Pushing the boundaries of trade through technology.

20mm steel coils. A Trade Innovation Project.

Westpac Institutional Bank.

200 years
proudly supporting Australia

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Sixty-second read.

In what we believe to be a world-first, Westpac has transformed fundamental business processes for a middle-market pilot customer, by weaving together the internet of things (IoT), artificial intelligence (AI), data analytics and blockchain technologies, resulting in major strategic and operational benefits. Predictive demand forecasting, inventory optimisation, identification of opportune time and source of procurement, as well as seamless procurement and payment processes will see this innovation commercialised in the future, as the technology achieves full scalability, standardisation and cultural acceptance.

The challenge.

By now, you are all aware of the promise of major technologies: the internet of things, big-data analytics, artificial intelligence and blockchain.

Internet of Things (IoT).

- The Internet of Things, commonly abbreviated as IoT, refers to the connection of devices (other than typical fare such as computers and smartphones) to the Internet. All the components that enable businesses, governments, and consumers to connect to their IoT devices, including remotes, dashboards, networks, gateways, analytics, data storage, and security is part of the Internet of Things ecosystem.[1]

Artificial Intelligence.

- Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalise, or learn from past experience.[2]

Data Analytics.

- Data analytics (DA) is the process of examining data sets in order to draw conclusions about the information they contain, increasingly with the aid of specialised systems and software.[3]

Blockchain.

- A blockchain is a data structure that makes it possible to create a digital ledger of transactions and share it among a distributed network of computers. It uses cryptography to allow each participant on the network to manipulate the ledger in a secure way without the need for a central authority. Once a block of data is recorded on the blockchain ledger, it's extremely difficult to change or remove.[4]

Individually, some of these – such as artificial intelligence – are already well developed and integrated into real-world business practices, while others have been shown to work in pairs, such as the blockchain and internet of things. Together, they are often referred to as BIoT.

But, until now, there has been very limited effort to weave together all four of these technologies to realise the exponential benefits of combining their complementary attributes.

In early 2018, Westpac teamed up with Infosys, a global digital transformation company and consulting firm, to run a client-oriented proof of concept, bringing together all four technologies in a real-world trial.

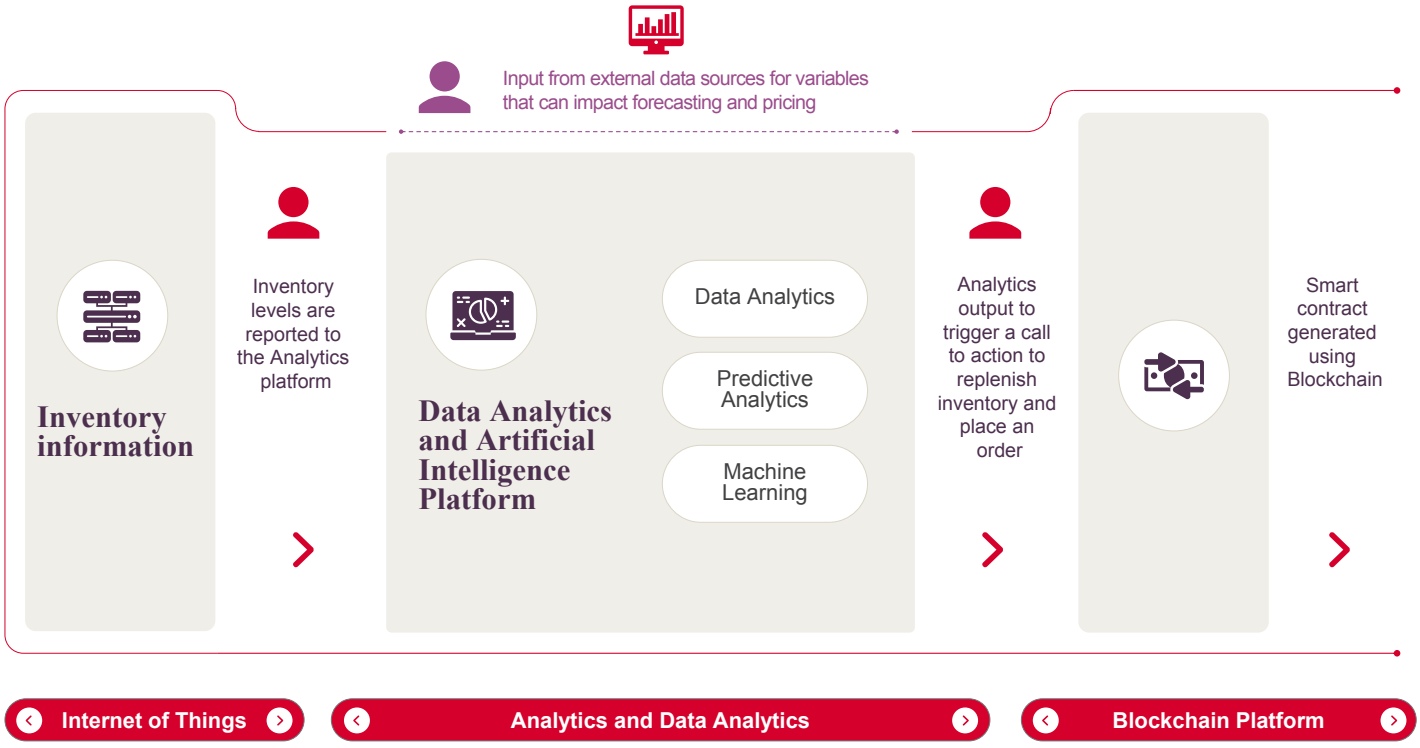
Our vision: strategic and operational value.

The practices of companies of all sizes that are involved in global trade have remained stubbornly analogue. To a large degree they involve a combination of human judgement based on limited and imperfect information, combined with the labour-intensive manual handling of paperwork that has characterised trade over millennia.

Our goal was to bring these four technologies together in a simple and practical way, in order to deliver tangible customer value at both a strategic and operational level. This would involve:

- Sophisticated analysis and tracking, yielding recommendations to inform strategic decision-making.
- Automated and digitised secure processing, to remove mundane, but, critical functions.

1 https://www.businessinsider.com/internet-of-things-definition/?r=AU&IR=T
2 https://www.britannica.com/technology/artificial-intelligence
3 https://searchdatamanagement.techtarget.com/definition/data-analytics
4 https://blogs.wsj.com/cio/2016/02/02/cio-explainer-what-is-blockchain/



Our focus: what companies actually need.

While we had a working hypothesis as to the value of these technologies, we wanted to be led by real-business requirements.

Westpac therefore assembled a customer focus group, comprising of a range of companies across different industries rather than work with large multinationals, which is the default approach of many such proof-of-concept projects.

Ausreo, a provider of reinforcing steel, and a long-standing customer of Westpac, agreed to provide the test-case product: 20mm steel coils.

Infosys, the technology partner for Westpac Institutional Bank Technology and a global leader in digital transformation, agreed to be our co-creator on the proof of concept.

Westpac customers, IVE and Iluka Resources, formed part of the customer focus group and also made significant contributions during development, offering insights on how the application could apply to other industries.

By working closely with the customer focus group, which included a site visit to Ausreo's manufacturing facilities, data analysis, and pain point discussions, we were able to identify the essential elements of the project use-case. This exhaustive consultation process gave us confidence that any success would be a game-changer for Ausreo and, eventually, every other company facing their generic challenges.

Our client focus group was unanimous about its first major objective: To improve demand prediction.

The Trade Innovation Proof of Concept: Customer focus group.

Ausreo is a fast-growing supplier and manufacturer of reinforcing steel products, based out of Australia. Ausreo's 20mm steel coils were selected as our pilot product.

Iluka Resources is an Australian-based resources company, specialising in mineral sands exploration, project development, operations and marketing. Iluka is an ASX-listed company with operations in Australia and Sierra Leone.

IVE Group is an ASX-listed diversified print and marketing communications business, founded in the 1920s.

Objective #1: Predict demand.

Procurement and purchase processes in most businesses are reliant on subject matter experts with key business knowledge. For example, when forecasting demand for its steel coil, Ausreo has no steel price index to compare against, and therefore relies heavily on the expert judgement and analysis of experienced individuals.

This is a common challenge across businesses because such processes rely on people, who invariably move jobs, retire or go on leave, which sees them take their expertise with them. Building up this knowledge and experience also takes time and represents a business risk. The process is imprecise and subject to human error.

Further, up-to-date information about price trends is not readily available. Pricing is negotiated at the time of an order, which may not be the optimum time for purchase.

Ausreo's existing forecasting environment.

- Monthly demand forecast for the next 3 months based on sales orders.
- Monthly procurement forecast based on demand.
- Suppliers lead time of 2–3 months, depending on the source.

Objective #2: Track consumption.

Ausreo's incumbent consumption tracking process is achieved mainly through several stages of barcode scanning. This enables Ausreo to update inventory, monitor specific sources of steel and the delivery. It also contains ACRS certification, an industry-quality standard for reinforcement steel in Australia and New Zealand.

Ausreo's existing consumption tracking process.

- Barcode attached to coil at steel mill, scanned on arrival at Ausreo and sent to its central planning hub and becomes inventory.
- Barcode is read again on admittance to factory for fabrication to identify its source.
- Simultaneously, the inventory is reduced in the central planning hub and the coil consumption is updated.
- A new barcode is added to the finished product to track delivery to customers.
- Delivery validated on arrival at customer. Inventory is reduced and invoice to customer is generated.

Ausreo's ERP system tracks the amount of 20mm steel used in production. Inventory is updated as it's consumed, and available stock is modified to reflect the daily consumption.

Objective #3: Better decision-making in terms of the best time and source to buy inventory.

Ausreo wanted a more robust way to make decisions around purchasing stocks from the best source at the optimal time to buy. Their existing reliance on human judgement, expertise, talent retention and historical data is vulnerable to both aberrations in the market and environment.

Objective #4: Smarter and more efficient transacting.

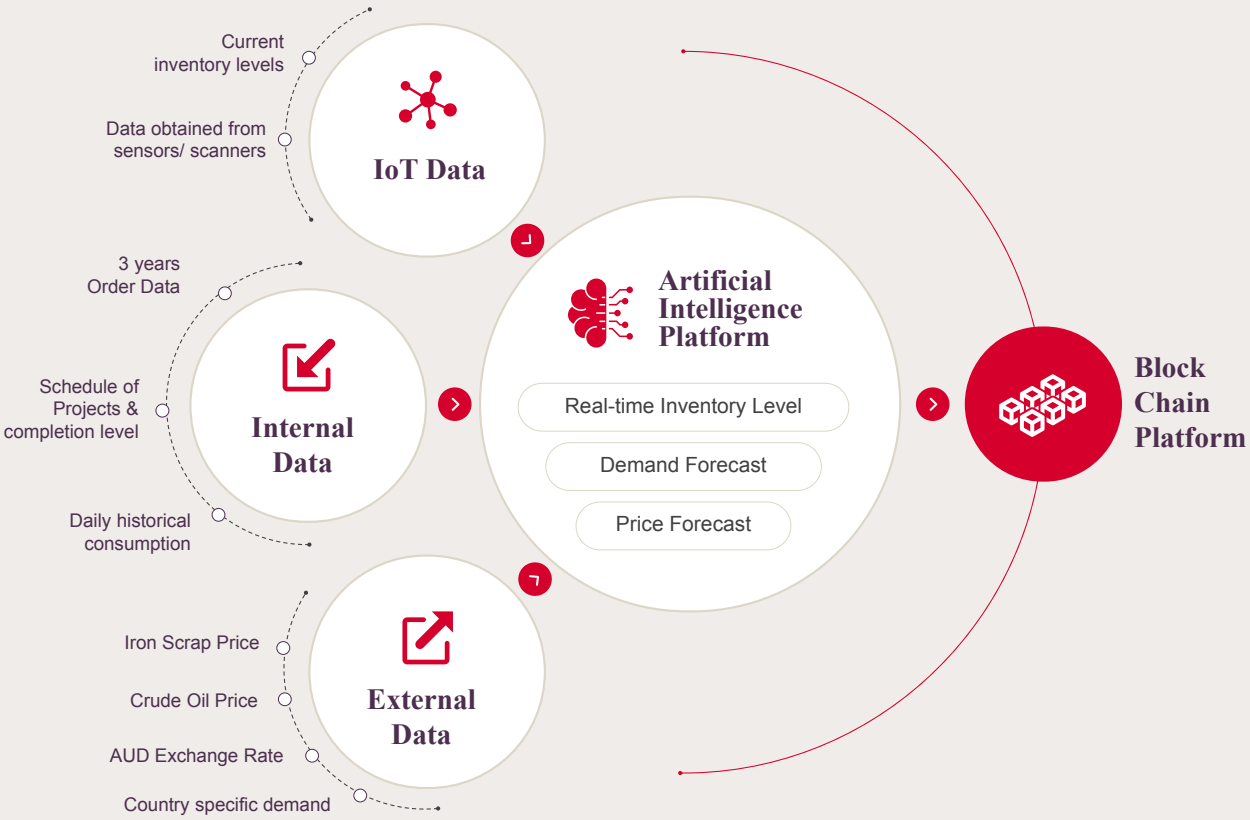
The approach to commercial transaction is highly manual, and its processes around invoice receipt and payment are not integrated with the other core functions of demand prediction and procurement. As a result, data is duplicated throughout, as it is processed by different teams and systems for specific functions without the ability to seamlessly integrate. Further, paper-based transactions are prone to manual errors and delays in processing.

Method.

Integrating the technologies.

The proof of concept integrated the individual components of the internet of things (IoT), data analytics, artificial intelligence (AI) and blockchain.

All available data, from planning systems, external data and IoT data, as well as current and historical information, was consolidated within the AI's data analytics layer.



#1 Better demand prediction.

Prediction models for coil demand and price were created based on historical data, using the platform data analytics and machine learning modules.

Current data from various systems was used to execute the demand and price prediction models to estimate the trends for the future. Based on Ausreo's requirements, coil demand was predicted for three months and coil price for the next six months.

#2 Better stock-tracking.

The data regarding the current stocks was brought in through the IoT gateway and into the analytics layer. The amount of raw material held could be assessed on a continuous basis using the IoT solution.

Stock levels over the next two months were calculated based on the predicted consumption rate, lead time for delivery, minimum order values and replenishment rates of stock.

Additionally, data from existing ERP Systems, news feeds and various other sources was fed into the data analytics platform and AI.

#3 Better decision-making.

We then created a user interface module to allow for smart procurement. Data on demand, pricing and stock levels were used to create recommendations and alerts for a procurement manager to act upon.

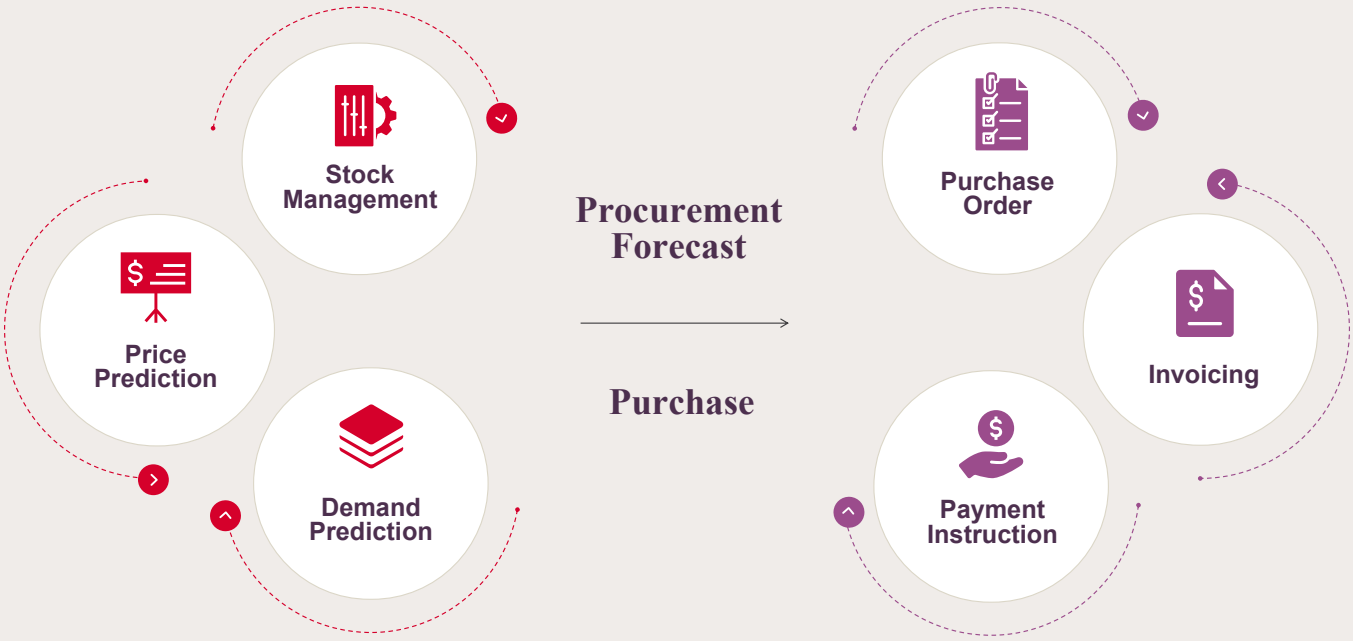
The price prediction module provided three-month price trends of the coil for different countries using data analytics. This information was presented in an easy-to-read dashboard with demand prediction, pricing prediction and inventory requirements all on one screen, saving the procurement manager the time it usually takes to gather and interpret different reports to gain insights.

Thus, using data analytics and AI, the purchasing manager is provided with pricing forecasts, along with the recommendations for order-quantity, inventory level and price. Once the purchasing manager has made a decision to procure, the details of the order quantity and price are entered in the AI analytics module, which is linked to the purchase system for further action.

#4 Smarter transacting.

A purchase system user interface, created on R3 Corda Block Chain technology, handled the complete purchase flow, starting with purchase order generation, invoice generation, bill of loading uploading, order acceptance and payment instruction.

Target Process with integration across the solution components.



Once the best supplier was selected, and an order submitted in the AI analytics module, a purchase order request was automatically created on the blockchain purchase system.

The purchasing manager continued the process and placed a digital order on the blockchain. The buyer/supplier used the blockchain secure data network to create/fulfil the purchase order and validate transaction using a smart contract.

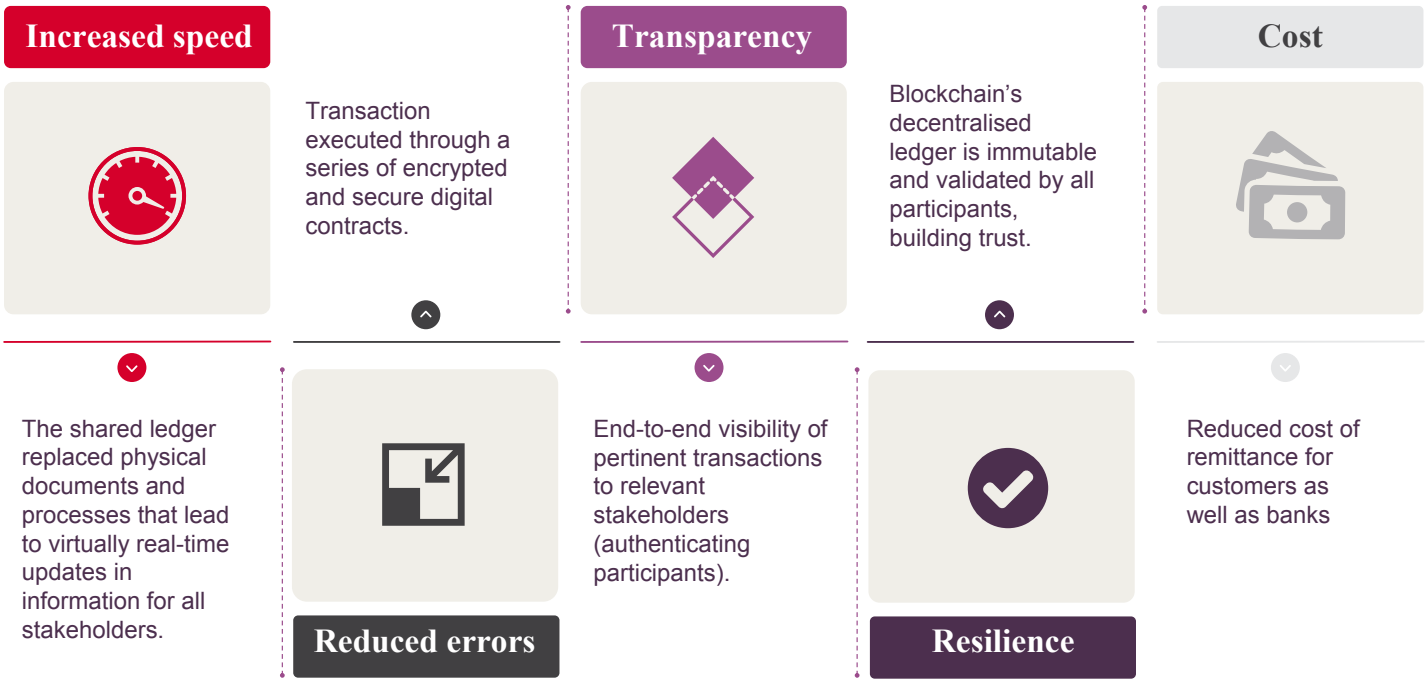
The payment and financing request was triggered to the bank and payment to the supplier was sent, completing an end-to-end paperless transaction. The purchase system was also able to validate information and flag if and where any discrepancies had occurred, reducing the dependence on the staff to spot errors before authorising payment.

Benefits of the Proof of Concept.

The IoT-AI-Analytics solution:

1. A single-page view of the entire procurement lifecycle from demand to PO creation.
2. A better view of consolidated demand, raw material price and stock level details.
3. Reduced manual effort and dependence on the knowledge of the subject matter expert.
4. Ausreo suggested this solution could potentially provide time savings of 14.5 hour per month.

The blockchain solution:



Conclusions.

In one of the first real-world proof of concepts to combine all four technologies – IoT, data analytics, AI and blockchain – into one solution, we demonstrated convincingly the exponential benefits of these solutions working together.

The scenarios tested were exaggerated cases such that, when inventory was very low the prices were very high and, when there was sufficient inventory, opportunistic buying was undertaken, i.e. when prices were expected to rise in the future.

Scenarios were created to ensure optimal stock levels were maintained, based on demand prediction and current inventory levels. We also created scenarios where the price was predicted to rise sharply in the future, to show the capability of the proof of concept to identify ability to do opportunistic purchasing to take advantage of a lower price. As such, the exercise has brought forward the day when machines will replace many of the mundane tasks of project management, procurement, ordering and payment in order to free up individuals to fulfil more meaningful and strategic roles.

These outcomes are particularly convincing because of their applicability to different types of businesses, across different industries of different sizes. In addition, the modular approach means that components used in the exercise can be easily applied to develop solutions appropriate for specific customer requirements.

Path to an industry solution.

The outcomes highlight a number of areas that require specific attention during the roll out of any commercial product.

An IoT solution needs to be selected to track both incoming and outgoing materials, that has longevity and that can be easily upgraded when required.

Essential decisions around sensor/tag cost, reusability, ease of scanning the tags/sensors, connectivity for data transfer and data consolidation at the gateway level, must be decided. Multiple solutions are currently available in the market.

In the current state, AI requires a degree of customisation to suit a particular industry and business. The more real data presented, the better and more precise the AI response. There will be continuous improvement in AI-based scalable solutions over time. One of the potential enhancements to the AI/analytics solution is the functionality to calculate a customer's working capital requirement based on the inventory forecast, which can also trigger a request to the bank for trade financing.

Blockchain can bring all trade participants onto a single network and make the entire trade flow transparent and tamper proof. It can also reduce time delays in document exchange and reduce overall trade messaging costs. Blockchain can be integrated with customer's internal systems like payment engines to execute the payment instructions.

Artificial intelligence and data analytics exist today, and are widely used in many forms. A combination of one, two, three or four of these technologies in any form will add value to the business process, and the opportunities are endless.

Challenges.

In order to fully implement such solutions, there are still challenges to face in areas such as security, legal jurisdictions and common standards. However, the success of this proof of concept gives great confidence in the future provision of a scalable, commercial offering.

IoT challenges:

- At the IoT level, selection of the appropriate technology for both incoming raw material and outgoing products has to be made taking into consideration costs, redundancy, ease of use and the ability to upgrade to new technology.
- IoT device and data security challenges are mitigated by providing security features in the IoT gateway. Data connectivity will be utilised only from secured vendors.

Data Analytics challenges:

- As data sets are becoming bigger and more diverse, it becomes more challenging to synchronise and incorporate them into an analytical platform
- The growth of the companies increases the amount of data produced. The storage of this massive amount of data and combining data from diverse sources remains a challenge.
- Data quality challenges such as missing data, inconsistent data, logic conflicts, and duplicate data.
- Security and privacy of data

AI challenges:

- AI requires a degree of customisation to suit a particular industry and business.
- The biggest challenge is the availability of data, which is needed by the AI platform to base decisions upon.
- The availability of robust internal and external data is key to the success of the AI solution.
- Having the right infrastructure for computation – this can be a cloud environment, or on-premise infrastructure.

Blockchain challenges:

- The underlying blockchain continues to evolve at a fast pace in response to changing industry demand Regulatory compliance is still being developed within countries and at an international level.
- Private blockchain is generally set up on an externally available network. This restricts access to the network for certain transactions. Participants need to receive an invitation, or obtain permission to join. The access control mechanism may vary such that existing participants could decide future entrants, a regulatory authority could issue licenses for participation, or a consortium could make the decisions.

Cultural change.

The proof of concept demonstrated that a fully-automated global trade process/flow is now technically achievable.

Cultural change and adoption will occur over time. Knowledge and confidence are required to radically reshape business processes.

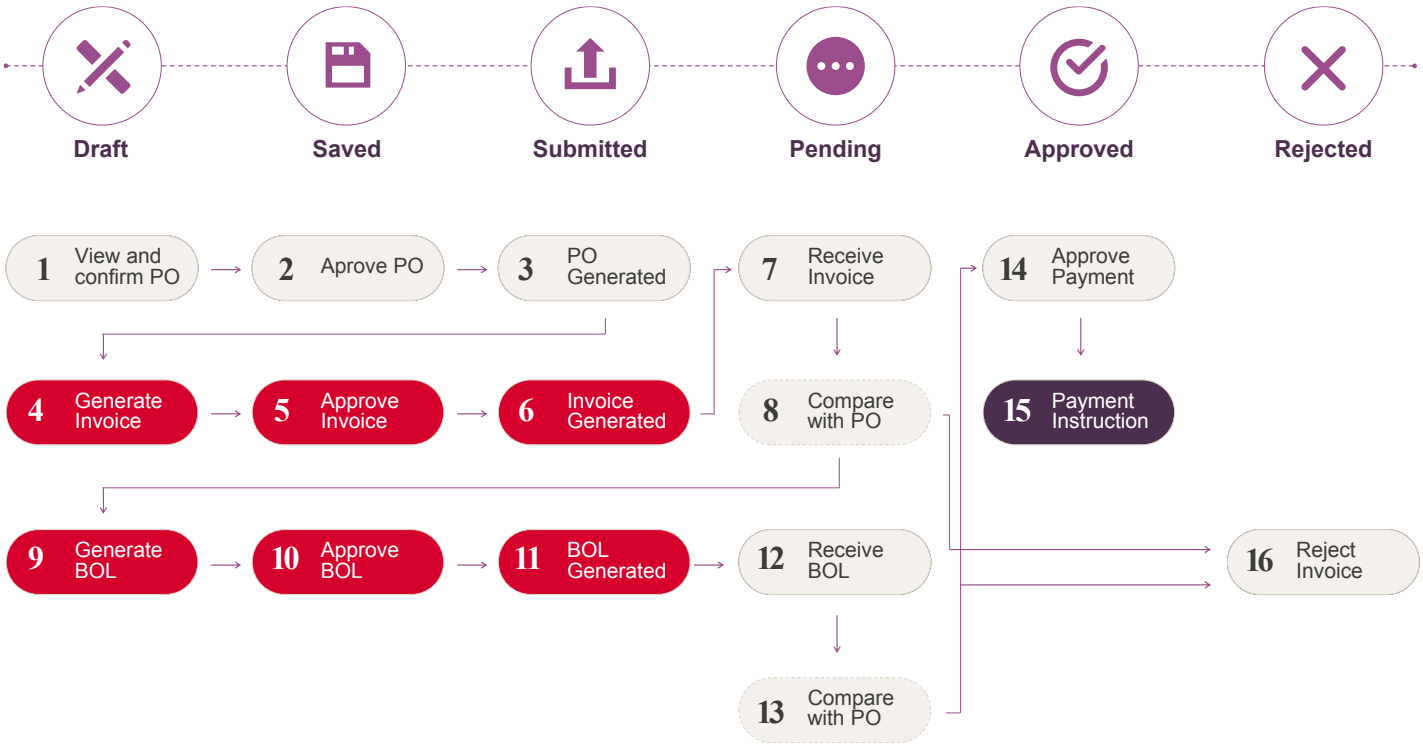
Plans for re-skilling workers freed from manual tasks, to greater value-add roles within the business need to be a focus. Successful implementation will therefore be as much a people-management task as a technological revolution.

Ends.

Appendix.

Primary stakeholders: Roles and responsibilities:	
Buyer (Ausreo)	**Operation Team:** Responsible to view demand and create Purchase Order (PO). **Approver:** Approver can view all PO requests, verify and confirm for ordering. The approver can also view list of verified invoice and generate payment request. **System (Smart Contract):** Validates the Invoice, Bill of Loading (BOL) against PO and moves to verified list for approval for payment, submission of payment instruction to Westpac.
Seller (Supplier)	**Operation Team:** Responsible to view all the requested purchase orders and generate invoice and bill of loading. **System (Smart Contract):** will compare the PO quantity and price with Invoice and Bill of Loading document before submission.
Bank (Westpac)	**Operation Team:** view and validate payment instruction received, and effect payment.

Workflow for Order to Cash Prototype:



*PO = Purchase Order. BOL = Bill of Loading

Buyer Bank Seller

Notes:
- The blockchain platform is able to compare details between PO, Invoice, and BOL such as weight, quantity, price and identify discrepancies.
- Once Seller generates invoice, Buyer will receive invoice in real-time and can compare it with PO.

Notes on technology used in this pilot:

IoT gateway.

An IoT gateway was used to consolidate incoming data and transfer the data to the trade system.

The gateway can be utilised for many unique use cases, for example to consolidate data, increase data collection, create alarms and events, and diagnose critical events. Notifications based on the events can be sent to the appropriate personnel through SMS/email, etc.

Protocols.

IoT gateways can support various protocols enabling accurate data transfer in real time.

Internet of Things will enable the tracking and tracing of raw materials, work in progress and finished goods through the factory. The application of IoT extends throughout the supply chain, from procurement to delivery:

a. Procurement & Inventory Management: Real-time tracking of stock levels of different materials in the manufacturing cycle, from raw material to finished goods.

b. Logistics & Delivery: Ability to track shipments to customer in real time and validate the delivery.

Based on the products of the customer, IoT solutions can be selected that fit both the above scenarios, taking into account the usage, cost, connectivity and gateway consolidation requirements.

Artificial intelligence/analytics.

- For the purpose of the proof of concept, the Infosys NIA platform for AI and Big Data analytics was used.
- Demand forecasting models predict the demand for the next quarter based on input historical data and various other project attributes such as:
  - Number of ongoing projects
  - Project completion percentage
  - Total bid quantity for steel i.e. the amount of steel including all grades for the respective project
  - 20mm steel coil percentage out of total steel
  - 3 years historical data of 20mm steel coil consumption
- Price forecast model predicts the raw material price for next quarter based on input historical data and various associated parameters related to raw material from a commodity index such as:
  - steel scrap prices
  - oil prices
  - FX rates
  - local country demand
  - previous prices for steel
- Stock management is shown as part of the procurement dashboard; the stock management model receives real - time data from IoT for current stocks and data from the demand prediction model to correctly predict the stock levels for next quarter. The inventory prediction model also considered order lead time and stock in transit to calculate the stock requirement.

Blockchain.

Purchase to Pay (PTP) is a set of business processes that involve creation of a purchase order, receiving inventory, matching of purchase order with invoices and transport documents and making payment for the goods or services. This is critically important in every enterprise and it's often at the heart of delivering superior customer satisfaction.

Yet most large B2B corporations still face significant challenges in this cross-functional process, where inefficiencies or inaccuracies can lead to lost revenues. No synchronisation between price and product data, coupled with incomplete calculations of invoice discounts, leads to pricing discrepancies and customer invoice disputes.

That common scenario requires far too much manual effort to manage and resolve. The result is major delays in receipt of goods invoice settlement, and significant negative impact on customer experience. In fact, many organisations spend as much as 60% of total PTP[5] effort managing exceptions and resolving disputes due to billing discrepancies.

That's why there's been so much excitement about blockchain smart contracting.

What are smart contracts? It's simple. Smart contracts are coded programs that automate transactional events based on contractual terms. Like traditional contracts, smart contracts depend on both parties consenting to terms. But a distributed ledger environment such as blockchain manages these terms.

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5 http://www.genpact.com/insight/blog/how-the-blockchain-revolution-is-transforming-order-to-cash-processes

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