50 YEARS OF MANUFACTURING AT CAMBRIDGE

IfM Briefing Day

Digital Supply Chains

recent work undertaken in the IfM's Centre for International Manufacturing on the progressive digitalisation of supply chains

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IfM Centre for International Manufacturing

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Four themes – key questions

Critical questions and emerging value propositions include

- How do we enable **data integration** across the supply chain for more responsive or adaptive supply?
- How do we improve **end-to-end inventory management**?
- How do we **monitor product quality** and delivery performance, ensuring high product visibility, traceability, and environmental compliance?
- How do we monitor **product efficacy in-use**, and capture end-user patient/customer feedback?
- What is the **role of regulators and standards agencies** to facilitate the benefits that digital supply chains might offer?

ReMediES

RE-configuring MEDIcines End-to-end Supply

Headed up by GlaxoSmithKline (GSK)

Research led by the University of Cambridge's Institute for Manufacturing (IfM)

Brings together key players in the medicines end-to-end supply chain

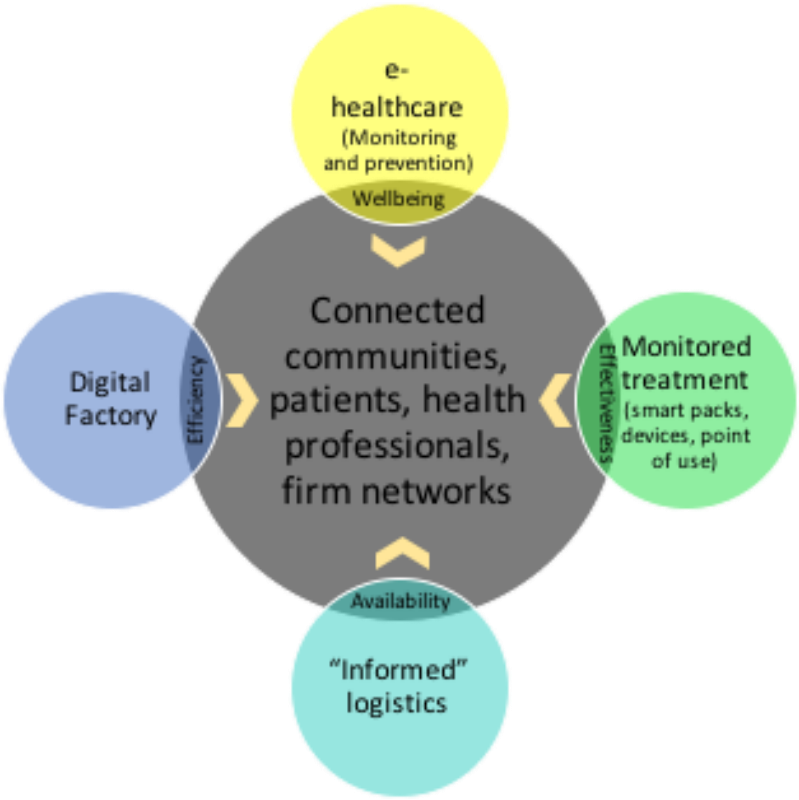
£11.5 m contribution from industry, £11.5 m of government funding through The Advanced Manufacturing Supply Chain Initiative (AMSCI) and the Scottish Funding Council

COLLABORATING PARTNERS

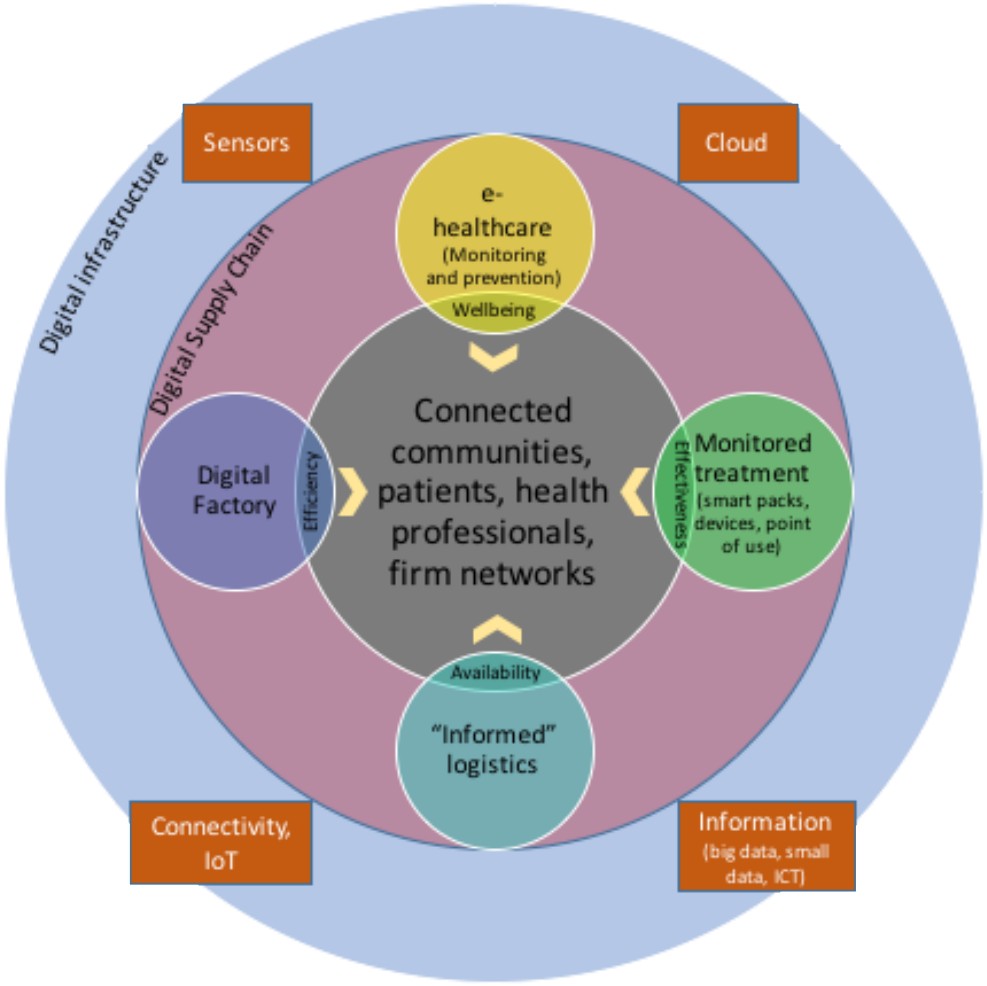
http://remediesproject.com/

Conceptualising the digital supply chain - Pharmaceutical

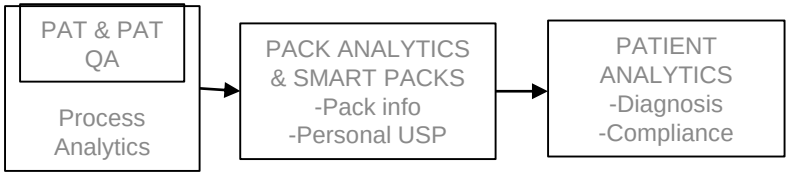
- Currently developing a patient-centric paradigm for the digitalisation of the pharma supply chain
- Empowered patients with improved health outcomes
- Augmented by new technologies
  - Production - ‘digital factory’
  - Packaging – ‘smart packs’
  - Devices – ‘wearables’
- Dynamic operations across multiple stakeholders
- Reduced healthcare costs, improved affordability and patient use/outcomes



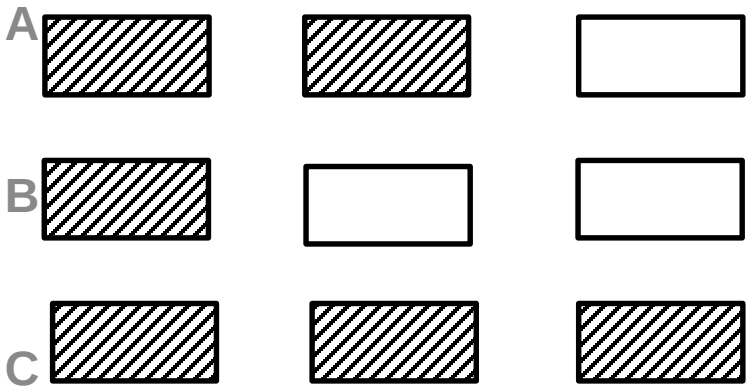
Conceptualising the digital supply chain - literature summary

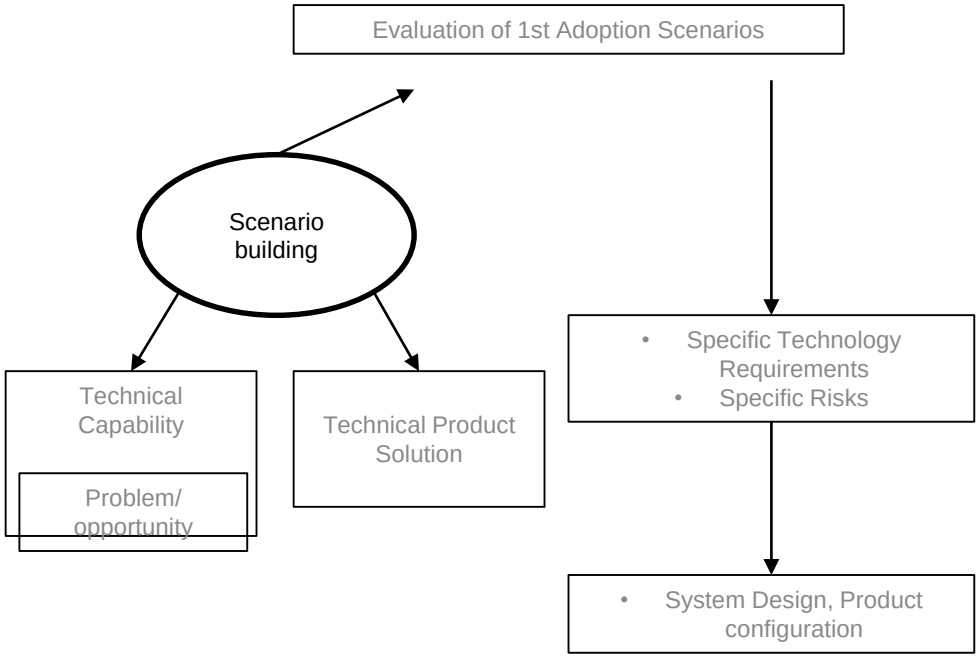


Experiment design



Scenarios:



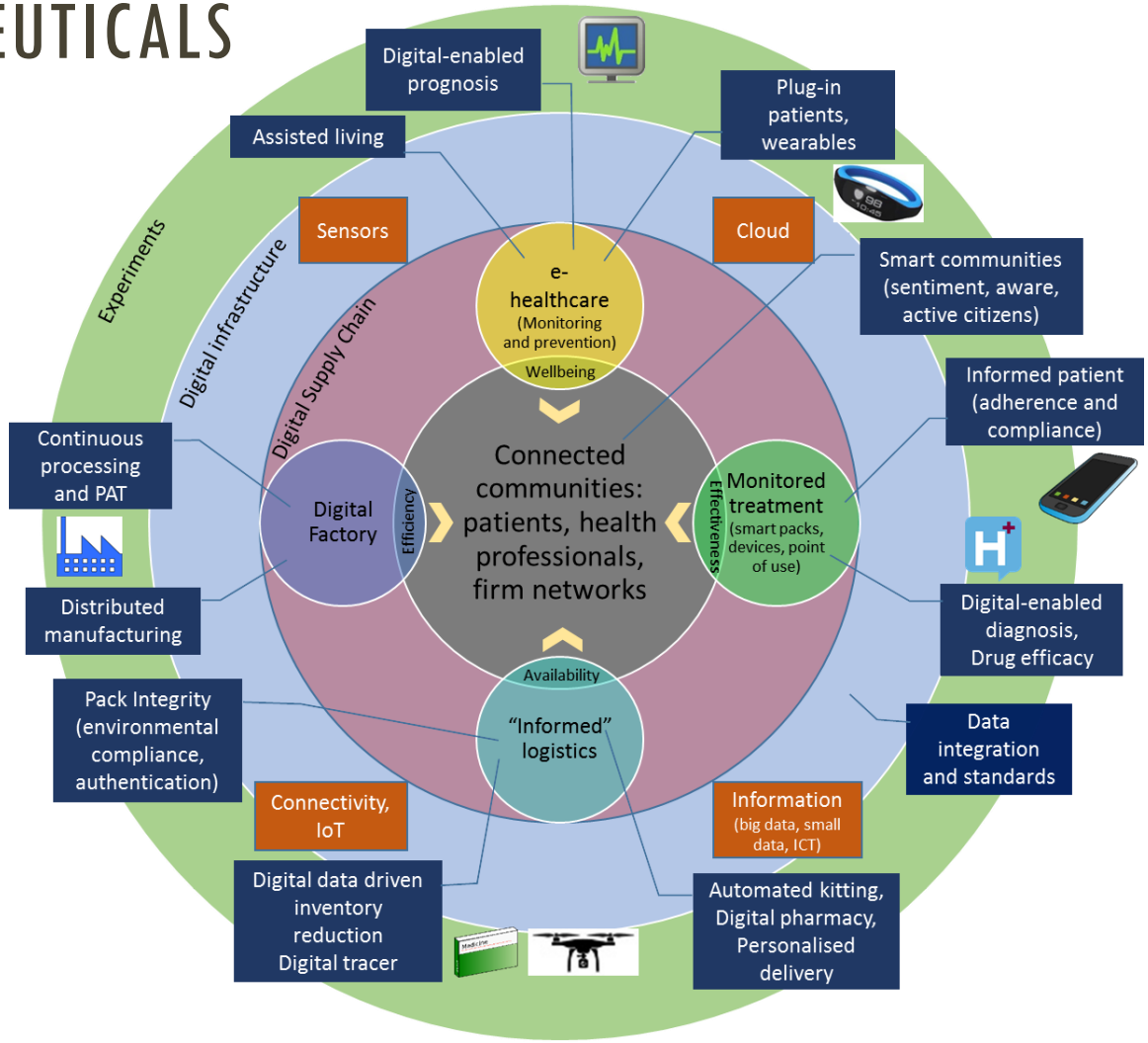


Experiments

We are developing a set of experiments addressing different specific challenges at various stages of the supply chain, which are geared towards developing a patient-centric paradigm for the digitalisation of the pharma supply chain.

a) Continuous Processing and PAT; Digital Factory
b) Pack Integrity (environmental compliance, authentication)
c) Modelling Inventory Flows
d) Improved Demand Forecasting (Patient-led Market Segmentation)
e) Semantic Infrastructure Experiments (Ontological Approach to enable eGovernance)
f) Device – patient compliance opportunities
g) Improving patient healthcare

DIGITAL SUPPLY CHAINS – PHARMACEUTICALS



Digital supply chain – Value Propositions

1) How do we enable data integration across the supply chain for more responsive or adaptive supply?
2) How do we improve E2E inventory management, and reduce levels of inventory?
3) How do we monitor product quality and delivery performance, ensuring high product visibility, traceability, and environmental compliance?
4) How do we monitor product efficacy in-use?
5) How do we offer a more personalised service to patients?
6) How do we achieve better segmentation? (patient focused?)
7) How do we capture patient/customer feedback?
8) What is the role of regulators and standards agencies to facilitate the benefits that digital supply chains might offer?

Developing a ‘Digital Attitude’

- A cross-sector industry study of digital supply chain initiatives, providing insights on how leading firms are adopting digital technologies and a ‘digital attitude’ to supporting supply chain transformation

- A Light-Touch non-competing firms - Peer Sharing Initiative -

- The peer sharing initiative has helped to define a number of future digital supply chain scenarios.

- A cross-cutting digest of major 'digital supply chain' initiatives for each company, with a key ranking initiatives by impact and maturity.

- Many initiatives are not at a high level of maturity, where they tend to be shy of proof of concept stage, indicating a great deal of scope to create new knowledge.

- **Preparing for Peer Group Workshop on 28 September**

A light-touch sharing initiative was conducted in March/April 2016

AIM

The aim of this initiative was to co-ordinate the sharing of latest experiences regarding the Impact of Digitalisation on Global Manufacturing and Supply Networks, involving a small group of non-competing companies.

HOW IT WORKED

1. IfM provided a simple process and templates for each participating company to outline their current initiatives in this exciting area.
2. Each participating company populated the templates as appropriate.
3. IfM collated the company inputs and provided a cross-cutting digest of common themes.
4. The collated outputs and digest have been made available to each company.
5. IfM will make peer-to-peer introductions on specific topics of common interest if this is helpful.

EFFORT REQUIRED

- Joining a briefing telecon with IfM to discuss the process and templates (1 hour)
- Completing the templates and sending to IfM (4-8 hours)
- Joining a feedback telecon with IfM to discuss the collated outputs and digest (1 hour)

TERMS

- There was no cost associated with participation.
- The initiative was conducted on an open-sharing basis amongst only non-competing companies, and no sensitive data was included.
- We expect to conduct further initiatives in this area to address some of the key challenges if this is interesting to the companies involved.

Companies involved:

ABB CATERPILLAR Electrolux GRUNDFOS IKEA LEGO wavin

The peer-sharing initiative led to the definition of 10 future digital supply chain scenarios

2. Digital Factory Design & Simulation

Digital 3D modelling systems for factory layout design, process simulation and material flow simulation

3. Digital Manufacturing Planning/Execution

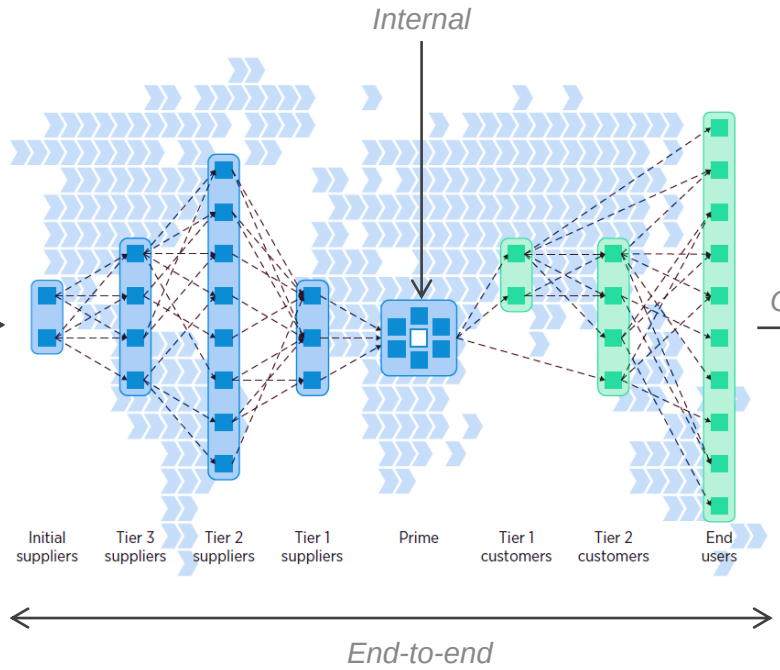
Advanced manufacturing execution systems with sensor-enabled, real-time data and smartdevice monitoring of KPIs/advance warning of disruptions

4. Flexible Automation & Additive Manufacturing

Flexible automation systems and additive manufacturing technologies that support customised or small batch production with quick changeover

1. Integrated/Automated Sourcing

Seamlessly connected/automated replenishment in line with master schedule with real-time monitoring of KPIs/advance warning of disruptions



5. Integrated (Omni)Channel Fulfilment

Integrated order management and inventory deployment to multiple / preferred points of sale, covering last-mile and direct delivery

6. Personalised Configuration, Order & Delivery

Web-based customer ordering systems for product/solution configuration, pricing and order entry/tracking

10. Product Lifecycle/Value Chain Management Systems

Nextgen PLM systems that provide accurate, up-to-date product information accessible throughout the value chain and product lifecycle

9. Strategic Network Design/Transformation

Design/visualisation tools to optimise supply network configuration/locations and monitor transformation/capex

8. Digital Quality/Traceability

Digital quality management systems for connecting 'traceability islands' back from customer cases to root causes

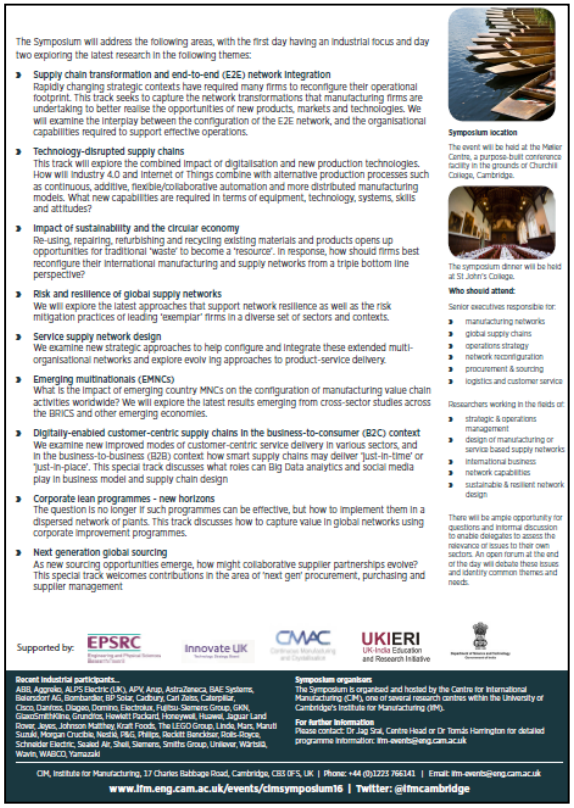
7. E2E Supply Visualisation/Monitoring

Global supply system visualisation / watch towers for real-time monitoring and decision making across full E2E chain from suppliers to customers

We are inviting further non-competing companies to join this peer group

- New companies joining the peer group are requested to share their current initiatives in this area (process and templates as per the original initiative)
- An updated digest of all peer contributions will then be provided to each company
- This will bring everyone up to a common level of understanding as a secure platform for on-going learning
- We will share ideas on how we might develop this initiative as a potential industry-academic collaborative programme at the September workshop
- There is no cost associated with participation
- This initiative is conducted on an open-sharing basis amongst only non-competing companies, and no sensitive data should be included
- ***Industry Project coordinator: Paul Christodoulou***

We are planning a peer group workshop in September (linked to Cambridge Symposium)



Wednesday 28 September

12.00-17.30 Peer group workshop
(to share progress, define needs and link with IfM research)

19.00 Informal dinner

Industry Project coordinator:
Paul Christodoulou

Thursday 29 September

Symposium Industry Day
(keynote speakers from leading companies)

Friday 30 September

Symposium Academic Day
(keynote speakers from leading universities, modular sessions on latest research)

Venue: Moller Centre, Cambridge

Costs:

- Peer group workshop – no cost
- Symposium £700 for 2 days (costs waived for keynote speakers)

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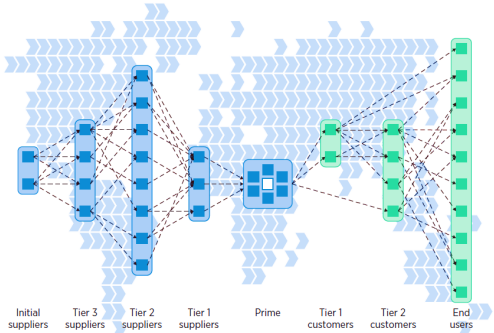
How might this work inform the debate on future standards in digital supply chains?

future digital
Pharma supply chain options



future digital
supply chain scenarios
(x-sector)

- Digital SC Remedies Consortium have developed an agenda with UK Healthcare regulator **MHRA**
- Understand how innovation efforts in continuous manufacturing and digitisation of Pharma SCs will require development in standards
- Industry consortium meeting scheduled in June

- A programme sponsored by **BSI** to establish digital manufacturing processes and systems definitions
- Current survey underway to explore competences
- Explore the implementation challenges of emerging digital supply chain scenarios and implications for standards development
- Workshop on 30th June 2016

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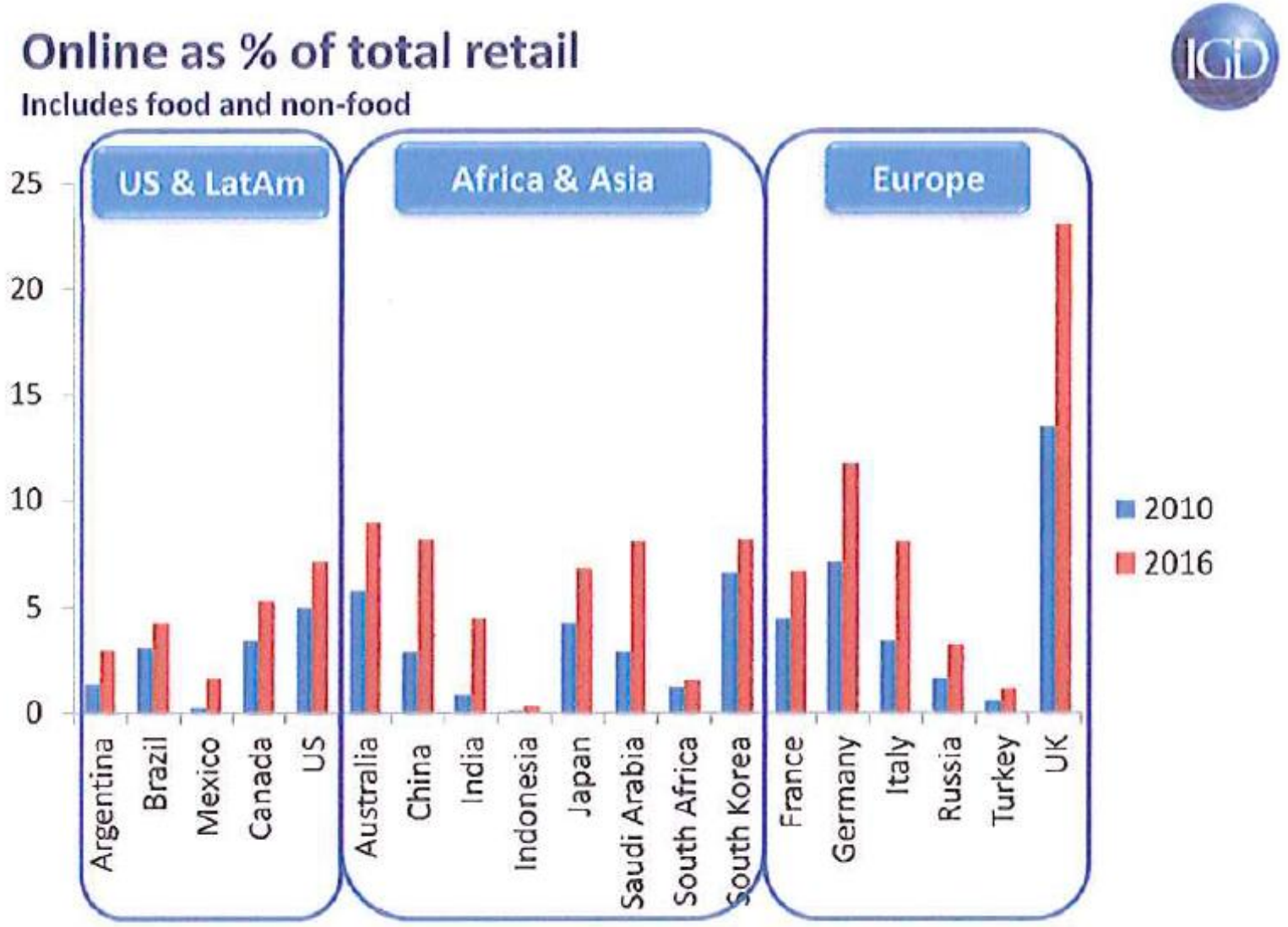
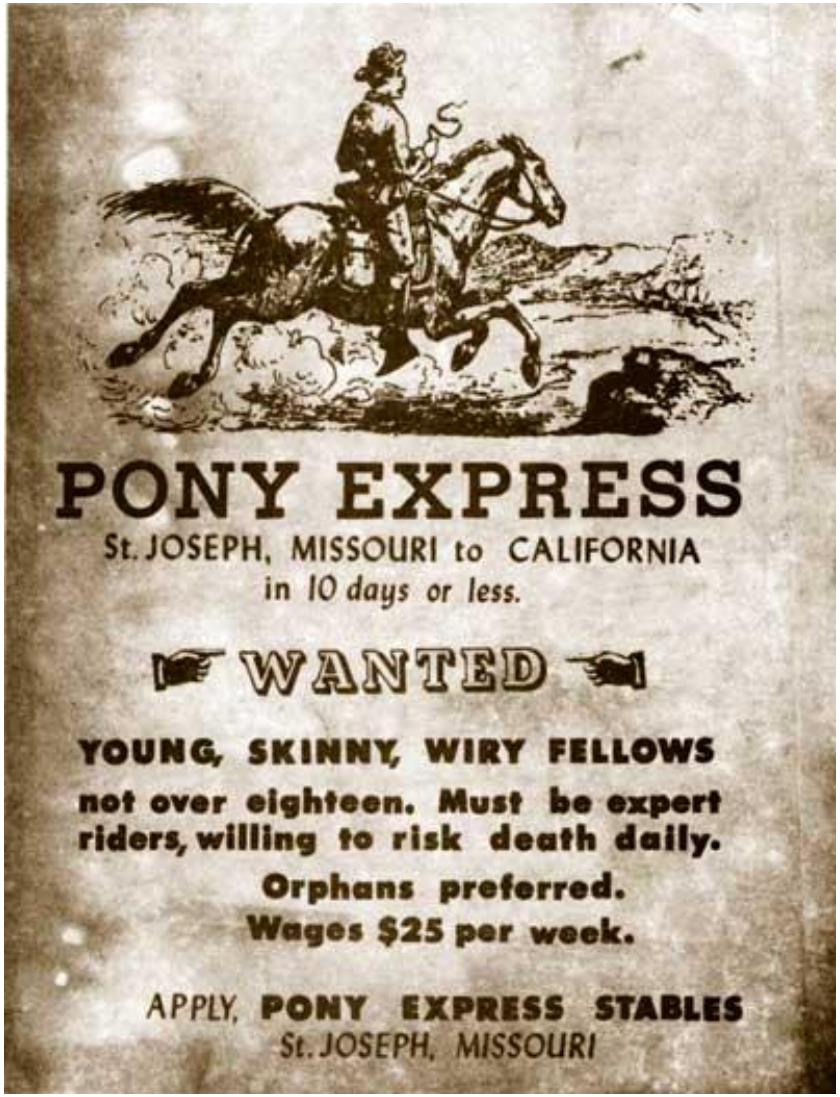
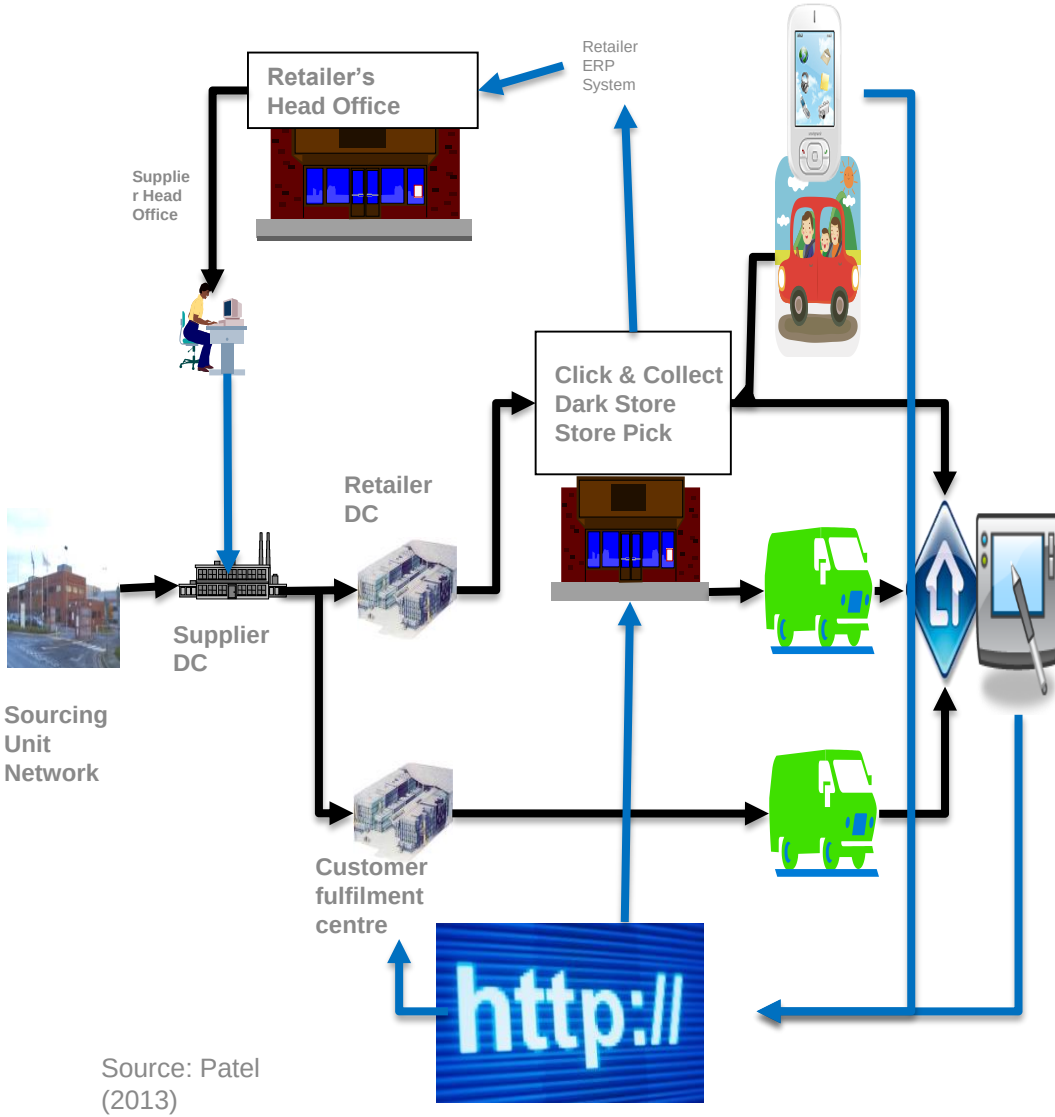
E-Commerce and Last Mile logistics - Growing fast!



Last Mile Configurations



21C Last Mile Configurations



Source: Patel (2013)

Last Mile Logistics – Future Developments

Political

- Environmental legislation
- Manufacturer direct involvement
- Disintermediation; channel conflict

Economic

- E-commerce market growth
  - UK grocery market size: £5.6bn in 2013 → 11.1bn in 2018 estimate
  - Higher customer density

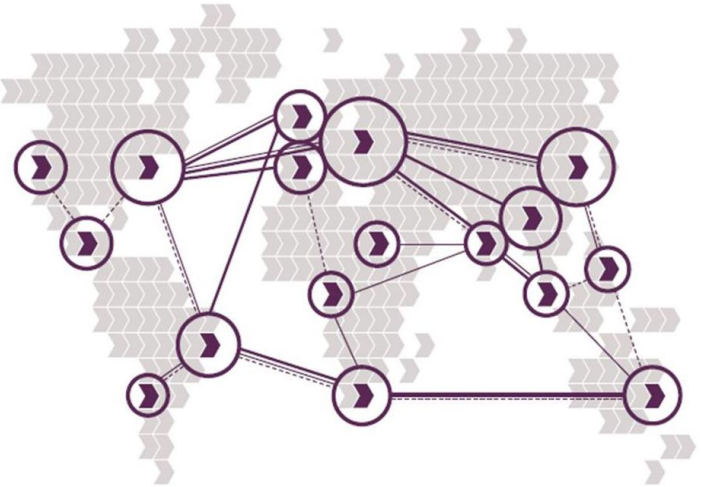
Social

- Personalisation
- Larger SKU numbers
- Convenience vs. Miles vs. CO_2

Technical

- Shorter lead time, better availability, lower cost?, automation, flow through

Architecting the Digital Supply Chain



Two-day Symposium, 29-30 September 2016

The 20th Annual Cambridge International Manufacturing Symposium.

Topics address current themes impacting the design and operation of international manufacturing such as*;*

- *e-commerce and service based supply,*
- *industry evolution models*
- *risk and resilience of extended supply networks,*
- *re-shoring of production,*
- *technology implications on operations network design,*
- *design of sustainable supply networks,*
- *emerging country multi-nationals*.

www.ifm.eng.cam.ac.uk/events/cimsymposium16/

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