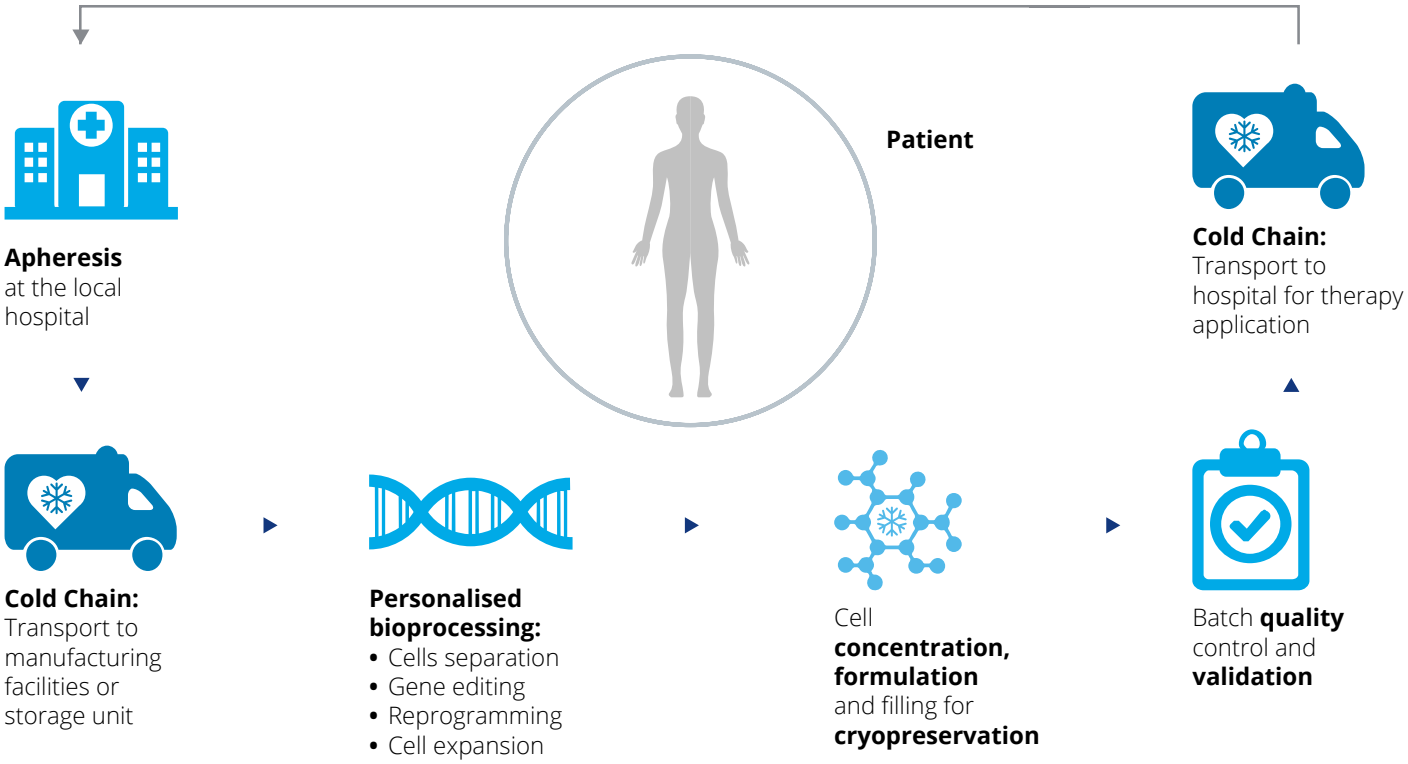
Use case #2: Enabling a Cognitive Command Centre to support the supply of COVID-19 vaccine around the world

Use case #3: Enabling a Capable-to-Promise capability from your Cognitive Command Centre

Use case #1
Enabling the Command Centre Eagle Eye for emerging cell and gene therapies

What is CAR-T ?

The CAR-T cell therapy is a revolutionary new type of product & service where a patient's blood is collected, after which chimeric antigen receptors are added to the "T" cells, and finally the blood is re-injected into the patient's bloodstream. The T-cells are part of the natural immune system of the patient, which typically targets all sorts of viruses like the common cold or influenza. However, after these gene-modifications, these cells are then equipped and enhanced to very specifically attack otherwise undetectable or unidentifiable cells. Although CAR-T and other autologous therapies hold promising results for the treatment of cancer and other diseases, it also brings new challenges to more traditional healthcare providers due to the differences in the requirements linked to the manufacturing and delivery processes compared to more traditional chemical drugs.



Cells are traced by means of a manufacturer-provided chain of identity (COI#), which is mapped to all other key trackers generated along the treatment journey.

Supply chain challenges within CAR-T cell therapy

CAR-T is an autologous therapy, which means it needs the patient's specific biological components to undergo a series of complex, clinical intensive and costly transformation steps. Naturally, these transformation challenges are also further translated into supply chain operations challenges.

- **Complexity 1 - Time, temperature sensitivity:** In the case of autologous therapies, the patient's blood is apheresed and collected in a certified laboratory environment. The apheresed white blood cells have a short half-life, often only a few hours, before the quality could begin to deteriorate. To ensure apheresed cells maintain viability, specific temperature requirements (ultra-cold ice or liquid nitrogen storage) must be fulfilled. The same applies for manufactured CGT products (both allogenic and autologous), which need to be stored and handled with precision and care (e.g. CAR-T needs to be kept at – 150°C), impacting the supply chain capabilities beyond those of traditional pharmaceutical products. As a result there needs to be an increased focus to maintain product veracity and process timeliness even in case of unplanned events, like the most complex procedures such as organ and cell transplantations.

- **Complexity 2 - Closed-loop supply chain:** Unlike traditional pharma products which begin their journey at the point of manufacturing, shipped to storage warehouse and distribution centres before final delivery at treatment sites, the CGT journey begins and ends with each individual patient. For gene therapies, this closed loop value chain could begin with a unique diagnostic test (antibody testing for specific viral vectors for gene therapies) and for autologous therapies, apheresis of cells at the treatment site or a specialised apheresis site. In addition, with each product being unique and individualised to each patient, every product batch needs to be monitored, tracked across the closed loop supply chain to maintain chain of Identity and custody leading up to final delivery and infusion.

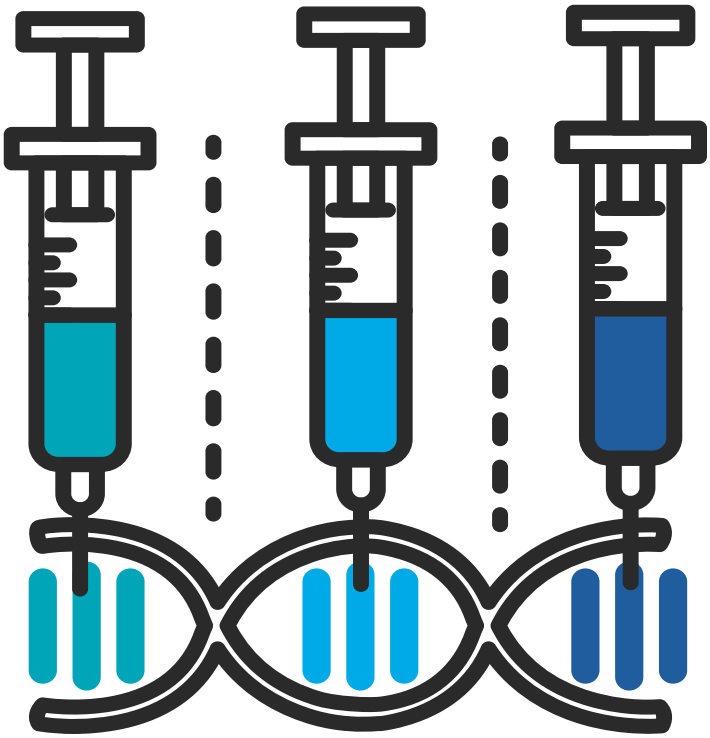
- **Complexity 3 - Low volume, high value:** Being patient specific and currently centreed around rare diseases or last-lines of therapy, CGT often serves limited patient populations compared to traditional pharma products, due to low disease prevalence or a strict patient eligibility criteria. The low volume combined with a highly complex manufacturing process translates into the high value pricing of CGT products. The cost for manufacturing one batch of a CGT product typically varies between $500,000 and $1m, confirmed by the price tags of some of the currently marketed CGT products. The significant financial burden associated with CGT poses an unprecedented challenge, to biopharmaceutical companies, supply chain partners, treatment centres and medical care payers. The cost forces organisations to fundamentally rethink the traditional commercialisation models including pricing and contracting modalities.

Discover more Deloitte insights around cell and gene therapy here.

- **Complexity 4 - Make-to-order:** Due to the high value, patient specific nature and ultra-short shelf life of CGT products, cell therapies can be manufactured after collection and shipment of patient apheresed blood cells to the manufacturing site (autologous therapies) or in the case of in-vivo gene therapies, only allow for very limited inventory of finished products. In the case of make-to-order gene therapies, labelling of the end product can be a two-step process: a product label is affixed once the product vial batch is manufactured and a second one tailored to the individual patient during fulfilment. The second label could contain highly specific patient details, with COI and COC information, and prepared to a weight-based dosing. Hence, these supply chain requirements necessitate close coordination between treatment centres and biopharma companies within the same country or across international borders.

- **Complexity 5 - COI/COC and end-to-end visibility:** **Chain of identity (COI)** refers to the end-to-end traceability of a drug right from raw materials sourcing (which in the case of autologous cell therapies refers to the patient) to preparatory steps leading to manufacturing and finally delivery and infusion. A COI being established often refers to the unique identifier generated at patient enrolment, and this identifier being visible and traceable throughout the treatment journey. For instance, as part of the COI, an autologous donor's patient number should be associated with their unique donation number (donor identification number/DIN or SEC number) and the manufacturing batch number.

Chain of custody (COC) refers to the ownership/stakeholder 'in-custody' of the cells or drug product, at any stage of the value chain. COC often includes reporting several critical parameters (if required to regulators) to healthcare professionals who look out for the quality and integrity of the cells/ drug-product at every step of the journey. COC often supports decision making on out-of-spec products with reading on concentration of cells, temperature, pressure and qualitative parameters such as abnormality in colour, sedimentation when not intended to happen etc.



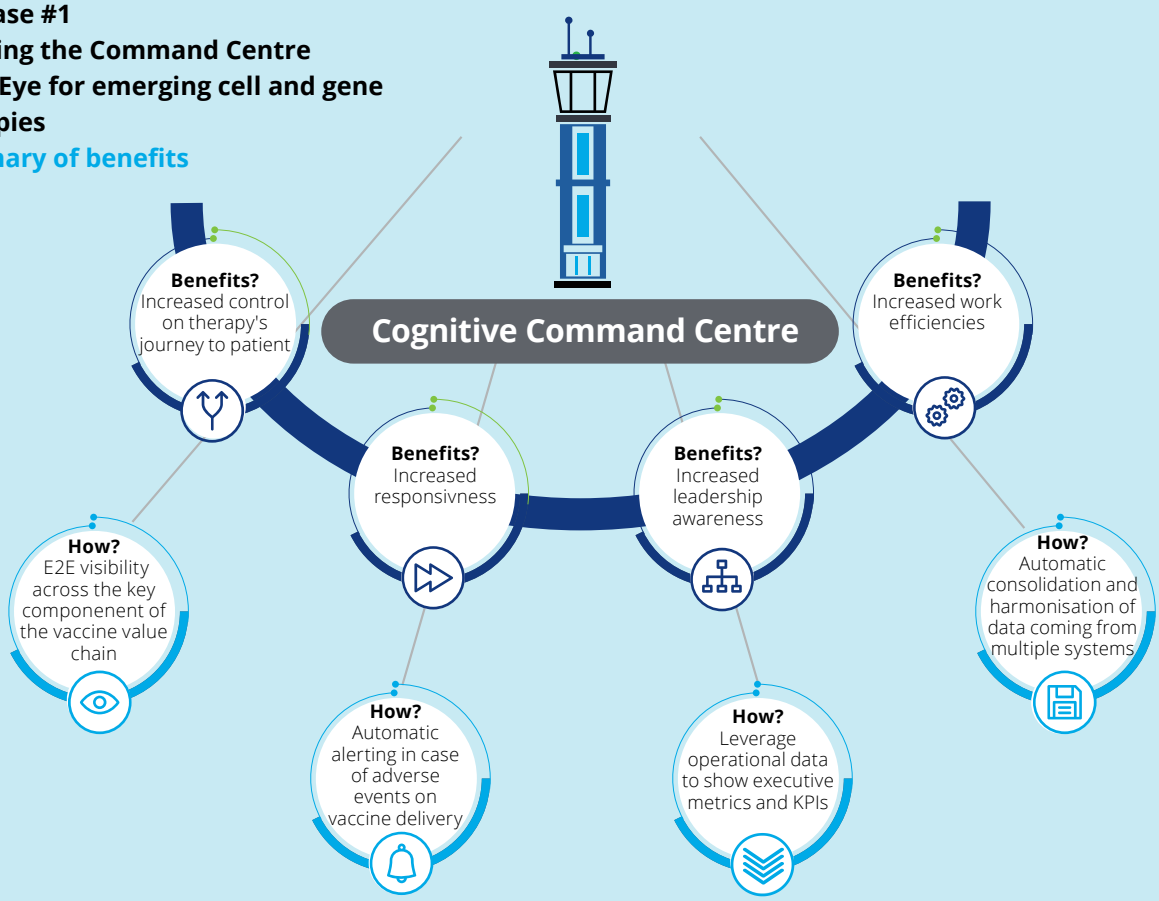
The (Cognitive) Command Centre as an answer

Based on the above mentioned complexities brought forward by emerging cell therapies like CAR-T, it is clear that end-to-end visibility becomes a critical capability for an organisation to keep track of the different products, stakeholders, and transformation processes along the way. This can prove to be a challenging task as the required data and information for this is scattered across different information systems, supply chain domains and even entities. The concept of cognitive command centres can help overcome these challenges by bringing together data and information from all over the patient-to-patient processes into one central location. This data can then be used to generate a list of complementing reports, dashboards, alerts and other capabilities, and thus provide the necessary tools to control and orchestrate the end-to-end transformation processes. A fitting example could be:

- **Track-and-trace capabilities** to continuously monitor the locations, transformation processes and patients linked to the products along the end-to-end supply cycle. This could be done by integrating COI/ COC applications, and combining them with other supply chain related metrics to allow for better understanding of lead time variability, information transparency towards patients for a better customer experience and better planning capabilities on all the activities within the supply cycle.
- **Dashboards** to continuously **monitor the temperature** at which the products are stored or transported, enabled by Internet-Of-Things sensors, and equipped with alerting mechanisms in case temperature required conditions are breached.

Next to this visibility layer, **cognitive layers** can be added on top to further address the potential risks which might occur during each of the mentioned activities, and propose action-driven recommendations to mitigate these risks. Think about **predictive algorithms** which could monitor the conditions under which the products are transported, proactively detect potential problems which could jeopardise these conditions, and recommend corrective actions to prevent these risks from happening.

Use case #1
Enabling the Command Centre Eagle Eye for emerging cell and gene therapies
Summary of benefits

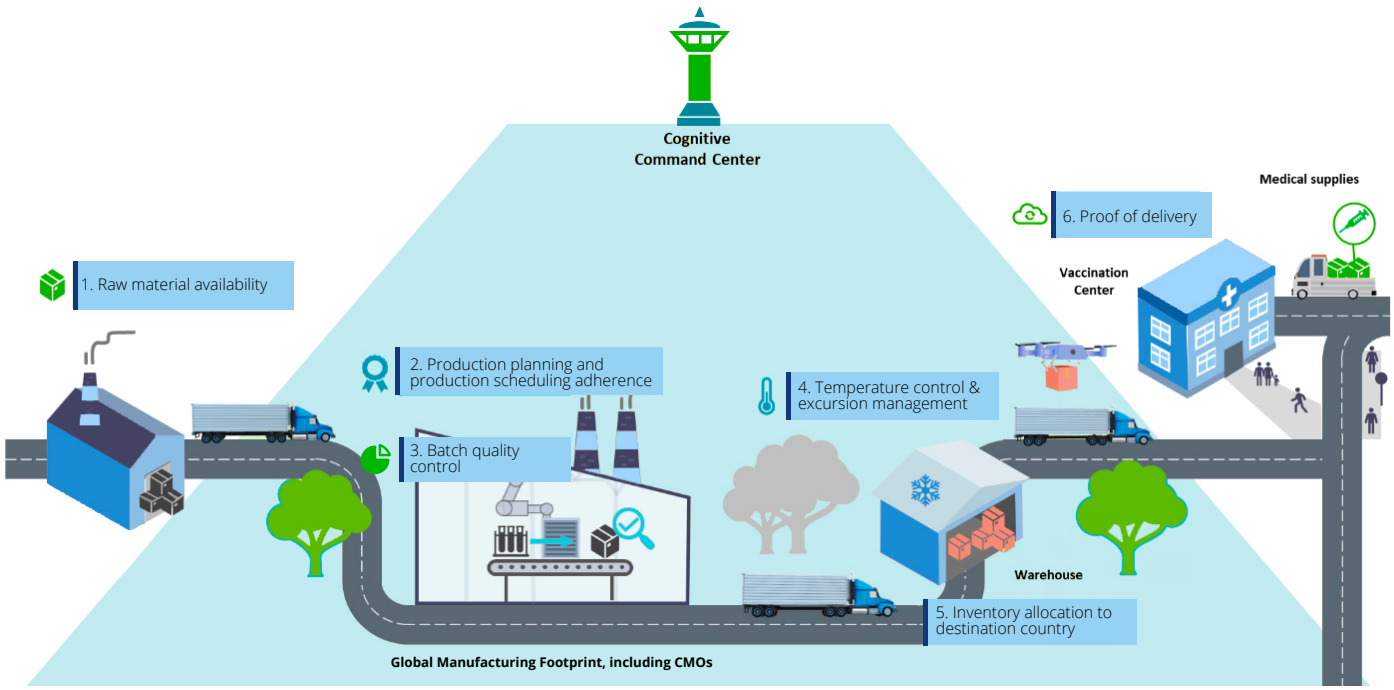


Use case #2
Enabling a Cognitive Command Centre to support the supply of COVID-19 vaccines around the world

COVID-19 context

Globally, as of 25 October 2021, there have been 242,7M confirmed cases of COVID-19, including more than 4,9M deaths, reported to the WHO. [1] Alongside its devastating human impact, the pandemic has exerted unrelenting pressure on pharma and healthcare supply chains. COVID-19 has exposed the fragility of our medical supply chains and highlighted their global interdependencies and vulnerability to shock. We have also experienced major challenges in the medical equipment supply chain, including manufacturing, transport and distribution of testing kits, personal protective equipment (PPE) and ventilators. The scientific world has shown tremendous speed in the development of a vaccine. However, these challenges pale in comparison to the huge task ahead of us in getting life-saving COVID-19 vaccines to people around the world, in record time, to halt the spread of this virus.[2] Although a total of ~3,8 B COVID-19 vaccine doses have been administered so far globally, the sustained success of COVID-19 vaccine production and distribution will hinge on a strong collaboration of complex networks of government, pharma companies, Contract Manufacturing Organisations, logistics service providers, health workers and public institutions.

A Cognitive Command Centre helping to synchronise across the critical steps within the E2E COVID-19 vaccine supply chain (simplified view)



1 https://covid19.who.int/?gclid=Cj0KCQiA3smABhCjARIsAKtrg6KYUF6JpEHI5u2ipXd-ZrvybxSOixpzKXZAGdk8NAO902i9yCyvcfYaArPTEALw_wcB dd.
2 Vaccines like it (very) cold – how to build a resilient COVID-19 vaccine supply chain - Thoughts from the Centre | Deloitte UK

Supply chain challenges for vaccine manufacturers

Although the challenges to make this journey a success are countless, our experience in the field has taught us that the most critical ones are:

Upstream of delivery:

- **Market allocation:** Governments and industrials need to think about allocation scenarios whenever the capacity at key supply node is insufficient or in case along the chain events happen that destroy the vaccine's effectiveness. Today, several leading pharmaceutical companies have already announced they will not be able to deliver all promised doses of vaccines to some countries[3], hence capacity issues are already happening and there are no clear solutions yet present. Who will be prioritised when the agreed doses are not delivered upon: will countries get a pro-rata share or will a country's risk of collapsing healthcare situations define the priority setting? Outside of the life sciences business, stock would be logically allocated to the most profitable markets. On the contrary the WHO prescribes that all countries – regardless of their developmental or economic status - should have access to a share of these products once they are available. For this principle to be realised, the world needs a clear, transparent and broadly accepted framework and mechanism for access and allocation based on objective criteria such as that the WHO tries to capture in the newly created COVAX framework[4]. Critically[5], if one only manages to get 50% of the population vaccinated, the campaign will have failed as there is no chance of achieving adequate levels of immunity with vaccination rates lower than 70 to 80%.

- **Contractual policies:** As supply and distribution requirements are an essential component of the contractual agreement between COVID-19 vaccine manufacturers and (supra-) national bodies, manufacturers need to ensure that these are being rigorously respected. Strict requirements around traceability, supply availability, minimum order quantity, payment terms, delivery frequency and imposed partnerships with inter-governmental organisations (e.g. with UNICEF for deliveries falling under the umbrella of the COVAX framework) need to be planned for, and sustained in the long run.

Across the supply chain

- **Temperature control:** Vaccines require along the complete process a cold chain with end-to-end temperature control as they need to be kept at low temperatures. Traditional vaccines typically require refrigeration between 2 and 8°C.[6] Any exposure to inappropriate conditions, such as higher temperatures, could reduce or even destroy the vaccine's potency. This is particularly difficult in warmer climates and remote locations.[7] Several COVID-19-vaccines use an RNA-based technology approach, which, despite its ease of manufacturing and scalability, requires sub-zero temperatures for storage and transportation as low as -80°C. The existing global vaccine cold chain has not had to work with such low-temperature requirements, especially not at the scale that is now required. Dry ice - solid carbon dioxide, which sublimates at −78.5°C - is currently used as a solution to keep RNA-based vaccines frozen for a period of time during transportation and distribution without the need for on-board freezer-units. How will we ensure, however, the temperature requirements have not been violated and is there a way in which we can pro-actively intervene in case of any risk?

- **Traceability:** From temperature control to traceability is only one small step. Traceability along the chain needs to be impeccable and this goes further than temperature only. Given the current speed at which vaccines move from the production line to the patient, pharmaceutical companies need to be able to trace back where potentially contaminated or non-qualitative vaccines are, to timely intervene. Governments will need to follow-up which percentage of the population already had a first and potentially a second vaccine. Important to note is these two vaccines need to be injected within a specific time span of a few weeks to make sure the vaccine has sufficient coverage. This makes the logistical puzzle even more complex. Vaccines have an expiry date, as do all medicinal products. Distribution centres need to have the right systems in place to distribute the vaccines First Expired First Out to avoid any vaccine needing to be scrapped.

3 https://www.reuters.com/article/us-health-coronavirus-italy-pfizer-idUSKBN29U2924
4 https://www.who.int/initiatives/act-accelerator/covax
5 https://www.un.org/sites/un2.un.org/files/sg_report_socioeconomic_impact_of_covid19.pdf, accessed 5 September 2020

- **Capacity issues along the chain:** Capacity constraints can occur at different stages: the manufacturer (and their CMO network) needs to have raw materials, packaging materials and production employees available at the right place and time. The production lines need to work smoothly, at full speed and without any interruption. After production, there needs to be sufficient capacity for storage within the temperature boundaries. Currently, all produced stock is almost immediately being transported as we are still in the beginning of the vaccination campaigns. Pharma companies are ramping up stock to ensure that once the campaign is at cruising speed, it is not hampered by any unforeseen event. Many countries have, however, recently encountered **new variants** (e.g. COVID Delta Variant) of the initial coronavirus. A company's global manufacturing network is thus expected to show a tremendous amount of agility as R&D teams might still change the composition of the vaccine, if it seems the current vaccines do not work against the new variants.

- **Transport-capacity and infrastructure:** When all the previous stages are finished properly, the next hurdle arises as there needs to be sufficient transportation capacity, be it via air or road. Knowing that the amount of logistics service providers that can guarantee the cold chain is limited, this seems to be a risk. Capacity is not the only risk transportation encounters. At the end of December 2020, distribution of vaccines started in the US and Western Europe and this is only the beginning as two thirds of the world's population is living in areas where infrastructure is far from ideal. Getting the vaccines delivered to the major population hubs in these areas will be challenging, however getting to the extremely remote villages will be very hard to manage.

- **Vaccine administration:** At the end of the chain, healthcare authorities around the globe need to mobilise an extraordinary amount of skilled people to get the world's population vaccinated. Given the fact that these healthcare workers are in the front line and thus most susceptible for the disease, these resources are scarce. Whether the healthcare workers will receive the vaccination at first or not, remains at the sole discretion of the different governments and is thus an important part of a country's vaccination strategy.

All the above challenges, amplified by the magnitude and urgency of the situation, is requiring an almost unprecedented mobilisation of financial resources, people, regulations, science advancements, private-to-public partnerships and operational excellence. These challenges also reinforce the need to move from the traditional supply chain towards a more digital and inter-connected supply chain, ready to cope with the need for traceability, agility and information sharing. As noted in Deloitte's report *Intelligent drug supply chain: Creating value from AI*[8], artificial intelligence, blockchain and other analytical technologies are poised to transform supply chains and manufacturing through real-time data processing and decision making, with end-to-end visibility and traceability, as well as forecasting and predictive capabilities. This will ensure the effectiveness and safety of the vaccines when they reach their destination. Regarding the challenge on the last mile, robots and drones can play a major role across the COVID-19 vaccine supply chain, particularly in the distribution and delivery to the most vulnerable and inaccessible geographies.

Intelligent drug supply chain: Creating value from AI report here.

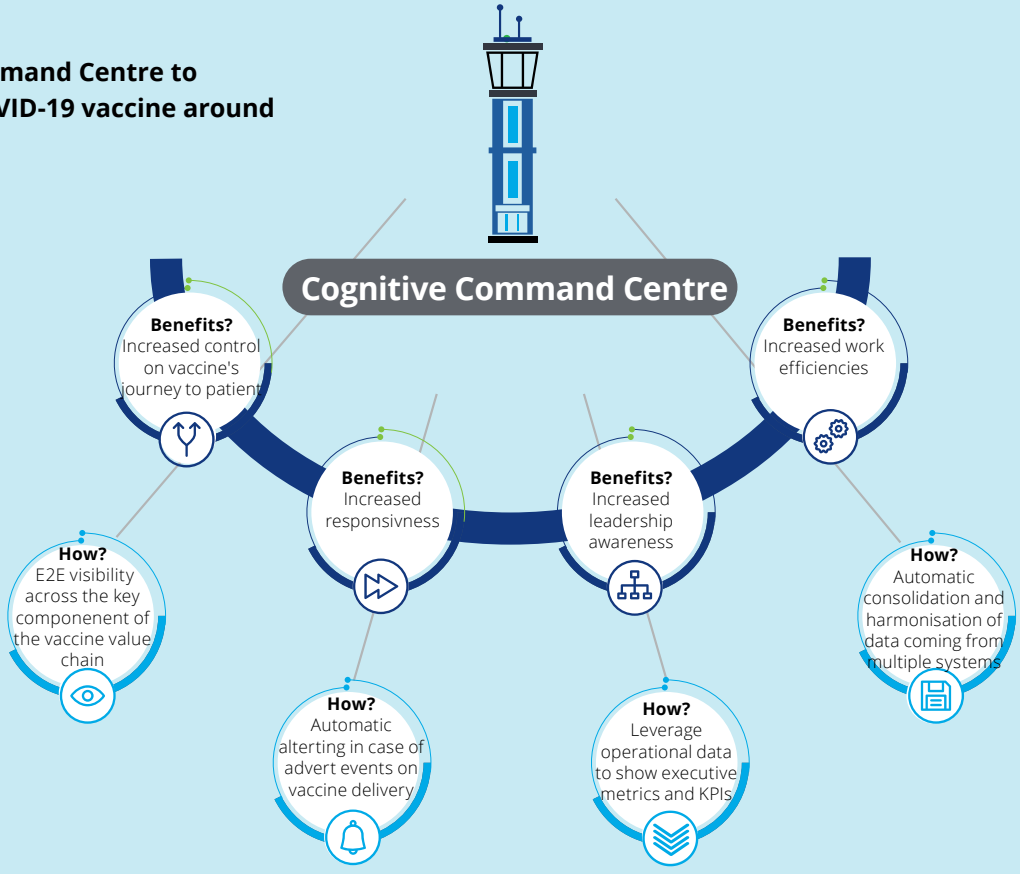
8 https://www2.deloitte.com/content/dam/insights/us/articles/nse32976_intelligent-drug-supply-chain/DI_Intelligent-drug-supply-chain.pdf

The (Cognitive) Command Centre as an answer

Pharmaceutical companies are using this cognitive software to help them shape their supply chains and looking for optimal coordination between manufacturing, distributing, storing and transporting the vaccines around the globe. It could also enable connecting the different stakeholders in the ecosystem to ensure outages, quality issues and delays are quickly spotted and tackled to avoid any dose of the long-awaited vaccines goes to waste.

- **Visibility:** The real-time time monitoring of production, inbound and outbound shipments, stock levels and percentage of people vaccinated is definitely enabled by the visibility layer that this software adds on top. In one view, all stakeholders are able to create customised KPI dashboards. These dashboards also enable decision makers to focus on whatever should be corrected and alert when certain measures are outside of boundaries.
- **Traceability and temperature control:** A leading pharma company already demonstrated the effectiveness of such a Command Centre as it was alerted mid-December that three shipments were recording colder temperatures outside internal specifications during transit. The Command Centre immediately worked to have those three shipments returned while in transit and the company was able to ship replacement doses in parallel, which arrived either the same day or early the next morning[9]. On shelf-life monitoring, the Command Centre has a proven record as well. As production capacity will gradually increase, pharma companies will be able to create inventory buffers at key nodes in their supply chain to avoid stock-outs. The ability to monitor the shelf-life of the products held at these nodes will be key to prevent inventory obsolescence and destruction. Eventually, the Command Centre will enable companies to have 80% of their decisions automated and machine-based. A minority of decisions will still rely upon humans, however AI will still support as it prompts to make the right decisions on time.

Use case #2
Enabling a Cognitive Command Centre to support the supply of COVID-19 vaccine around the world
Summary of benefits

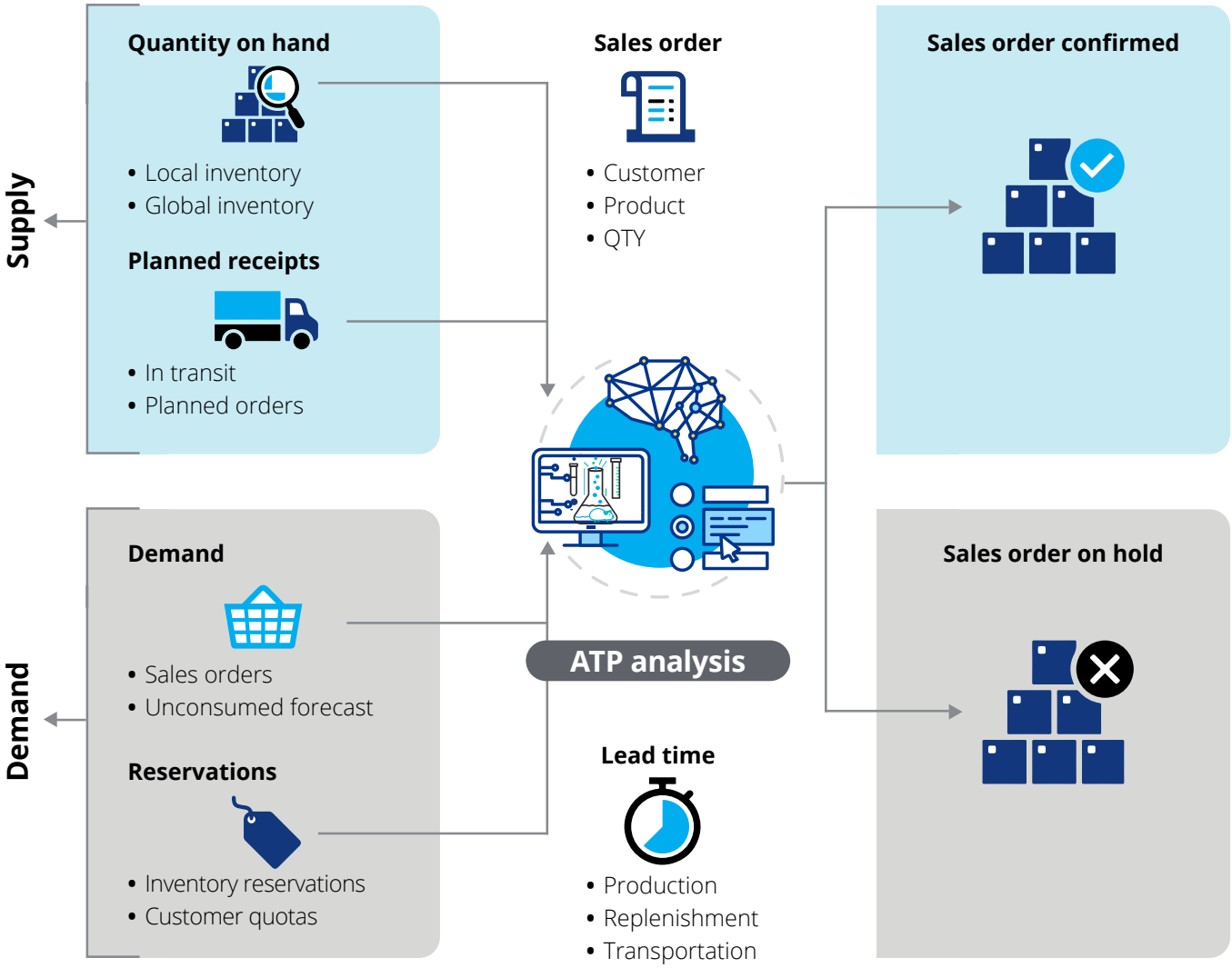


9 https://www.supplychaindive.com/news/pfizer-vaccine-deliveries-turned-around-after-becoming-too-cold/592447/

Use case #3
Enabling a Capable-to-Promise capability from your Cognitive Command Centre

What is ATP ? What is CTP?

Available to promise (ATP) is the ability of an organisation's supply chain to determine how much inventory of a certain product it has (or will have in the (near) future), and which portion of that is not yet allocated, and thus available to be promised to "other" customers. Typically, there are two ways ATP can be implemented, based on what is called the push versus pull strategy. With a push strategy, ATP inventory analysis can be used to help forecast future demand. Past sales, combined with growth expectations, dictate what is held in inventory. A pull-based ATP strategy however is responsive to the actual orders placed, so inventory is allocated as each order comes into the system. In this situation, ATP is performed in real-time so that resource availability can be checked immediately, or in batches, when inventory is checked at certain intervals.



In line with the trends of increasing customer expectations and the increasing competition across multiple channels like wholesale, e-commerce and bricks & mortar, ATP supply chains are becoming increasingly necessary in order to meet customer expectations and make sure complex inventory management processes run smoothly.

In addition to ATP, **capable to promise (CTP)** supply chains look at product demand, and match it to the company's peak operations capabilities. Unlike ATP, CTP is benchmarked to a company's peak production, while ATP looks at the inventory forecasts and availability. While ATP considers available inventory on hand for purchased and manufactured items, CTP inventory also accounts for inbound purchase receipts, supplier lead times, alternative sourcing options, and availability of raw materials and labour. During an order entry, a CTP supply chain factors in all of these items to estimate a customer delivery date.

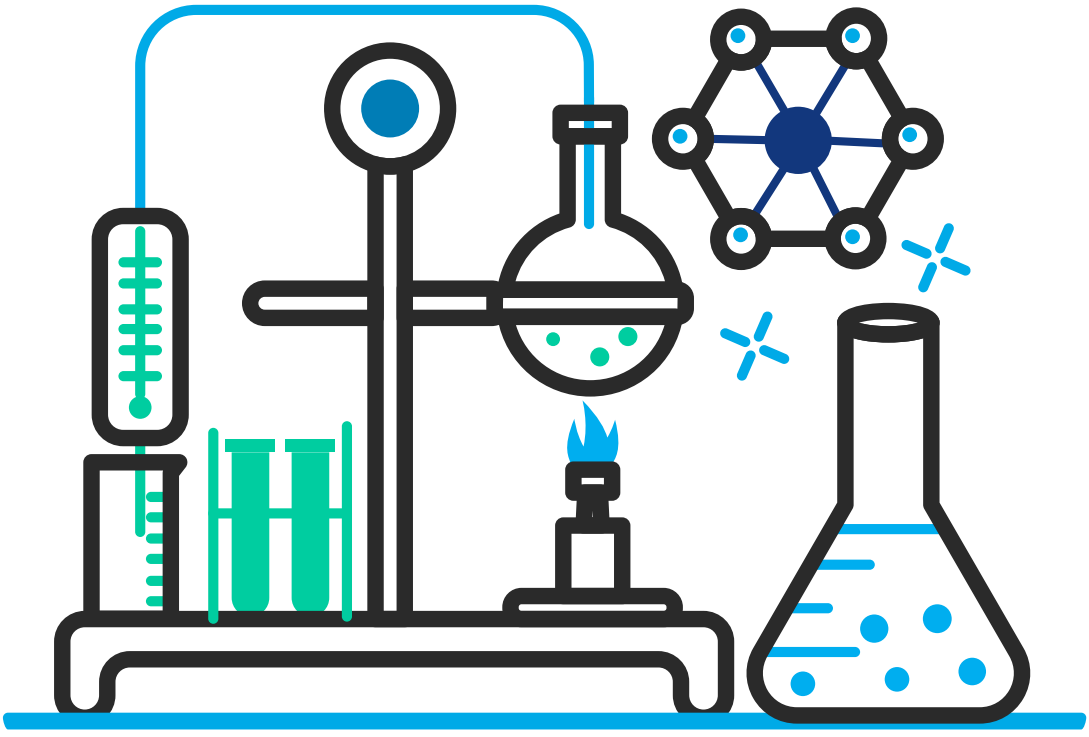
Supply chain challenges for ATP and CTP

The concepts of ATP and CTP might sound straightforward enough, but in reality faced with a series of challenges in order to be calculated continuously, detailed and accurate.

- **Increasingly complex ordering channels:** With the rise of digital platforms allowing customers to place orders via an increasingly long list of different channels, the ATP and CTP exercises become more complex. These different channels need to be synced continuously to the inventory systems to be able to give customers an accurate answer on product availability, expected delivery dates, and thus providing them the desired customer service.

- **Traditional static and theoretical ATP:** In more traditional ERP planning software, ATP is fundamentally a more theoretical and rule-based calculation. Applying fixed lead times and inconsistent allocation rules , these ATP calculations can turn out unreliable and not as an accurate representation of reality.

- **Complex CTP calculations:** As mentioned above, the CTP principle takes it a step further by including a wider range of data components, thus providing a more accurate picture of which customer orders the supply chain is able to fulfil. However, taking all this additional information into account is not an easy task. On a continuous basis, different inventory, manufacturing and transportation processes both up-and down-stream need to be synced, so that an accurate CTP answer can be provided.

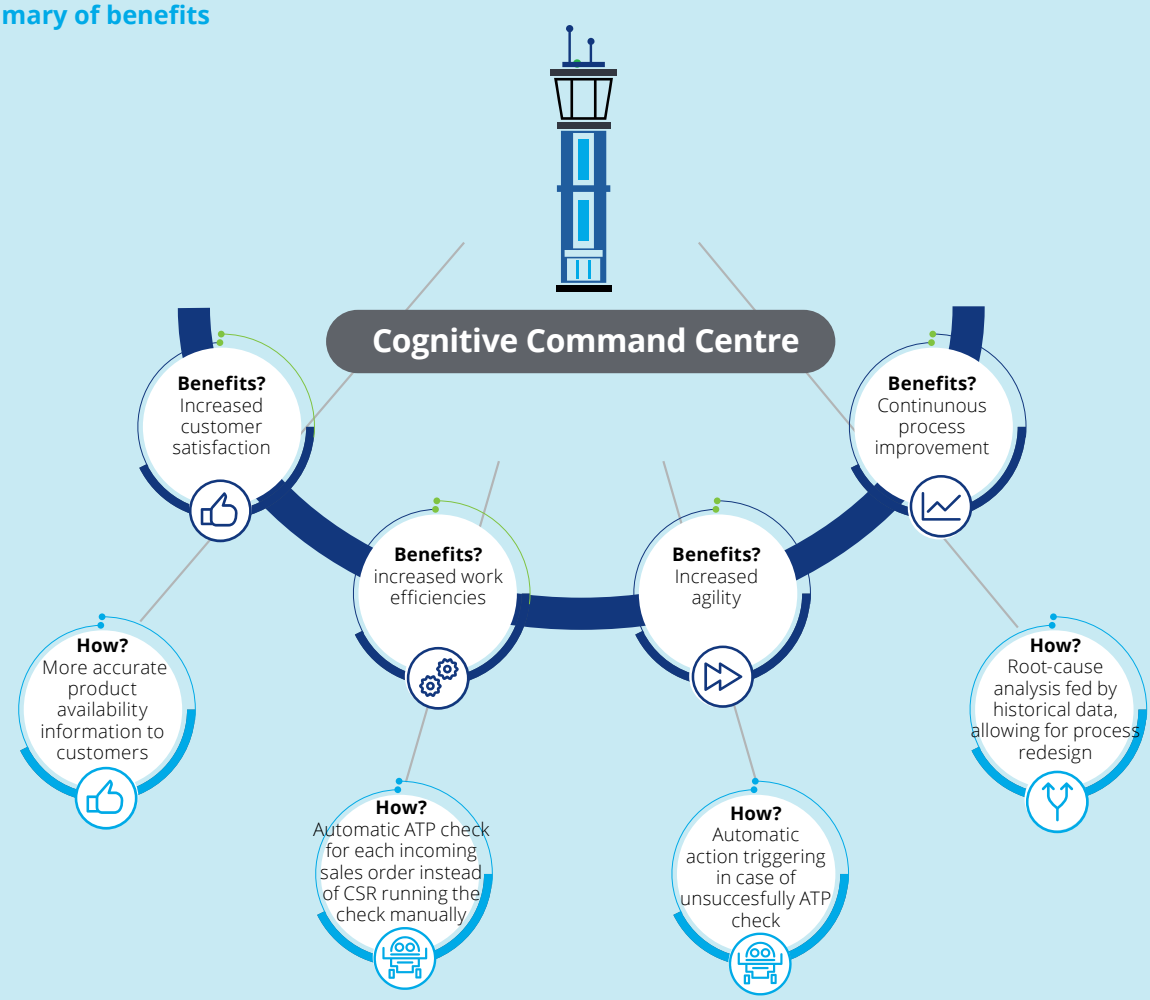


The Cognitive Control Centre as an answer

Based on the above mentioned challenges, organisations are in need of an holistic overview on the status and performance of the different end-to-end supply chain processes. This is something organisation across all industries struggle with, as all this data and information is scattered across different systems, information flows and supply chain functions. This is where the concept of the Cognitive Control Centre comes into play.

- **Harmonised data enabled by crawlers:** With the use of data crawlers and other data extraction technologies, the cognitive command centre can source, extract and structure different data components from all over the supply chain. Applying standardised data structures and intelligent data interpretation technologies, real-time data can be gather centrally on a continuous basis with little to no human intervention.
- **Smart ATP/CTP calculations:** Visibility solutions (i.e. dashboards, reports) can be designed on top of cognitive use cases, designed to calculate ATP and CTP with the help of AI and advanced learning algorithms. Rather than using fixed ERP planning parameters like theoretical lead times, correlations between lead time variations and potential variability drivers (e.g. machine down-time, employee absence, expected back-orders) can be observed and analysed to provide more accurate allocation quantities and expected delivery dates.

Use case #3
Enabling a Capable-to-Promise capability from your Cognitive Command Centre
Summary of benefits



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Conclusions

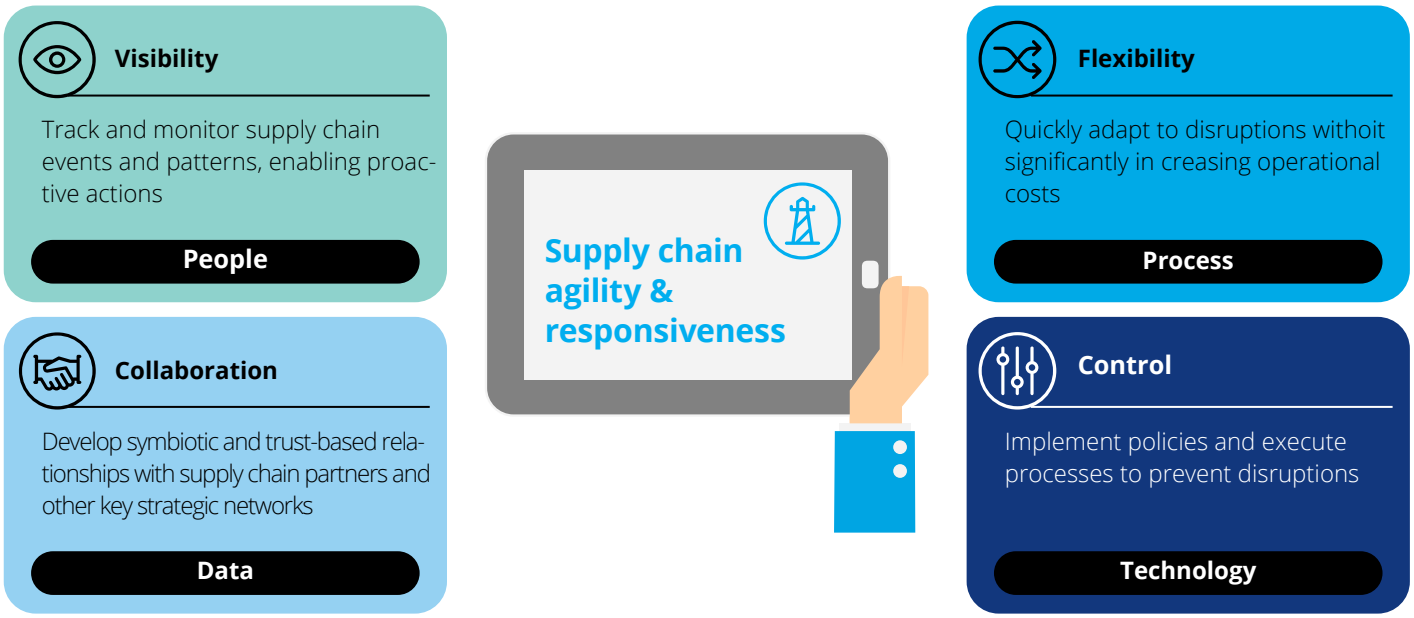
Taking into account the volatile context of today, and looking ahead at how we see the LSHC environment evolve towards the future, one thing is clear: to thrive, LSHC organisations will need to be resilient and agile in the way they manage their risks and opportunities. Although risk management has always been an important part of supply chain management, the pace and impacts of market disruptions are growing. Agility however comes at a cost.... For example, storing vast amounts of inventory buffers increases inventory holding costs, whereas continuously monitoring all potential disruptive drivers at high granularity can prove to be a very complex and time consuming activity. The ultimate goal is to achieve the right balance between agile capabilities, while doing this in a cost effective way.

Whereas eliminating all risk is impossible, a resilient supply chain using an cognitive automation-powered risk management strategy can help LSHC companies identify and sidestep risks which are avoidable – and bounce back quickly from those which are not.

As the pandemic continues to evolve, companies are attempting to respond and create resilient enterprises, capable of maintaining cost-efficient, trustworthy and compliant operations. In addition, the role of governance, risk and compliance is increasingly important. The need for transparency and end-to-end visibility is particularly important, as highlighted in Deloitte's Cognitive Command Centre framework based around the pillars of a resilient supply chain.

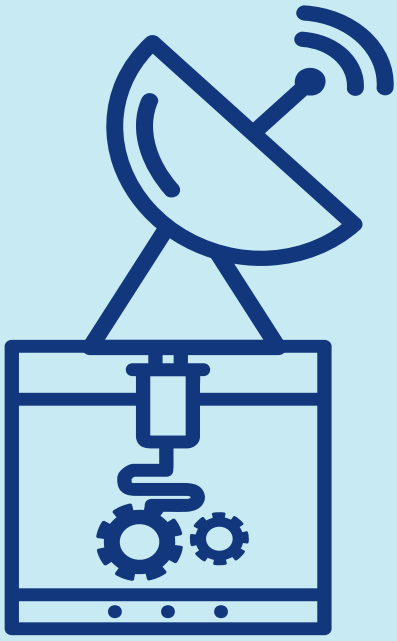
Moving LSHC products from suppliers to customers requires a chain of extensive coordination and collaboration. Therefore, companies should critically evaluate their risks using the above pillars in order to extract value and create or maintain a competitive advantage in the marketplace.

Your Cognitive Command Centre as an enabler for supply chain agility & responsiveness



Getting started

Following its "Think Big, Start Small, Scale Fast" motot, Deloitte is there to accompany you in your Cognitive Command Centre Journey. Deloitte capitalises on its cross-functional expertise to advise on strategy definition, technology selection and organisational change.



Are you at the start of your Cognitive Control Tower journey? Then, Deloitte can:

- Advise on where to start (leveraging our enterprise value approach and identifying which use case to begin with, depending on your industry challenges and company's ambitions in the supply chain space)
- Advise on the development of a cognitive automation roadmap
- Advise on the right technology to use
- Support you in the development of pilot/prototype (following our "Think Big, Start Small, Scale Fast" motto)

Already started to develop & scale Cognitive Control Tower capabilities? Then, Deloitte can:

- Help you scale up your capability internally (at the right cost)
- Help you define the future Target Operating Model around the Cognitive Command Centre
- Advise how to embed the change in your organisation ("make it stick")

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