Driving UK GDP growth through transformation of UK border performance

Future Border Programme –
The Fujitsu Point of View

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Contents

Why Fujitsu

For over 40 years, Fujitsu has been a trusted provider to the public sector through the delivery of nationally critical services. This expertise encompasses those specialist fields primarily affected by EU Exit, including the movement of people and goods, security of the borders, the collection of duties, revenues and payment of benefits.

Our services touch 99% of the UK population each day and this expertise provides a deep insight into the options available to both address the challenges and maximise the opportunities of EU Exit, whether through the application of today's technology or the exploitation of emerging technology which can transform UK border performance.

The purpose of this paper

This paper presents the Fujitsu point of view on how current and emerging technologies can be applied to automate border administration processes to support the UK's future trade ambitions, while addressing some of the anticipated challenges of its withdrawal from the EU. It looks at the key dynamics of the global supply chain industry, examining the implications and opportunities presented by its digital transformation as it tackles today's challenging market conditions. This paper also describes the nature of the highest performing borders in today's global trade markets with recommendations on the technology-based initiatives which are required to make this a reality for the UK. The purpose of this paper is to provoke thought and stimulate discussions to bolster the current initiatives to address several key EU withdrawal challenges, helping to shape the Future Border Programme and promote post-EU Exit growth of the UK economy. This paper is specifically focussed on the movement of goods across the border. A similar paper centred on the movement of people across the border is currently in production.

1. Executive Summary

Exiting the EU – The Challenge and the Opportunity

An efficient and effective border administration eases the flow of international trade, driving GDP growth while enhancing the economic competitiveness of the country. It ensures revenues are collected and homeland security is maintained, whilst goods move 'friction-free' across the border to support industry and promote trade.

A study by PwC predicts the UK's short-term economic growth could lag between 3 – 5.5% behind that of the other member nations.[1] To mitigate this risk, as the UK prepares to leave the EU and its Customs Union, its border must be prepared for the impact of this withdrawal and the associated challenges. Concurrently, the EU Exit offers the opportunity for the UK to take control of its future trading destiny, driving economic growth via its own independent trade policies, and negotiating new trade agreements with global partners.

The UK Government has established the Border Planning Group to deliver a successful border strategy, or 'Future Border Programme'.

In order for the UK Government and Border Planning Group to both mitigate the risks and maximise the opportunities, it is important to:

- Create, co-ordinate and implement a long-term vision for the UK border that drives GDP growth; and
- Drive short term initiatives to assess and manage the impact arising from the chosen EU withdrawal strategy.

This paper will explore three major near-term priorities related to EU Exit, and how relevant technology may offer automation to help address these challenges with.

1 www.pwc.co.uk/economic-services/assets/leaving-the-eu-implications-for-the-uk-economy.pdf

Priority #1 – The Irish Border

To address the potential need for border controls at the Northern Ireland – Republic of Ireland border without implementing additional physical infrastructure or manned checkpoints, an innovative approach is required to evaluate how emerging technologies can provide a solution. To effectively achieve the necessary 'infrastructure-free' solution, Fujitsu recommends a GPS or satellite-based tracking solution be evaluated extensively through an early proof of concept trial. This will allow the capabilities and benefits of such a solution to be thoroughly validated by a small consortium of key stakeholders from across the industry including the UK border departments, a GSM carrier, major logistics organisations and supply chain intermediaries. Full details can be found on page 11.

Priority #2 – Processing Roll-on, Roll-off (RoRo) Freight at Dover

In an EU Exit scenario which results in all imports and exports between the UK and EU requiring customs declarations, the volume of vehicle checks at the port of Dover could rise dramatically from an average of 500 per day to over 10,000. To avoid the significant congestion, delays and disruption that would result from using today's declaration processes, as well as the impact to both UK and European supply chains and their economies, existing port controls will need to be further automated. Possible solutions presented include automation of declaration processing and undeclared goods detection systems, such as the 'physio-metric' gate solution detailed on page 14.

Priority #3 – Supporting UK industry to prepare for the EU Exit

As a direct consequence of the EU Exit, businesses will invariably be faced with immediate changes to trading procedures with the EU. Their operational overheads may increase to fulfill these new requirements, and additional demands will be placed on government departments and IT systems.

In light of the Government's recently published Guidance Notes (23rd August 2018), a review is recommended to ensure all affected government systems have been correctly identified and adequate remediation activities are in progress. For example, the proposed new Trade Remedies Authority will require an IT system together with supporting infrastructure. Planning should commence in earnest for this new requirement.

The new Customs Declarations System (CDS) replaces the current system CHIEF in early 2019. The migration of services from CHIEF to CDS should be reviewed, together with any contingency scenarios such as dual running. Additional demands on customer services will stretch existing resources and capabilities. Greater automation, for example through the use of Robot Process Automation technology, may ensure continuity of service through periods of peak demand. Full details can be found on page 18.

Exploiting innovation in the Global Supply Chain Industry

In addition to addressing short term priorities associated with the EU Exit, this paper also explores the role of new and emerging technologies in delivering a future UK border vision. We consider best practice from leading trading regions, and examine how we can leverage benefits from the digital innovation programmes of today's global supply chain industry.

The challenging economics of today's highly competitive global supply chain industry is seeing the creation of new business models to generate operational efficiencies. A fundamental shift is the emergence of common trading platforms where data is shared across all players, creating a digital partner ecosystems or "Digital Arenas". Common trading platforms offer the future border access to a 'data pipeline', providing unprecedented insights into the movement of goods within the entire supply chain. Fujitsu recommends a "Digital Arena" be enforced to improve post-border capabilities, enabling initiatives such as extending the 'data pipeline' into retail and consumer sectors, and increasing the border's contribution to UK GDP.

The creation of Global Trading Platforms and the real-time insights available from the global supply chain's digital transformation will support more efficient border operations, increase revenue collection, and strengthen security.

Fujitsu recommends early involvement and collaboration with leading insight-related industry initiatives, such as Common Trading Platforms, Smart Ports and Smart Shipping in order to be ready to maximise the value of real-time insights in the long-term (see page 20 for more detail).

Core Principles for a Successful Future Border Programme

To extract optimum value from what promises to be exponential growth in supply chain data, Fujitsu recommends two core principles to underpin the technical strategy of the Future Border:

1. Establish a 'one government at the border' operational capability supported by the implementation of a Single Trade Window (STW), and
2. Design and establish a common cross border department IT infrastructure, capable of ingesting data from multiple supply chain sources, adopting AI to analyse and make information available to all departments.

To deliver a UK Single Trade Window (STW), Fujitsu recommends an incremental, agile approach, utilising the investment in the new Customs Declaration System (CDS) as a starting point. This approach will reduce risk associated with such a large transformation programme. In parallel, Fujitsu recommends accessing the required expertise to build such a solution through an eco-system which includes traders, shippers, policy organisations, as well as all border agencies. Full details can be found on page 28.

Exploiting New and Emerging Technologies

The application of current, new and emerging technologies is critical to the Future Border Programme's vision to realise operational improvements, and ultimately drive GDP growth. To deliver this vision, Fujitsu provides its recommended action plan, identifying which of these latest technologies will be integral, together with how best they can be deployed:

Artificial Intelligence

Fujitsu recommends Artificial Intelligence (AI) be used to enhance existing processes to improve and fully exploit data management practices across all border operations. To achieve this, Fujitsu recommends (1) engaging with supply chain industry leaders and linking up with current AI-related projects; (2) a close evaluation of border processes which are heavily reliant on human analysis and intelligence to explore how AI could be used to augment these processes; and (3) an evaluation of the data sets involved in border-related processes to be leveraged, using data science, to glean additional insights around compliance trends and patterns.

Distributed Ledger Technology (DLT)

Given the relatively embryonic nature of Blockchain technology, to successfully utilise DLT within the Future Border Programme Fujitsu recommends a multi-faceted approach based on continual learning and skills development.

This approach should include several initiatives, including the establishment of a centre of excellence, partnering with carefully selected DLT innovators, as well as initiating both cross-department and shipping industry DLT trials (see page 31 for more detail).

Internet of Things (IoT)

Fujitsu recommends that the Future Border Programme should create a specific IoT supply chain and UK border consortium. This forum will take the lead in designing the architecture for an IoT Event Processing Platform which will provide a cross-department capability to integrate IoT data supplied by any source. The Programme should also pursue improvement initiatives of both port operations, working with Port Authorities and Border Force to identify and prioritise suitable use cases, and operational activities such as the tracking of sensitive assets, and tracking the safekeeping of seized goods within and moving to and from Queen's bonded warehouses (see page 32 for more detail).

Satellite Technology

To evaluate the applicability of satellite technology to the programme, Fujitsu recommends a focus on the monitoring of unmanned ports as the initial use case. Establishing a small working group to test the value and applicability of the technology is the best way to progress this initiative (see page 34 for more detail).

2. Introduction: The future border, EU Exit and beyond...

The UK Government is establishing a programme to deliver its vision for the future UK borders to be realised post-EU Exit. Through the coordination of a range of Government activities it will create a single coherent border strategy to drive UK GDP growth by facilitating trade, and maintaining homeland security through advanced risk-based border enforcement capabilities.

While it is envisaged this programme will take a number of years to fully deliver its objectives, it will also drive short-term initiatives focused on improvements to existing UK Border services to facilitate trade. The programme will collaborate closely with partners from industry, technology and trade organisations to seek input, leveraging expertise and best practice in the shaping of this vision.

The Border Planning Group

To drive the Future Border initiative, the Border Planning Group[2] has been established to work across the Government's 21 border departments and agencies with a remit to:

- Create and co-ordinate a Future Border Programme to develop and implement a long-term vision for the UK border
- Assess and manage the impact arising from the chosen EU withdrawal strategy

The immediate focus for the Border Planning Group will be on its remit to manage the impact of our withdrawal from the EU.

The UK border in numbers

- Over £820bn of annual trade in goods
- Generating over £34bn in tax and duty revenues[3]
- Contributing to 62% of UK GDP

The EU Exit challenges

At the time of writing, the terms of the UK's future relationship with the EU are being negotiated, as such the exact details of that relationship and the changes required to the current arrangements based upon EU membership cannot yet be fully evaluated.

The Government's Whitepaper 'The Future Relationship between the United Kingdom and European Union' sets out in some detail the principles on which the UK Government believes this relationship should be based through the Facilitated Customs Arrangement. The FCA would require the UK to apply the EU's tariffs and trade policy for goods intended for the EU. The UK will apply its own tariffs and trade policy for goods intended for consumption in the UK. A proposed Free Trade Area for goods governed by a Common Rule Book will enable goods to cross the UK–EU border without the need for customs declarations and border checks.

The Government's recent Guidance Notes released on 23rd of August 2018, confirms a high focus on contingency preparations to ensure goods, people and services are not impacted by the EU Exit; 'A scenario in which the UK leaves the EU without agreement (a 'no deal' scenario) remains unlikely given the mutual interests of the UK and the EU',

2 https://publications.parliament.uk/pa/cm201719/cmselect/cmpubacc/558/558.pdf
3 www.nao.org.uk/report/the-uk-border-2

it is natural that 'as we get nearer to March 2019, preparations for a no deal scenario would have to be accelerated, although this does not reflect an increased likelihood of a 'no deal' outcome'.

This Point of View document does not make predictions about the ultimate outcome of the negotiations. However, to ensure that this paper provides the most valuable insight, it is based on a 'no deal' EU Exit scenario. As such we consider the impact of a 'no deal' EU Exit scenario which subjects the movement of all goods crossing the UK-EU border to customs checks for duty declarations and adherence to trading standards and policies, so as to help support contingency planning, as well as provide options to support an Exit and transition to a more long term agreement. Furthermore, by considering a 'no deal' scenario, this paper provides insights applicable to other scenarios such as a Facilitated Customs Arrangement.

A 'no deal' scenario requires comprehensive contingency plans to ensure goods, people and services continue to move across the border as efficiently as they do today. We consider three priority areas where innovation through technology offers solutions:

1. The Northern Ireland – Republic of Ireland border

With over 200 crossing points across 300 miles of border, any customs checks implemented on the movement of goods across the only UK-EU land border would present significant challenges. The political sensitivity of the area means any solutions must not involve the addition of any new physical border infrastructure which would be deemed as a hardening of the border.

2. Roll-on Roll-off (RoRo) freight at the port of Dover and Eurotunnel

Every year, over 2.5 million goods vehicles pass through the port of Dover, handling £120bn worth of goods[4]. Currently, heavy goods vehicles (HGVs) carrying goods from the EU pass through the port without customs intervention and experience very little dwell time. Non-EU goods are subject to customs checks which take at least one hour to complete. Subjecting all EU goods vehicles to such checks will result in major traffic jams and delays with the potential to impact supply chains servicing UK industry, the retail sector and the food industry.

3. UK industry must be supported throughout the EU Exit

An estimated increase in the number of declarations from today's 50 million per year to over 250 million will place a huge strain on existing IT systems. Furthermore, the changes in VAT policies for imported goods which will impact existing VAT systems, the changes in Tariffs, which may impact the Tariff IT Systems, as well as the proposed new Trade Remedies Authority which will require an IT system and supporting infrastructure, will all add to this strain. Finally, the 150,000 UK traders who currently trade with the EU will become new users of the declaration system, putting further demand on current IT systems, and customer services.

4 www.economist.com/britain/2017/04/06/to-see-how-trade-may-work-after-brExit-visit-dovers-docks

The case for Technology at the border

All of these priorities have in common the need to ensure goods continue to flow rapidly across what is today a 'friction-free' border with the EU, avoiding potential delays and disruption as a result of any new customs arrangements and checks.

The World Bank ranks global trading regions according to their performance in six categories including 'customs processes', 'infrastructure', and 'tracking and tracing'. Its latest 2018 report ranks the UK's performance in 9th place[5], a fall of one place from the last report of 2016. Leading trading regions in this report, such as Germany who are ranked first, have consistently invested in technology to optimise their border operations. Research suggests a correlation between improvements in a region's ranking in this index and growth in GDP.

New customs administration processes will invariably be required as a consequence of any changes to trade policies and legislation. Technology solutions will therefore be essential to provide automated capabilities, avoiding delays by rapidly processing the customs administration of goods as they cross the border in vehicles, or other modes of transport.

The use of technology at the border is already widely adopted to provide operational efficiencies by many border agencies around the world today. Relevant examples of the use of technology at the border are highlighted in a recent EU report by Dr Lars Karlsson, "Smart Border 2.0. Avoiding a hard border on the island of Ireland for customs control and the free movement of people"[6].

His report provides examples of nations using tracking devices such as Radio Frequency Identification (RFID), and in some instances Global System for Mobile (GSM), to automate and speed the clearance process at the border.

With the Future Borders Programme remit expedited by the catalyst of the EU Exit, the UK now has the opportunity to invest in current and emerging technologies to create a leading global border capability, supporting growth in national GDP.

We will now review each of the major near-term priorities related to EU Exit, and how relevant technology may offer automation to help address these challenges.

5 lpi.worldbank.org/international/global/2018

6 http://www.europarl.europa.eu/RegData/etudes/STUD/2017/596828/IPOL_STU(2017)596828_EN.pdf

3. Addressing the major near-term EU Exit Priorities

Priority#1 – The Irish border

The Irish border represents the only land-based border between the UK and the EU. While the UK remains in the EU, there are no border control requirements, and goods flow freely across a 300-mile long border with some 200 road crossing points. Reflecting a highly sensitive political situation, the UK's EU Exit negotiation team has committed to 'no hardening' of the border after Exiting from the EU. To deliver this commitment requires a negotiated policy agreement to avoid the need for customs checks at the border. Or alternatively, the use of a non-intrusive technology-based solution to enable goods to continue to flow freely across the land border, with automated import-export compliance and duty checks.

Key Northern Ireland – Republic of Ireland cross-border freight metrics

- The Republic of Ireland is Northern Ireland's largest external trading partner, exporting £2.7 billion of goods to the Republic of Ireland, which represents 36% of NI's total exports
- An estimated 177,000 HGVs and 208,000 light vans cross the border between Northern Ireland and the Republic of Ireland each month
- 6.6 million tonnes of freight is transported each year – 4.4 million from Northern Ireland to the Republic of Ireland and 2.2 million tonnes from the Republic of Ireland to Northern Ireland
- Half of all border crossings to the Republic of Ireland from Northern Ireland are at the Newry-Dundalk corridor, with the rest predominantly on the southern part of the border along main roads into the Irish borderlands and Dublin.

Her Majesty's Government (HMG) has published several consultation papers that describe its intended approach to address the specific circumstances of the Northern Ireland border, highlighting the desire to look at creative solutions to avoid a hard border for the movement of goods.

The Key Principles include:

- Aiming to avoid any physical infrastructure on either side of the border
- The solution must maintain the integrity of the United Kingdom and cannot impose internal barriers such as different customs arrangements between Northern Ireland and Great Britain
- Preventing new barriers to doing business within the UK, including between Northern Ireland and Great Britain.

In the absence of a formal agreement with the EU a solution will be required to ensure that freight passing through the UK land border with the Republic of Ireland is compliant with UK trade policies, has been correctly declared, and appropriate duties paid. The August 2017 Position Paper on Northern Ireland and Ireland suggested exceptions for SMEs engaged in local trade within an established local market. Reports placed this local SME trade at around 80% of the goods crossing the border and thereby reducing the level of checks required. However, for the remainder of physical checks would be incompatible with commitments made on the border and would create practical challenges if required, therefore a technological solution would be the only viable options to providing customs checks at the Northern Irish border.

The UK also wants to continue to protect the Community and Common Transit Convention (CTC)[7] and associated reciprocal bilateral arrangements. As such, the UK recognises, and is committed to protecting the ability for British and Irish nationals to work without hindrance across the border between Northern Ireland and the Republic of Ireland.

So, the particular challenge of the Northern Ireland – Republic of Ireland border is to establish effective border controls without the implementation of additional physical infrastructure or manned checkpoints.

There are no global precedents for a comprehensive 'infrastructure-free' border crossing solution, as highlighted in Dr Lars Karlsson's report[8], which is capable of rapidly processing the clearance of goods transported by vehicles without the presence of physical infrastructure. A new approach is required to assess how current and emerging technologies could help solve this challenge.

As part of its ongoing assessment of the EU Exit challenges, Fujitsu is assessing several potential solutions, including an innovative satellite tracking solution, as well as passive roadside sensors and in-vehicle GPS tracking systems. We recognise that the UK Government has specifically ruled out the use of ANPR cameras, with the Secretary of State for Northern Ireland, The Rt Hon Karen Bradley MP, specifically committing to 'no new ANPR cameras and no new cameras' and assuming that any existing ANPR camera infrastructure in the area would not provide sufficient coverage we include references to ANPR only as part of the full range of options technically available.[9]

An automated border crossing solution will be dependent on the ability of sensors to 'sense' the presence of a vehicle as it crosses a border, and to link this vehicle to its relevant declaration with customs, and other appropriate border systems. In order to sense a trade vehicle, there will need to be an appropriate transmitter fitted to the vehicle to electronically announce its presence to a roadside sensor, or local cameras will be required to read the vehicle registration or other unique markings on the vehicle.

Any new 'local' land-based infrastructure such as ANPR cameras, or overhead gantries for RFID-based solutions, to read freight vehicle details would be politically interpreted as a hardening of the border and therefore, a less intrusive solution needs to be developed and considered as an alternative.

Sensor-based systems require the implementation of suitable reporting devices into freight vehicles to make them visible to mobile phone masts (GSM), roadside devices, or geo-stationary satellite sensors, depending on the chosen solution. Linking tracking information for each vehicle to its customs declaration, and other mandatory import/export documents, would provide the basis of an automated border checking capability. Furthermore, the collection of data on the movement of freight and goods across the border, combined with advanced analytics and AI, can be harnessed to gain new insights and help to automate the risk assessment and alerting of unknown or undeclared goods to the appropriate border agency.

7 https://www.gov.uk/government/publications/uk-trade-tariff-community-and-common-transit-outwards

8 http://www.europarl.europa.eu/RegData/etudes/STUD/2017/596828/IPOL_STU(2017)596828_EN.pdf

9 http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/european-scrutiny-committee/eu-withdrawal/oral/83055.html

A GPS or a mobile phone signal-based solution has several advantages over more traditional roadside sensors and mounted cameras. Primarily, it requires no physical infrastructure at the border. However, several challenges still exist. Strong co-operation, or some form of legislation, will be required to ensure freight and logistics organisations install such devices into their vehicles. Major manufacturers, including the food industry, will be required to transport goods and livestock via vehicles fitted with such tracking devices.

A mobile phone signal-based solution is also significantly cheaper compared to a satellite solution, where transmitter devices can cost up to £1,000 each, compared to less than £100 for SIM card-based devices. However, there are areas of the Irish border where GSM signal coverage is either too weak or non-existent, resulting in dead zones where tracking will not be possible, compared to the full visibility of a satellite solution.

A useful case study of a GPS-based tracking solution for border management can be found in the Jordanian Government border operations where every goods vehicle entering the country is tagged and tracked until its point of Exit.

Fujitsu Point of View

To effectively achieve the necessary 'infrastructure-free' solution, Fujitsu recommends a GPS or satellite-based tracking solution be evaluated extensively by developing a proof of concept trial. This will allow the capabilities and benefits, along with any restrictions of such a solution, to be thoroughly validated by a small consortium of relevant key stakeholders from across the industry including:

- Members of the UK border departments, including HMRC, Border Force and Defra
- A GSM carrier, such as Vodafone or EE, to provide tracking solutions
- Representatives from major logistics organisations from both Northern Ireland and the Republic of Ireland to provide expertise and take part in a trial
- Supply chain intermediaries such as Grosvenor[10] who provides extensive services to local businesses in the management of customs declarations and processes.

10 http://www.customs.net

Priority#2 – Processing Roll-on, Roll-off (RoRo) Freight at Dover

Currently, heavy goods vehicles (HGVs) carrying goods flow freely in the EU under the terms of the UK's membership of the EU Customs Union and the EU Common Transport Policy. Due to the UK's membership of the Customs Union, today's border controls for RoRo freight are limited to checks on non-EU goods and goods excluded from the freedom of movement within the EU. As a result, trade flows 'friction-free' through these ports, and there are no requirements to process declarations or undertake compliance checks for EU goods.

The vast majority of RoRo vehicles are therefore not subject to customs clearance procedures and pass rapidly through their ports of entry. The major UK RoRo ports are Dover and Eurotunnel which facilitate the movement of 78% of the UK's trade with the EU. In terms of scale, Dover handles £120bn of trade[11], equating to 2.5 million freight vehicles per annum, peaking at over 10,000 per day, with an additional 7,000 for Eurotunnel (inbound plus outbound figures). It is estimated 26% of the UK's total food imports pass through this supply corridor[12], much of this in the form of fresh food which must not be delayed on its journey to consumers.

On average, just 5% of vehicles per day are subject to customs clearance checks which are processed by Motis Freight Services Agency in Dover's West Dock. This equates to just 500 vehicle checks per day. Motis provides parking facilities for 300 vehicles and amenities for truck drivers while their vehicles are checked, which can also extend to cover statutory rest breaks of up to 48 hours. There are 3 inspection bays for customs officials to inspect selected vehicles. Processing times for each declaration average 30 to 40 minutes when the journey to the West Dock, together with parking vehicles, is taken into account.

In the absence of a Free Trade Agreement with the EU, the post-EU Exit scenario will require Dover-based border departments to ensure all freight is compliant with UK trade policies, has been correctly declared, and appropriate duties paid. If these checks were to be completed manually, as they are today, there would be a dramatic increase in the volume of vehicle checks rising from today's average of 500 to over 10,000 per day. Using today's declaration process will cause significant congestion and disruption, with a direct impact to both UK and European supply chains and their economies.

11 https://www.economist.com/britain/2017/04/06/to-see-how-trade-may-work-after-brexit-visit-dovers-docks

12 randd.defra.gov.uk/Document.aspx?Document=10442_FO0108MainReport.pdf

New declaration management processes facilitated by automation with new technology, will be essential to facilitate the rapid verification of vehicles and their goods entering and leaving RoRo ports such as Dover. At the core of any solution would be the requirement to record and link declared goods to the vehicle they are being transported on. This would pave the way for the introduction of technology which automatically senses the vehicle as it crosses a border and confirms it against pre-registered declarations, as illustrated in the diagram on the right:

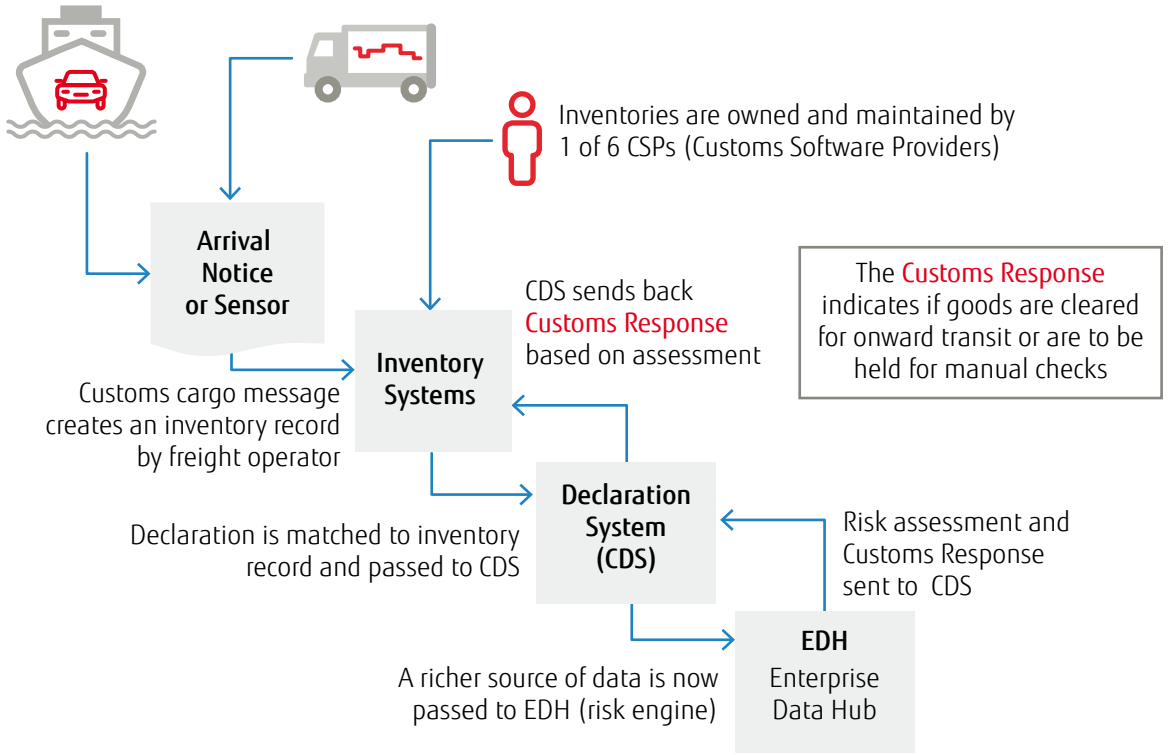

Figure 1: Process flow for the automated verification of freight vehicles

The existing HMRC customs declarations platform, known as CHIEF, is in the process of being replaced by a new, modern system called CDS (Customs Declaration System). The solution depicted above relies on the augmentation of existing capabilities using technology available today. The proposed system integrates the emerging CDS with the existing Enterprise Data Hub (EDH) platform as the two pivotal systems in border clearance following the UK's Exit from the EU. These services are augmented with sensor-based technologies that deliver notices of arrival, promoting automation and efficiency in border processing.

The design and implementation of a solution that can rapidly scan and measure a range of attributes associated with each vehicle to then match with the HMRC Customs Declarations System can provide the basis for an automated solution.

Such an automated border control system, referred to hereafter as a 'physio-metric gate', is a concept which includes a range of scanners and sensors to check and validate the vehicle crossing the border, including:

- Existing video cameras to read vehicle details such as vehicle number plates and TIR numbers on containers
- Facial recognition cameras to compare identity with planned driver identity details and passport/ID card
- QR scanners to enable an advanced 'bar code' capability for drivers to electronically present declaration details, similar to the QR functionality used in air travel boarding cards
- Advanced scanners that can check containers and lorries for stowaways or suspicious cargo
- Weighbridges that can compare 'expected' weight with actual weight, similar to a grocery self-checkout which weighs scanned goods to discourage and reduce theft.

The latest video surveillance and scanner technology can also be enhanced with Artificial Intelligence (AI) technology to recognise types of objects, as well as specific details or configurations associated with those objects. For example, the system can look for vehicle type, colour, brand and model etc. providing additional security checks, if required. Areas of interest on vehicles can be targeted such as seals on TIR containers to assess whether tampering may have taken place.

Current and emerging technologies are further enhancing the ability to detect the presence of stowaways. Everyday background wireless signals, which reflect off human bodies but pass through solid walls, are being used to detect people behind walls and in vehicles.[13] Another technology detects small vibrations of heart beats to find stowaways in vehicles.[14] These emerging technologies can be added to the concept of a physio-metric gate whenever they are adopted by Government border departments.

13 www.alphr.com/artificial-intelligence/1009591/ai-see-through-walls
14 www.wi-ltd.com/product/human-presence-detection-system

To be effective, video surveillance and scanning solutions need to link their data to relevant customs declarations that are associated with the appropriate vehicle or container.

There are potential solutions to this challenge by ensuring organisations, or freight carriers, are required to input vehicle details as part of the original customs declaration submission.

A further challenge is to ensure video and scanning analysis of vehicles can be matched in real-time, enabling vehicles to be automatically cleared at the point of disembarkation without causing delays and hold-ups. Systems will need to perform at appropriate speeds to rapidly process the required data.

Linking video analytics to digital signage within the port will automate management of traffic flow by directing vehicles of interest that require inspection to appropriate holding areas. Such automated digital signage can be offered in the local language, appropriate for the nationality of the driver detected.

Fujitsu Point of View

Existing port surveillance will need to be enhanced considerably to maximise efficiency and avoid significant congestion, delays and disruption that would result from using today's declaration process. Testing existing port of Dover surveillance infrastructure and evaluating its capability to automate vehicle recognition through number plate detection, linking this information in real-time to declaration information, will highlight unknown or undeclared goods.

Priority #3 – Supporting UK industry to prepare for the EU Exit

The Government released a number of Guidance Notes, on the 23rd August 2018, to aid businesses in their EU Exit preparations, while also reaffirming its commitment to minimise any impact on trade;

The UK 'will continue to apply highly automated, risk based and intelligence targeted customs controls', and 'as they do today, HMRC will ensure its interventions are conducted in a way which minimises delays and additional burdens to legitimate trade, while robustly ensuring compliance'.

The Guideline Notes identify a number of immediate changes to the procedures that apply to businesses trading with the EU, as the free circulation of goods between the UK and EU would cease including:

Trade

- Businesses have to apply the same customs and excise rules to goods moving between the UK and the EU as currently apply in cases where goods move between the UK and a country outside of the EU. This would require a customs declaration when goods enter or leave the UK.
- The EU will apply customs and excise rules to goods it receives from the UK in the same way as it does for goods it receives from outside of the EU. This would require a customs declaration when goods enter/leave the EU from/to the UK.
- The Excise Movement Control System would no longer be used to control suspended movements between the EU and the UK. This will mean that immediately on importation to the UK, businesses moving excise goods within the EU, including in duty suspension, will have to place those goods into UK excise duty suspension to avoid payment.
- For UK exports to the EU, the EU will require payment of customs duty at the rate specified in the Common Customs Tariff. For goods imported to the UK from the EU the UK will require payment of customs duty at the rate set by the UK Government. The Customs Bill will provide the necessary powers for the UK to set its own tariff once it leaves the EU.
- Trade with the EU will be on non-preferential WTO terms. This means that most favoured nation (MFN) tariffs and non-preferential rules of origin would apply to consignments between the UK and EU.
- The UK's MFN tariffs may be different from the rates set by the EU. The Government will publish these rates before the UK leave the EU.
- The UK intends to continue offering unilateral preferences to developing countries and will seek to transition all EU Free Trade Agreements in order to ensure continuity for goods imported to the UK and for UK exports.

VAT

The Governments aim is to keep VAT procedures as close as possible to current arrangements, however, specific changes may be necessary for transactions between the UK and EU Member States. Key changes to today's VAT practices include:

- Importing goods from the EU, VAT will be postponed and paid on their VAT return, rather than paying VAT on or soon after the time that the goods arrive at the UK border (this will apply to imports from both EU and non-EU countries)
- Exporting goods to the EU, VAT and customs processes will be implemented at the EU border, with businesses required to check with the EU or relevant Member State on the necessary rules and processes which will apply to goods.

The Guidance Notes also describe the creation of a new department, the UK Trade Remedies Authority (TRA), independent of the EU, to manage claims of unfair trade practices from UK businesses.

Fujitsu Point of View

In light of the recently published Government Guidelines (23rd August 2018), a review should be completed to ensure all such impacted IT systems have been correctly identified and appropriate remediation plans are in place, supported by sufficient resources, to ensure they are addressed in time for the EU Exit deadline, including:

- An estimated 5 fold increase in declaration volumes, from a current 50 million to an estimated 250 million per annum, will significantly increase transaction volumes on a range of systems
- An estimated 150,000 businesses will need to register for a valid UK Economic Operator Registration and Identification (EORI number)
- Compliance, safety and security certification volumes will increase
- More goods will be subject to Value Added Tax (VAT) and import duties.

HMRC will deliver the new Customs Declaration System (CDS) in early 2019. CDS will support anticipated future import and export growth of the UK, and provide businesses with access to more of their customs information in a single location. To support the success of CDS, and provide a contingency option, the existing declaration system, CHIEF, is also being upgraded to handle an estimated five fold increase in customs declarations. A clear strategy for the migration of service from CHIEF to CDS, including any potential intermediate dual running options must be a core feature of the CDS programme. Existing tariff management systems need to be reviewed to determine how they will handle a multi-tariff regime. VAT systems should be reviewed to assess the dual impact of both a potential increase in transaction volumes as well as new requirements to support the proposed VAT deferral policies. Planning should commence as soon as possible to develop the new system required to support the new TRA department, together with establishing any required IT infrastructure and support services. A thorough review of the Customer Services function and its capacity to expand and support potential increased demand from its customers during the early post Exit period. To support the registration of new users, Fujitsu recommends the use of Robotic Process Automation (RPA) and AI as a means of automating existing agents repetitive clerical tasks to better enable them to support other EU Exit demands.

4. Exploiting innovation in the global supply chain industry

The global supply chain industry is undergoing a period of significant economic challenges, which is driving investment in the creation of new business models supported by the adoption of new and emerging technology.

In this section we look at these market challenges, how the industry is adapting to tackle these issues and what this means for the Future Border Programme.

Key dynamics in the global supply chain industry

Manual processes are still commonplace

The global supply chain industry has changed relatively slowly since the last major innovation of the 1960s when the introduction of standard size containers delivered efficiencies in the movement of goods between different modes of transport. Despite some modernisation since then, much of the industry still relies on paperwork to manage the shipment of goods between supply chain parties and Government Border Departments.

A fragmented supply chain

The modern world of international trade is complex, involving many players who historically have operated in siloes, resulting in a loosely connected end-to-end model with little operational integration and limited sharing of data. The diagram below provides a high-level view of the key operators within an end-to-end global supply chain. Red lines indicate where touch points exist, but generally operate without the benefit of shared objectives, processes and, importantly, data.

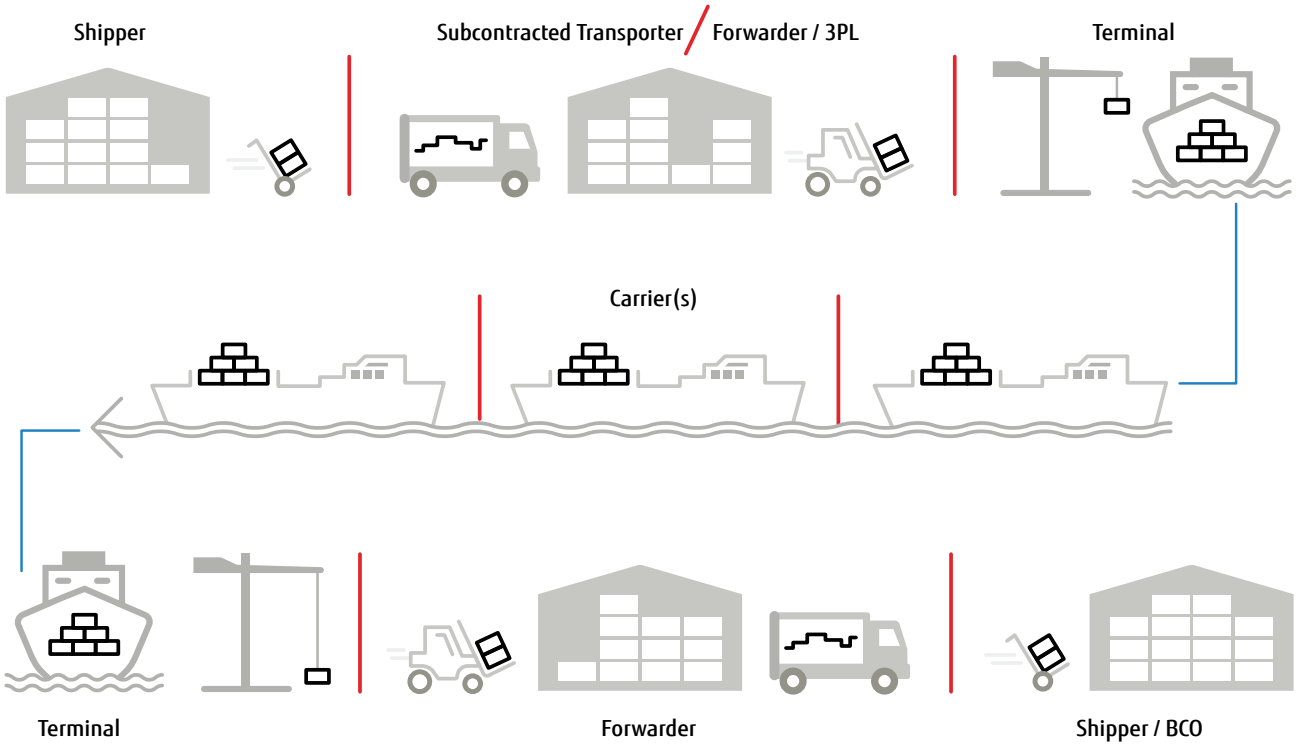

Figure 2: The international supply chain - the red markings highlight a lack of communication and collaboration between the parties [Source – Kris Kosmala Quintic]

Supply outstrips demand

The shipping industry is operating in a market where capacity outstrips demand. Despite this excess capacity, major shippers continue to invest in larger vessels to seek operational efficiencies, further stoking the situation. Boston Consulting estimates excess capacity will continue and forecasts it to reach between 8.2% and 13.8% by 2020.[15] Major shipping firms are experiencing periods of negative profits, forcing some into liquidation and others to merge with competitors to seek operational efficiencies.

New players squeeze the market

New entrants such as Amazon's China subsidiary are entering the market, increasing competition and placing further pressure on pricing. Amazon China now has a US maritime freight forwarders' licence that allows the subsidiary to sell existing carrier capacity. This enables an Amazon freight-shipping service to handle goods from the point they leave a factory in China to the point they are lodged in a distribution warehouse in the US - a win-win for Amazon and those who produce the goods it sells.[16]

Alibaba is following similar plans to extend their operations into the global supply chain. Founder and Chairman, Jack Ma, coined the term "New Retail" in a letter to Alibaba's shareholders in October 2016 to explain his strategy in this area:

"Pure e-commerce will be reduced to a traditional business and replaced by the concept of New Retail: the integration of online, offline, logistics and data across a single value chain."

Fujitsu Point of View

Advancements in the global supply chain industry continue to occur irrespective of organisational boundaries through digital partner ecosystems or "Digital Arenas". To exploit these advancements, Fujitsu recommends a "Digital Arena" be enforced to improve post-border capabilities, enabling initiatives such as extending the 'data pipeline' into retail and consumer sectors, and increasing the border's contribution to UK GDP.

Fujitsu believes that this is the model for next generation global commerce, with large retailers and niche category specialists leveraging technology to provide an integrated service with the consumer at its core.

15 www.joc.com/maritime-news/container-lines/container-shipping-overcapacity-forecast-worsen_20161102.html

16 www.porttechnology.org/news/amazon_launches_service_to_disrupt_shipping_industry

The Industry's Response

The industry is responding to its economic pressures with key players investing in new business models to ensure their survival and future growth.

Connecting the supply chain with Common Trading Platforms

Operational efficiencies, and improved customer service, are being sought by digitising the business processes connecting supply chains, effectively joining the fragmented industry together. A survey by Navis, published as 'Working as One', found 97% of the industry supports the importance of supply chain stakeholders being able to operate with a common set of data, as in the travel industry today.[17]

Case Study 1: Smart Marine Ecosystem

Wärtsilä, a leading Finland-based marine engineering company, is developing a 'Smart Marine Ecosystem' vision whereby smart vessels connect with smart ports to deliver three fundamental industry benefits:

1. Maximising the use of resources and operational efficiency
2. Minimising environmental impact and risk
3. Achieving the highest levels of safety and security.

Wärtsilä sees four primary forces that will re-shape the industry:

- Shared capacity will improve fill rates and reduce unit costs
- Big data analytics will optimise both operations and energy management
- Intelligent vessels will enable automated and optimised processes
- Smart ports will result in smoother and faster port operations.

"The world is moving towards a future that is more and more connected, and nowhere is this more apparent than in the shipping sector. The opportunities offered through smart technology will foster a new era of collaboration and knowledge sharing with customers, suppliers and partners."

Roger Holm, President, Wärtsilä Marine Solutions

Other similar cases exist. For instance, a multi-national technology firm and a freight forwarder are attempting to connect all components of the supply chain and digitise the process of managing and tracking container shipments by establishing a Global Blockchain-based Trading Platform. Customs departments of countries such as Singapore and Peru are joining this consortium, providing further evidence these common platforms are gaining traction in the industry.

"This... marks a milestone in our strategic efforts to drive the digitisation of global trade. The potential from offering a neutral, open digital platform for safe and easy ways of exchanging information is huge, and all players across the supply chain stand to benefit." Vincent Clerc, Chief Commercial Officer A.P. Moller - Maersk

17 navis.com/workingasone

In another example, a global freight forwarding agency is partnering with a technology enabler to pilot a programme to digitise shipping document processing based on Blockchain technologies. This programme involves a European customs agency digitising the processing of Bill of Lading (BoL) documents, one of the most important documents in the shipping process that details the goods a ship is carrying. In this example the aim is to offer the global logistics industry a smart eBoL that eliminates paper versions of this legal document and reduces operational overheads.

Smart Ports - Automating with the Internet of Things

The Internet of Things (IoT) has been readily adopted by the global supply chain industry.

Many initiatives are in progress, seeking to benefit from its ability to provide tracking of goods as they progress through the supply chain, together with monitoring their environmental conditions to ensure conditions are optimal for their transport, and even to detect potential tampering and theft.

Fujitsu is working with a range of industries to develop their IoT strategy further, including actively developing the "Fujitsu Mobility IoT 2020"[18] vision. The technology solutions and platforms for this connected car and vehicles vision are directly relevant to many IoT scenarios, including the supply chain.
The use of AI to intelligently manage the vast array of resultant data, and the importance of robust security are fundamental to IoT programmes, as well as some examples of how this technology can be deployed effectively.

Case Study 2: The world's smartest port

Rotterdam, Europe's largest port, is integrating IoT sensors with AI and weather reports to automate the management of docking schedules for vessels, ensuring utilisation is optimised according to demand and weather conditions. Rotterdam aims to be the world's smartest port, with plans to digitise and create an IoT-based operations platform which will collect and process data from a large number of processors.

The initiative is intended to prepare the 42km port for the future of autonomous shipping. The port's first steps in this journey have been to create a real-time port dashboard to increase the safety and efficiency of transport management.

IoT is also being combined with other technologies, such as Blockchain, where it is being used to develop 'crypto-anchors'. These are being trialled to automatically validate the origin and manufacture of goods. Microchips are placed on goods and encoded with Blockchain entry references to act as a digital certificate of authenticity. This provides a way to control counterfeiting and Certificate of Origin fraud.

18 www.youtube.com/watch?v=LN5szrjsf9I

This technology is currently being evaluated to understand how it could help tackle the global issue of tobacco fraud. The UK Exchequer estimates a tax gap of £1.9bn of unpaid tobacco duties, equivalent to 16.9% of total tobacco revenue in 2015/16. To combat this issue, Article 15 of the EU Tobacco Products Directive will mandate that by May 2019 all member states must have in place the ability to trace tobacco goods to their source of origin, and to track all points of their supply chain journey. Smart devices installed in cigarette packets, able to contain important product and supply chain data which can then be automatically read by sensors, will form the core technology strategy for a viable solution.

Fujitsu is currently trialling a tracking solution where individual cigarette packets are tagged during manufacture. These tags can store product information and journey history, which can readily be scanned, and information accessed via a simple mobile phone, preventing counterfeiting and supporting customer engagement.

Case Study 3: Port of Hamburg seeks 300% growth in container volumes

Europe's second largest port, Hamburg, anticipates that it will need to accommodate a 300% growth in container volumes by 2025 but without being able to increase the size of the port. The port authority is looking to IoT technologies to become more efficient:

- By using automatic radar identification and RFID, port authorities know what is moving around the port, the origin and destination of goods, what the expected delivery times are, and what port services need to be deployed for proper handling.
- IoT sensors provide automated asset management of trucks, cranes, carriers and infrastructure management of roads, parking lots, warehouse storage and so on.
- Heat and motion sensors linked with cameras and alarm systems are being used to detect and deter crime in the port.
- Sensors and cameras are being used to reduce the amount of physical checking needed at custom control points, which in turn reduces labour costs and dwell time at customs.

Smart shipping enabled by Artificial Intelligence and Machine Learning

The shipping industry has also led the way with extensive adoption of AI and Machine Learning technology to optimise complex operational processes, driving efficiency and saving costs.

A comprehensive report on the adoption of AI in the shipping industry has been published by INTTRA[19]

Much of today's complex capacity planning, scheduling and route optimisation is handled by AI-based systems:

- The task of loading and unloading today's vast super tankers, capable of carrying 20,000 containers, is a hugely complex challenge which only AI can now solve.
- Complex variable pricing structures are continually checked and optimised to ensure capacity and demand are matched and the most suitable pricing schedule offered.
- Routes are planned and managed by AI systems ensuring speed and direction are continually optimised to minimise transport costs.

Fujitsu Point of View - Digital Transformation creates Opportunities

The emergence of Common Trading Platforms promises real-time access to detailed supply chain data. Using AI to mine and extract information from these platforms will provide unprecedented levels of insight, supporting more efficient and effective border operations while strengthening security capabilities.

Fujitsu recommends early involvement and collaboration with leading insight-related industry initiatives, such as Common Trading, Smart Ports and Smart Shipping, in order to be able to maximise the value of real-time insights in the long-term.

This will enable the Future Border Programme to gain significant benefits, such as:

- Exploring how and where it can benefit from these industry initiatives
- Influencing programmes to include border requirements
- Identifying ways to motivate industry to invest in border initiatives
- Build internal skills in new technologies and
- Prepare cross-department IT platforms to host common systems.

19 https://www.inttra.com/inttra-insights/white-paper/how-artificial-intelligence-can-power-growth-and-opportunities-in-global-container-shipping/

5. Shaping the Future Border Programme

The wide range of technology available to organisations today offers a bewildering choice of options. Fujitsu Technology and Service Vision 2018[20] sets out our view of the future, providing insights to leaders of business, and the public sector, into how they can use technology to create innovation and build a better future.

The previous section looked at how the challenging dynamics of the global trade industry are driving the creation of new business models and the adoption of new technologies which will ultimately digitise the supply chain. This section now focusses on the technologies required to extract value from the resulting exponential growth in supply chain data to help to deliver the future border vision.

Delivering the Future Border Vision

Delivering the Future Border Programme is a highly complex challenge. The vision for the Future UK Border will be continuously developed by the Border Planning Group across border departments and agencies, and evolve at a more detailed level in collaboration with industry and technology partners. This process will provide the governance required to identify the change programmes necessary to successfully deliver and implement the solutions.

Central to the success of the Future Border vision is the operational integration of border departments, establishing 'one government at the border' joined with common, simplified and integrated processes to manage the border. This provides the foundation to build technology solutions to automate these common processes, and enable the efficient sharing of information across departments.[21]

Singapore, a leading global trading region, began its future border journey in 1986, through a government-led programme focused on integrating all border departments, as well as improving coordination with industry stakeholders.

This led to the creation of an electronic portal called Tradenet, an example of a 'Single Trade Window' (STW), which integrates import, export and transhipment document processing procedures, enabling trade and logistics communities to electronically fulfil their trading formalities with government departments.

Underpinning the successful integration of border departments is the requirement for an IT infrastructure common to the Government's 21 border departments, supporting shared applications, and systems, such as a Single Trade Window. Such a platform must be:

- Scalable and flexible to meet ever-changing volumes and demands
- Able to connect with and ingest data from a wide range of sources
- Consistently perform to required service levels
- Remain secure as threats continue to increase in complexity and frequency.

Establishing a central architecture and governance function to oversee the future border IT platform architecture and standards will provide the basis to deliver this requirement.

20 www.fujitsu.com/global/vision

21 www.customs.gov.sg/about-us/national-single-window/tradenet

Fujitsu Point of View

To extract optimum value from the exponential growth in supply chain data, Fujitsu recommends two core principles underpin the technical strategy of the Future Border:

1. Establishing a 'one government at the border' operational capability supported by the implementation of a Single Trade Window.
2. Design common IT platforms to enable border departments to benefit from shared access to applications and data.

One Government at the Border and the Single Trade Window

A Single Trade Window (STW) is a facility that allows parties involved in trade and transport to lodge standardised information and documents with a single entry point to fulfil all import, export, and transit-related regulatory requirements. The STW reduces non-tariff trade barriers, delivering immediate benefits to all members of the trading community in the form of quicker and more cost-effective processing times.

Organisations engaged in international trade with the UK today regularly have to submit large volumes of information and documents to border authorities to comply with import, export and transit-related regulatory requirements. This information and documentation often has to be submitted through several different agencies, each with its own specific (manual or automated) system and paper forms. These requirements, together with the associated compliance costs, constitute a burden both to the Government and to the business community, potentially creating barriers to the development of international trade.

At least 30 major trading regions[22] have successfully implemented a Single Trade Window, however, there isn't one consistent standard to define what a STW should comprise. There are several approaches to the creation of a STW, some have deployed package solutions from specialist software houses such as Crimson Logic, while others have taken a more bespoke path, developing their own in-house solution.

The existing HMRC customs declarations platform known as CHIEF is in the process of being replaced by a new, modern system called CDS (Customs Declaration System). This new product has greater flexibility than the legacy platform it replaces and has the potential to form the basis of a future UK STW.

Lessons learnt from successful implementations around the world include the importance of a strong culture change programme which unites border departments with a set of common processes integrated by the STW. The United Nations Economic Commission for Europe has published a Single Trade Window implementation guide in which it also details the benefits several nations have obtained from its implementation.[23]

22 www.unece.org/fileadmin/DAM/cefact/single_window/draft_160905.pdf

23 http://www.unece.org/fileadmin/DAM/cefact/publica/SWImplementationFramework.pdf

Case Study 4: Port of Singapore implements TradeNet

In 1989, the port of Singapore deployed the world's first single trade window. TradeNet connected 34 Government departments, and provided a single point for all trade transactions, while delivering some significant cost and efficiency benefits:

Activity	Before TradeNet	After TradeNet
Processing time / permit	2-7 days	Within 10 mins
Fees charged	US$6-$13	Approx. US$2.10
No. of documents	4-35 documents	1 eform
Time of submission	Office hours	Available 24 hours

Source: Crimson Logic[24]

Fujitsu Point of View

To effectively develop a Single Trade Window for the UK, Fujitsu recommends the following action plan:

- Build a solid business case to support the investment required to create a STW. Case studies from trading regions who have created a STW capability confirm there can be a significant investment requirement, both internally for business changes and externally to technology suppliers.
- Any development of a STW must build on the existing and ongoing investments in the new CDS declaration system.
- Access to proven expertise in the creation of STWs is essential to guide the programme through the building of the required eco-system. Identify and establish collaboration with the required stakeholders, including traders, shippers, freight forwarders and CSPs, insurance, finance, legal and policy organisations, as well as all border agencies.
- Encourage the engagement of key industry stakeholders to actively participate in the eco-system by providing clear benefits of their involvement and investment.
- An incremental and agile approach will de-risk such a large programme, where each increment is able to provide a measure of business value.

24 www.crimsonlogic.com

Technology at the Border

At the core of the vision will be the application of new and emerging technologies to digitise the border, realise operational improvements, reduce friction and thereby facilitate growth in trade and UK GDP. We've already looked at how the global supply chain industry is adopting innovative technologies to tackle economic and business challenges facing the sector today. Now let's look at the key new and emerging technologies which will be integral to the delivery of the Future Border vision.

Artificial Intelligence

We have shown how the use of AI has started and will continue to grow in the global supply chain industry, playing a part in trading hubs, serving the needs of individual organisations as well as partnerships. AI should be a common thread in the Future Border Programme, serving to deliver the border vision. AI is fuelled by data and, as such, its successful exploitation will depend on robust data management practices across all border operations.

The Future Border Programme needs to be the vehicle for moving UK Government from a position of having data about border operations to being eager and highly proficient in gathering more data and putting it to use in both reducing friction for trade, increasing compliance, and improving security capabilities.

Fujitsu Point of View

Fujitsu recommends the Future Border Programmes should use AI to enhance existing processes to improve and fully exploit data management practices across all border operations. The approach to determine focus areas for enhancements should include:

- Collaborate with Industry Leaders – close collaboration and engagement with supply chain industry leaders and bodies, linking up with their AI-related projects and programmes
- Explore AI as a means of augmenting current processes – evaluation of existing border-related processes that depend on human analysis and intelligence and explore whether these could be augmented with AI-based automation
- Evaluate current data sets to glean new operational intelligence – evaluation of existing data sets involved in border-related processes, and with a data science 'lens' explore how these could be used to provide new operational intelligence and compliance trends and patterns.

Distributed Ledger Technology

The global supply chain industry is one of many early adopters of Blockchain technology, with several interesting trials and proof of concept programmes relevant to the Future Border vision which are actively in progress today. The following attributes of Blockchain technology are of value to the UK Future Border Programme:

- Visibility – a Blockchain integrated global supply chain (data pipeline) has the potential to provide unprecedented access to trade data.
- Smart Contracts – within Blockchains, 'Smart Contracts' can be created using predefined rules, enabling processes such as border clearance to be automatically triggered when transactions meet certain criteria as they arrive at the border.
- Trusted Data – all those party to the data in the supply chain Blockchain have validated this data which is permanently recorded, providing a new level of veracity of the data.

However, according to Gartner, Blockchain is currently immature and anticipated to be 5-10 years away from becoming a proven and established technology.

To further complicate matters there are new Blockchain-like technologies emerging, such as Hashgraph[25], which have the potential to offer the benefits of Blockchain without its inherent drawbacks.

Fujitsu Point of View

For the Future Border Programme to develop successful Blockchain strategies, Fujitsu recommends the following multi-faceted approach:

- **Centre of Excellence** – establish a Blockchain competency centre with skills and knowledge to own Future Border Blockchain strategy and initiatives.
- **Partner with leading innovators** – understand the industry's adoption of Blockchain and how it can be leveraged by the border (see examples on page 23).
- **Initiate cross-department exploratory trials of Blockchain** – the Blockchain Centre of Excellence should establish a cross-departmental working party to identify use cases where Blockchain technology can be applied to enhance inter-departmental collaboration.
- **Initiate exploratory Blockchain trials with the Shipping industry** – preparing for inbound goods, declaration digitisation, such as integration with Shipper's Blockchains which capture movement of goods, eBoL forms, etc.
- **Continually assess learning needs** – as specific use cases are evaluated and PoCs are identified and delivered, learnings need to be continually assessed, and adoption strategies refined to ensure the success of Blockchain at the Future Border.

25 www.hederahashgraph.com

Internet of Things

We have already seen how the adoption of IoT technology by the global supply chain provides the opportunity to develop an effective smart border. Information from devices attached to vehicles, shipping containers or individual packages can be collected and combined with data from other detectors, such as port cameras, to provide a comprehensive data stream about the movement of goods.

This adoption of IoT technologies is being driven by governments and trading regions as they recognise its potential to deliver efficiency through automation and reduce fraud at the border. One such application is the implementation of Articles 15 and 16 of the EU Tobacco Products Directive 2014/40/EU which is mandating an EU-wide system of traceability and security features for tobacco products to address the issue of illicit trade[26].

Sensors and detectors at ports of entry will be capable of automatically collecting data from any 'tagged' goods, to be used for customs and security checks. This digital transformation of the border is represented in the diagram below, and will generate huge volumes of data which can be enriched further with news and social media. The use of advanced analytics and AI to mine this data will provide deeper levels of insight than are possible today, allowing departments to interrogate the data like never before and determine action based on the answers.

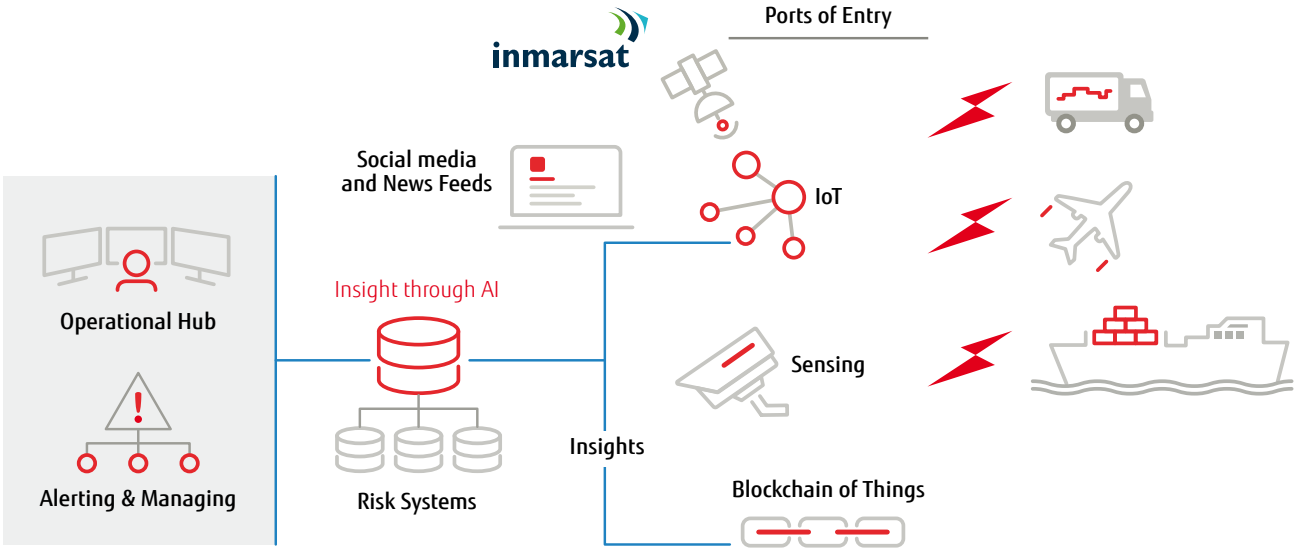

Figure 3: The digital transformation of the border

26 ec.europa.eu/health/tobacco/tracking_tracing_system_de

IoT technologies can also be used to automate the management of important assets managed by border officials. These assets can vary from important and secure managed devices such as laptops and border 'stamps', to customs and border force seized goods. Seized goods are retained in warehouses where manual processes are often used to track their lifecycle from seizure to destruction or return, via an often complex journey including court evidence requirements. A tagging solution, such as RFID, will automate the inventory management of these goods, increasing efficiency, and improving security.

Fujitsu Point of View

Fujitsu recommends that the Future Border Programme create a specific IoT supply chain and UK border consortium to take the lead in designing the architecture for an IoT Event Processing Platform and providing a cross-department capability to integrate IoT data supplied by any source.

The Programme should also pursue improvement initiatives of both port operations, working with Port Authorities and Border Force to identify and prioritise suitable use cases, and operational activities such as the tracking of sensitive assets, and the tracking and safekeeping of seized goods within and moving to and from Queen's bonded warehouses.

These early projects will help set the foundation for an IoT-enabled border by creating internal capability in IoT, as well as highlighting which projects are more promising for a full rollout at the border.
It is also crucial that any IoT implementation be evaluated in the context of the other big data and AI or Blockchain initiatives, as these are likely to overlap, and/or address similar issues.

Satellite Technology

Fujitsu is working with Inmarsat, a British satellite organisation with a global presence. Inmarsat is present as a mandatory safety device in all commercial ships (300 Gross Tonnage and above). This enables Inmarsat to track maritime traffic to obtain and present valuable insights for border operations. This technology, combined with AI, has the potential to create several valuable capabilities, including:

- A highly visual operational hub capability, where all maritime traffic are displayed, items of interest are automatically alerted and 'tagged' for the attention of the border officials.
- Automated alerting of unusual vessel journeys and movements, e.g. potentially smuggling or piracy related.
- Detailed insights to border officials for incoming vessels and their goods by linking shipping manifests with their vessels (the data pipeline)
- Pre-authorisation allowing clearance of goods carried by Authorised Economic Operators (AEOs) and trusted traders ahead of reaching the port, speeding up processing.
- Ability to prevent illegal fishing by checking boats by their country of origin.
- Data can be linked with social media to enrich the insights provided. For instance, local news of smuggling activities in ports along the supply chain journey to the UK could be used to highlight vessels which have recently docked in that port and flag them for more detailed inspection.

Fujitsu Point of View

In order to evaluate the applicability of satellite technology to the programme, Fujitsu recommends a useful benchmark case would be the monitoring of unmanned ports. Establishing a small working group to test the value and applicability of the technology is the best way to progress this initiative.

6. Fujitsu Recommendations Reference Guide

Future Border Imperative	Fujitsu Recommendation
EU Exit Priority #1 The Irish Border	To effectively achieve the necessary 'infrastructure-free' solution, Fujitsu recommends a GPS or satellite-based tracking solution be evaluated extensively by developing a proof of concept trial. This will allow the capabilities and benefits, along with any restrictions of such a solution, to be thoroughly validated by a small consortium of relevant key stakeholders from across the industry including: ■ Members of the UK border departments, including HMRC, Border Force and Defra. ■ A GSM carrier, such as Vodafone or EE, to provide tracking solutions. ■ Representatives from major logistics organisations from both Northern Ireland and the Republic of Ireland to provide expertise and take part in a trial. ■ Supply chain intermediaries such as Grosvenor[30] who provides extensive services to local businesses in the management of customs declarations and processes..
EU Exit Priority #2 Processing Roll-on, Roll-off (RoRo) Freight at Dover	Existing port surveillance will need to be enhanced considerably to maximise efficiency and avoid significant congestion, delays and disruption that would result from using today's declaration process. Testing existing port of Dover surveillance infrastructure and evaluating its capability to automate vehicle recognition through number plate detection, linking this information in real-time to declaration information, will highlight unknown or undeclared goods.
EU Exit Priority #3 Preparing UK industry for the impact of the EU Exit	To support UK businesses with their preparations for an EU Exit, Fujitsu recommends a number of technology initiatives: ■ A review to ensure all government IT systems which will be impacted by the EU Exit have been identified and plans are in place to complete any required remediation. ■ A clear migration strategy is in place for the replacement of the current declaration system, CHIEF, with the new CDS platform. ■ VAT systems are reviewed to assess their ability to handle the proposed deferred payment policy. ■ Planning commences for a new system to support the new Trade Remedies Authority. ■ The existing tariff systems are assessed to determine they can handle multiple tariff regimes. ■ Customer services capacity is reviewed to ensure it will handle an anticipated increase in customer demand. ■ Automation technologies such as Robot Process Automation are adopted to streamline customer services operations.

30 http://www.customs.net

Future Border Imperative	Fujitsu Recommendation
Exploiting innovation in the global supply chain industry	Advancements in the global supply chain industry continue to occur irrespective of organisational boundaries through digital partner ecosystems or "Digital Arenas". To exploit these advancements, Fujitsu recommends a "Digital Arena" be enforced to improve post-border capabilities, enabling initiatives such as extending the 'data pipeline' into retail and consumer sectors, and increasing the border's contribution to UK GDP. Fujitsu believes that this is the model for next generation global commerce, with large retailers and niche category specialists leveraging technology to provide an integrated service with the consumer at its core.
Exploiting innovation in the global supply chain industry	The creation of Global Trading Platforms and the real-time insights available from the global supply chain digital transformation can support more efficient border operations, increase revenue collection, and strengthen security. Fujitsu recommends early involvement and collaboration with leading insight-related industry initiatives, such as Common Trading, Smart Ports and Smart Shipping, in order to be able to maximise the value of real-time insights in the long-term. This will enable the Future Border Programme to gain significant benefits, such as: ■ Exploring how and where it can benefit from these industry initiatives. ■ Influencing programmes to include border requirements. ■ Identifying ways to motivate industry to invest in border initiatives. ■ Build internal skills in new technologies and ■ Prepare cross-department IT platforms to host common systems.
Delivering the Future Border Vision	To extract optimum value from the exponential growth in supply chain data, Fujitsu recommends two core principles underpin the technical strategy of the Future Border: 1. Establishing a 'one government at the border' operational capability supported by the implementation of a Single Trade Window. 2. Design common IT platforms to enable border departments to benefit from shared access to applications and data.

Future Border Imperative	Fujitsu Recommendation
Driving UK Border Performance Transformation through Technology **Single Trade Window**	To effectively develop a Single Trade Window for the UK, Fujitsu recommends the following action plan: ■ Build a solid business case to support the investment required to create a STW. Case studies from trading regions who have created a STW capability confirm there can be a significant investment requirement, both internally for business changes and externally to technology suppliers. ■ Any development of a STW must build on the existing and ongoing investments in the new CDS declaration system. ■ Access to proven expertise in the creation of STWs is essential to guide the programme through the building of the required eco-system. Identify and establish collaboration with the required stakeholders, including traders, shippers, freight forwarders and CSPs, insurance, finance, legal and policy organisations, as well as all border agencies. ■ Encourage the engagement of key industry stakeholders to actively participate in the eco-system by providing clear benefits of their involvement and investment. ■ An incremental and agile approach will de-risk such a large programme, where each increment is able to provide a measure of business value.
Driving UK Border Performance Transformation through Technology **Artificial Intelligence**	Fujitsu recommends the Future Border Programmes should use AI to enhance existing processes to improve and fully exploit data management practices across all border operations. The approach to determine focus areas for enhancements should include: ■ Collaborate with Industry Leaders – Close collaboration and engagement with supply chain industry leaders and bodies, linking up with their AI-related projects and programmes. ■ Explore AI as a means of augmenting current processes – Evaluation of existing border-related processes that depend on human analysis and intelligence and explore whether these could be augmented with AI-based automation. ■ Evaluate current data sets to glean new operational intelligence – Evaluation of existing data sets involved in border-related processes, and with a data science 'lens' explore how these could be used to provide new operational intelligence and compliance trends and patterns.

Future Border Imperative	Fujitsu Recommendation
Driving UK Border Performance Transformation through Technology Distributed Ledger Technology (Blockchain)	For the Future Border Programme to develop successful Blockchain strategies, Fujitsu recommends the following multi-faceted approach: ■ Centre of Excellence – establish a Blockchain competency centre with skills and knowledge to own Future Border Blockchain strategy and initiatives. ■ Partner with leading innovators – understand the industry's adoption of Blockchain and how it can be leveraged by the border. ■ Initiate cross-department exploratory trials of Blockchain – the Blockchain Centre of Excellence should establish a cross-departmental working party to identify use cases where Blockchain technology can be applied to enhance inter-departmental collaboration. ■ Initiate exploratory Blockchain trials with the Shipping industry – preparing for inbound goods, declaration digitisation, such as integration with Shipper's Blockchains which capture movement of goods, eBoL forms, etc. ■ Continually assess learning needs – as specific use cases are evaluated and PoCs are identified and delivered, learnings need to be continually assessed, and adoption strategies refined to ensure the success of Blockchain at the Future Border.
Driving UK Border Performance Transformation through Technology Internet of Things (IoT)	Fujitsu recommends that the Future Border Programme should create a specific IoT supply chain and UK border consortium which will take the lead in designing the architecture for an IoT Event Processing Platform providing a cross-department capability to integrate IoT data supplied by any source. The Programme should also pursue improvement initiatives of both port operations, working with Port Authorities and Border Force to identify and prioritise suitable use cases, and operational activities, such as the tracking of sensitive assets, and the tracking and safekeeping of seized goods within and moving to and from Queen's bonded warehouses.
Driving UK Border Performance Transformation through Technology Satellite Technology	In order to evaluate the applicability of satellite technology to the programme, Fujitsu recommends a useful benchmark case would be the monitoring of unmanned ports. Establishing a small working group to test the value and applicability of the technology is the best way to progress this initiative.

7. About the Authors

For over 40 years, Fujitsu has been a trusted provider to the public sector through the delivery of nationally critical services. This expertise encompasses those specialist fields primarily affected by EU Exit, including the movement of people and goods, security of the borders, the collection of duties, revenues and payment of benefits.

Our services touch 99% of the UK population each day and this expertise provides a deep insight into the options available to both address the challenges and maximise the opportunities of EU Exit, whether through the application of today's technology or the exploitation of emerging technology which can transform UK border performance.

Committed to driving sustainable economic growth, Fujitsu has brought together over 50 years of experience of working with government and border departments into a working group of subject matter experts, business consultants, architects and engineers. Led by Frank Dunsmuir, Adriano Sergian, Marek Wolski and Matt Lockley, the group's goal has been to explore, evaluate and document how current and emerging technologies can drive UK GDP growth through transformation of UK border performance.

Since the inception of the Future Border Programme in 2017, this group has facilitated discussions and gathered inputs from government and border departments, port authorities, industry, economists, freight forwarders, and law firms, among others, to bring together a unique comprehensive perspective.

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"I would like to acknowledge my co-authors whose support and hard work have been instrumental in its production, most notably Adriano Sergian, Business Consultant, and Marek Wolski and Matt Lockley, both Fujitsu Distinguished Engineers."

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