Transitioning to the Pull Economy: the case of the UK Railways

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Abstract

Digital technologies are rapidly changing a broad variety of industries. This paper investigates the role of digital disruption in the UK Railways. Digital will disrupt even slow moving industries such as the rail industry in a number of ways from both supply and demand side, and its effects on customers may exist in a world of different pull based solutions. The current dominant design means that the existing industry underestimates the impact of digital and how this will enable all travel customers to “pull” solutions.

1. Introduction

In their 2013 technology report [1], Accenture argue that “every business is [now] a digital business”, whether the organization recognizes it or not. They suggest that the digital mindset is no longer the realm solely of the I.T. department within an organization, but impacts every area of the business including HR, Property, Finance, Strategy and Operations; in effect every budget is an I.T. budget1. The implications of this are being played out within many organizations. Digital is not only transforming what can be done, but how it is done and by whom.

In their 2014 report [2], Accenture go further, and emphasizing the scale of the disruption, suggest that the world is at a significant ‘inflection point’ and that the next 3 years is about determining an organization’s place in the digital world. This paper, (part of a wider research programme into the effect of this disruption on a variety of sectors amongst which are retail, healthcare, transport, and financial services) considers

the nature of this digital disruption, its determinants and its implications.

We begin by identifying two major drivers, the development of open standards and the blurring of the physical and digital in what Normann [3] calls de-materialization and the liquification of data. Taken together we contend they have enabled the beginnings of the “fullpull” economy, based not on provider push but signals from the customer to commence production. We then consider the barriers to fullpull focusing on the concepts of dominant design and institutional logic. We identify an industry sector, UK rail, to consider in depth. The UK Rail industry is scheduled to receive at least £100bn of public investment in infrastructure over the next 10 years in a significant modernization programme. Part of our research motivation was to examine whether this represents value.

Our research method was to conduct archival reviews and to interview industry experts and suppliers to consider the extent of the dominant design within this particular industry. In our discussion section we reflect that whilst a dominant design may be essential for questions of infrastructure and safety, applying this logic to all aspects of the architecture may be deeply problematic, both from the customer’s perspective and the providers. We conclude by recognizing the challenge of digital disruption and the fullpull economy and how its scale and speed may seriously disrupt even traditional, slow changing sectors such as rail as new ways of meeting customers’ needs emerge.

2. Digital Disruption

The academic literature, [3], [4], [5], [6], [7], [8], supports the view that key features of this digital disruption are open standards enabling the development and exploitation of multisided platforms, liquification in which digital and physical boundaries are increasingly blurred, and taken together they enable
the growth of a “pull” economy, in which all goods and services are provided on an “on demand basis.

2.1 Open Standards

A technology standard can be considered as “a set of specifications to which all elements of containers and pallets) which can lead to disruptive effects in proprietal systems, but can equally be used to enable trade restrictions (e.g. Accounting Standards and restriction of qualified auditors). They also frequently incur development and compliance costs, and can prevent activity ranging from discriminatory pricing through to illegality.

Much of the literature recognizes this dualistic nature of standards [6]. On one hand standards enable interfaces to be developed which help develop viable ecosystems (e.g. Apple and Android) but they can also may limit innovation and lead to the establishment of a dominant design paradigm [11]. One important aspect of standard development is their position on a spectrum of openness, from closed and proprietary through competing ecosystems to full open standards. Open standards are characterized by being generally available, without restrictions on use or change, and developed by a mutual community consensual process. In the digital economy open standards can be seen as being accompanied by open formats and open source software.

2.2 Liquification

A major attribute of the digital economy is the recognition that a physical device is not simply a collection of materials. This blurring of physical and digital is occurring across industry types. For example Yoo et al. [12], describe how the convergence of GPS, digital mobile technology, in-car navigation and entertainment systems and on-board microprocessors not only enables novel features for the car but also has had an impact on related industries such as insurance, safety and car maintenance.

This ability to separate the information from the physical world requires a special infrastructure. Rolls-Royce uses a collection of sensors and telemetry to collect data on engine utilization. Once this infrastructure is in place then information is free to flow; it has been dematerialized. An immediate effect of dematerialization is liquification [3], or the movement of information across the digital infrastructure and its combination with other liquefied assets to potentially create new insights, products and services. Digital technology makes it possible for almost any asset to be dematerialized and since this products, processes, formats, or procedures under its jurisdiction must conform” [9, p588], or more broadly a technology that “is accepted for current use through authority, custom or general consent” [10]. Standards encourage interoperability (e.g. information is quickly liquefied this produces new markets for the information.

For Normann [3], digital technology liberates us from constraints of: time, (when things can be done); place, (where things can be done); actor, (who can do what); and constellation, (with whom it can be done). Taken together these concepts enhance density, i.e. the best combination of resources mobilized for a particular situation, for example a particular customer at a given time and place.

This implies ever increasing individualization. What used to be a bundle of activities put together within one legal structure and in one geographical position is now in multiple geographical positions brought together by multiple legal entities. Ultimately, density means that the customer would have a whole world of specialist knowledge available when and where they like, creating an “on-demand” economy.

2.3 The “Full Pull” Economy

We consider that the combination of open standards (e.g. APIs) and liquefication of the material are enabling the development of the ‘pull economy’ [13]. The pull economy places the consumer at the centre of the production system, (rather than the producer) and at the extreme will draw on resources only as they are used. The roots of the notion of ‘pull’ are associated “Just-in-Time” and other related manufacturing techniques.

In manufacturing, the concept of pull is where a downstream workstation “pulls” the item of production towards it when it has available capacity and is a key feature of the Toyota Production System (TPS). Ohno [14] asserted that the purpose of the TPS was to shorten the time between order and cash. The essence of pull is hence to reduce time and stock held in the productive system.

Pull has traditionally been assumed to be a key facet of production systems and the literature naturally focuses strongly on the supply side; but we argue that in the world of datafication and liquefication the concept can equally be applied to the demand side (consumer) and that this will be enabled by all facets of digitization.
The demand side equivalent to TPS would be shortening the time between need/want and fulfilment. With pull from the customer being made possible, the customer will no longer need to hold stocks of e.g. Coca Cola. It will no longer be a producer aspiration for the whole world to be within an arm’s length of a drink, but for the whole system to be capable of delivering the tin whenever and wherever the need arises. Demand side pull will be enabled by demand side developments (among which will be datafication, big data, predictive technologies) complemented by supply side changes (e.g. platforms, 3D printing, zero hours contracts).

We contend that this will enable the “fullpull” economy, in which there is pull both on the supply side and the demand side.

Traditional markets operate on push to mass customers and pull from individual customers. Digital disruption allows pull from mass customers, based on predictions of their behaviour coupled with rapid response of the supply system, and push to individual customers, based on multisource knowledge of their recent behaviour. The positioning of production types within “mass” and “individual”, and “push” and “pull” are set out in Table 1 below.

**Table 1. From mass push to mass pull**

<table>
<thead>
<tr>
<th>Push</th>
<th>Pull</th>
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</thead>
<tbody>
<tr>
<td>Mass</td>
<td>Traditional make to stock</td>
</tr>
<tr>
<td></td>
<td>Mass services e.g. railways, hotels, postal services</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual</td>
<td>Targeted advertising based on ‘Big Data’</td>
</tr>
</tbody>
</table>
| | Offers based on data on individual customer | Signal is explicit order from customer, e.g.
| | Google adapts what it presents to your history | bespoke furniture or bespoke services |

The development of standards and liquification enables providers to move into the area of individual-push where they can individualize offerings in other words’ sell more’, for example these personalized adverts enable Amazon to be highly specific about recommendations and to drive sales.

However, a ‘pull economy’ enables a focus on the individual or the ‘market of one’. Data can be collected from active devices (e.g. my social media updates) and passive devices (e.g. home sensors). Together these enable personalized data, sometimes called ‘small data’ [15], which will enable organizations to personalize products, e.g. medicines or services to the individual.

These changes from push-pull are only now being considered by organizations through their systems design and in our view has the potential to influence all sectors, industries and communities. The challenge is to consider which industries will adapt quickly and whether those that have deeply held cultural limitations will face challenges in adapting their business to the demands of the fullpull economy.

### 3. Dominant Design

As Normann [3] notes, the challenge of the on-demand economy is “distancing”: the ability to take stock of what we have, yet distance ourselves from it. This enables us to release decision making about the future from our previous experiences, and instead to embrace the challenge of creating the “new”.

Being able to create a distance from what we have is inversely related to the concept of the dominant design. The concept of dominant design identifies those features that have become an unchallenged industry standard and which Abernathy and Clark [16] identify as passing through three distinct phases:

1. The introduction of a solution that has broad appeal based on performance and basic functionality
2. A second phase where competitors develop similar designs
3. This imitative behavior enforces standards throughout the industry and almost complete diffusion of similarity across markets.

The distancing from a dominant design requires a transformational shift. Tushman and Anderson [5] examined these transformational periods across three industries: cement, airlines and minicomputers. They considered technological shifts of the dominant design as being either competence enhancing or competence destroying [16].
Competence enhancing discontinuities are described as an order of magnitude improvement in price and performance that builds on existing knowledge: they do not render obsolete existing competences. Examples include the introduction of fan jets or the screw propeller which dramatically improved the speed of jets and oceangoing steamships. It is important to recognize that a major difference between the two is that competence destroying discontinuities disrupt industry structures as the skills and knowledge that brought product class leaders to pre-eminence are rendered obsolete.

Competence destroying changes require new skills, abilities and knowledge which fundamentally change the competencies: for example, diesel locomotives require new skills and knowledge that steam engine manufacturers did not possess. Competence destroying creates a new completely class of product or substitute for an existing product or a completely new process: for example the float glass processing glass manufacturing or mechanical ice-making substituted for natural ice harvesting, in which customer needs are met in a radically different way.

A closely related stream of research can be identified in ‘Institutional Logic’. Scott [18], [19], [20], identifies three components to Institutional Logic:

1. Regulative: rule-setting
2. Normative: the prescriptive and obligatory dimension

Each of these components offers a different rationale for claiming legitimacy, whether by virtue of being legally sanctioned, morally authorized, or culturally supported [20, p51]. Thus, it makes a difference whether an organization complies out of expedience (to avoid a punishment), because of a moral obligation to do so, or because it cannot conceive any other way of acting. But at the same time, each is properly seen as providing or contributing to an institutionalized social order; they all support and sustain stable behaviour.

Taken together these form three different pressures to conform which have been characterized as:

1. Coercive. These result from strong linkages to other industry agencies and institutions and are often in the form of pressures, compulsions, enticements/inducements and requests. They may also take the form of governmental measures, guidelines regulations or laws.
2. Normative. These guide decision making and come from the development of criteria and guidelines which influence judgments and outcomes. Organizations conform because of behavioural expectations. These pressures usually result in rules of thumb, standard operating procedures, and occupational standards [21].
3. Mimetic. These are associated with copying or mimicking other organizations’ systems, policies, processes and structures. In other words, organizations model themselves after organizations in their external environment that they see to be similar but also legitimate and successful [22].

4. Overall Research Aim

The aim of our overall research into digital disruption is to examine whether digital disruption will affect all industries or be limited to some, and what will be the impact of dominant design on the propensity to be disrupted.

To explore the characteristics and impact of dominant design on a specific industry, we used the case study research method. Yin [23] defined a case study as a method to examine: (a) a contemporary phenomenon in its real-life context, especially when (b) the boundaries between phenomenon and context are not clearly evident.

Our rationale for the choice of particular industry in which to conduct our current analysis was based on the identification of what we considered to be an ‘extreme case’ [24]. Specifically, we were interested in a sector with a long history of technology development within well established and relatively stable technology standards, without apparent evidence of recent disruption and then to consider their approach to digital disruption.

The UK rail industry is recognized to be an industry where base technology has changed relatively little in almost 200 years and that this represents a is a huge challenge in moving forward where there is a “Victorian legacy of a railway that was substantially built in the century before last” [25].

Specifically, of the 800 signaling locations over 500 of these are the Victorian signal boxes and mechanical “interlockings” (a restrictive control mechanism to ensure safe train transit through switches), are widespread throughout the network and

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often still regarded as ‘modern’ (despite the first installation being in 1843).

In the rail industry press it is often argued that the industry is something of a laggard in the adoption of new innovations the pace of innovation in railways might well be perceived to lag behind other industries just a bit too much [26].

In the academic literature Schilling, [27] in her widely cited article on the consideration of the management of technology standards, points to the importance of network externalities in leading to “technology lockout” and identified railways as the classic example of an industry with strong such externalities.

In short, we consider the rail industry to be an interesting and in many respects, extreme, case, characterized by large scale capital expenditure, a strong culture built on safety, heavily regulated and with well-established networks and infrastructure. All of these are typical features of a ‘dominant design’, an industry in which practices, norms and decision making strongly influence actions and strategy.

4.1 Research Design

From the above considerations we generated the following research question: to what extent does the rail industry have a ‘dominant design’?

Data was collected through three sources:

1. Context interviews with academics, journalists, informed observers and other industry sources to gain a broader perspective on the industry’s challenges.

2. Analysis of archival data. A wide range of publicly accessible data is available through industry and government websites such as NR, ORR, DfT, Parliament and trade journals.

3. Semi-structured interviews with five members of a leading industry supplier. (The firm are one of only 2 organizations to achieve an A rating in the Network Rail suppliers league table2).

Our approach to analysis was to review the data collected from our interviews and subsequent follow-up written correspondence and to characterize the data into the three headings of regulatory, normative and coercive pressure.

4.2 Evidence for Regulatory Pressure.

The UK rail industry has a significant number of organizations making for a highly complex eco-system. At the centre lies Network Rail responsible for the entire UK rail network (i.e. the track, signals, crossings etc). The rail industry is split between infrastructure providers, statutory regulators and safety bodies, Train and Freight Operating Companies who provide passenger and freight services, Rolling stock owners who lease trains to operators, passenger groups, and equipment manufacturers and service providers.

Wikipedia currently identifies 26 different Train Operating Companies (TOCs) who run trains on the track and lease rolling stock from nine different Rolling Stock Operating Companies (ROSCOS) and a further 5 spot hire companies.

The principal relationships between these stakeholders have been represented pictorially in the diagram set out below in Figure 1. The diagram demonstrates the extent of interlocking relationships and governance.

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achieve radical change, summarized by one interviewee as:

“The separation of signalling, rolling stock, civils, track etc. means that system level innovation is rare and significantly difficult to achieve” [Technical Director].

The UK railway investment programme, which needs to be signed off by the rail regulator, is predicated on control periods of duration of 5 years, with a significant lead-in period of 18-24 month lead-in process; to agree a settlement is challenging in an era of rapid technological change.

“In effect, plans are being “finalized” and costed 3-6 years before implementation, which is probably acceptable for building/civil works, but not technology-enabled asset management”. [Projects Director]

The… ‘5 year cycle with simple ‘punish on failure’ mentality means that long-term investment commitment is problematic and once Network Rail plans are signed off there is little incentive to challenge’.” [Technical Director]

Train Operating Companies (TOC’s) are operated on a fixed period franchise basis. The relatively short period of time awarded to a franchisee has contributed to some issues with returns on investment and ‘short termism’.

As KPMG report: “Many of the investments or actions that will improve performance or customer satisfaction in the UK rail industry do not necessarily have a financial payback over the life of the franchise, even if it is a relatively long contract such as 15 years and some investments may not generate a TOC financial return over any time period” [28].

Network Rail (NR), which provides the infrastructure, is liable to the TOC’s for planned and unplanned delays known as schedule 4 and 8.

“The impact of the Schedule 8 and Schedule 4 payment regimes, the regulatory mechanism to provide rewards/penalties based on performance, create cultural norms around which Network Rail, TOCs and FOCs plan their businesses and model revenue sensitivities. The focus on delay minutes, and attribution of costs has a huge industry overhead (lots of people looking at delay attribution cases) and a one-dimensional view as to what good looks like (i.e. fewer delay minutes) that does not marry up with what customers want.” [Projects Director]

The long evolution of technical developments and associated regulatory changes makes the industry a complex place within which to introduce change.

“The large distributed install base of assets introduced over many years to evolving standards – ..... makes change harder – not helped by vertical separation historically into Zones’. (Technical Director)

Many of these technical developments have, of course, been associated with ‘safety’.

“This is the basis of the railway. The primacy of the Rule Book is vital to safe operation.” [Industry Journalist]

4.3 Evidence for Normative Pressure

Normative pressures are defined by Khalifa and Davison [29] as arising from cultural expectations in which norms and standards of the operating environment are formed and which in turn guide decision-making. These pressures result in the development of rules of thumb, standard processes, operating procedures and organizational standards [21].

In a review entitled ‘Why is innovation so difficult in railways’ [26], the authors highlight that the challenge of implementing innovations lies not so much with the technology itself but the size of the physical network and the number of people and organizations that need to be aligned in order for innovations to work.

They highlight 12 ‘subtle reasons’ for the failure of innovative ideas including: among these are that the “new idea” does not fit with existing aging infrastructure, or culture, or regulations and procedures and even that the originators of the idea are not trustworthy according to the railway experts [26].

Some of our respondents have identified the unquestioning nature of these norms and standard operating procedures.

‘Standards are solutions specific and are very light on ‘why’. This encourages a ‘comply’ in preference to ‘challenge’ approach’. [Technical Director]

‘Silent interface standards – instances where there are implied/practical constraints that are unwritten but embodied in product ‘pairings’ – e.g. leading to a focus on extensive EMI testing of new trains on miles of instruction rather than being able to rely evidence of compliance’. [Technical Director]

Explanations for how these standards have emerged so strongly are deeply embedded in the industry’s history e.g.

‘Poor, incomplete and inaccurate records of the asset base – makes change undesirable and perceived as ‘dangerous’’. [Technical Director]

These standards are not necessarily formal. They may be implicit and encouraged by the industry’s tendency to promote from within.

‘It’s easy to see how many people in positions of influence (Senior Management) and blocking (Middle Management) have come through the ranks/railway supply’. [Solutions Development Director]

‘The newly formed Rail Executive in the DfT’ [U.K. Department of Transport]...places experience in rail
commercial environments above everything else’. [Solutions Development Director]

Perhaps most importantly accountability for performance may also be an issue.

‘No performance culture – neither success nor failure brings conspicuous consequences’. [Technical Director]

The consequences of these standards can be seen in the approach to innovation.

“Significant attempts to introduce process and product change (e.g. Signalling partnerships, Modular signalling etc) are tied to applications projects so that under delivery pressure the true novelty tends to get scoped out by risk-averse project managers’. [Technical Director]

‘Traditionally, it is extremely hard for a supplier to attempt to innovate outside of that which NR have said they will buy. We’re seeing this increasingly coming through now with the Railway Technical Strategy (RTS). So long as you fall within the RTS, you’re allowed to innovate, but the RTS is just a shopping list for technical improvements. If you are an established multi-national player, you are in a position to lead, but then this goes against the increasingly perceived wisdom in technology circles that innovation and change comes from the SME’s not the giants’. [Solutions Development Director]

4.4 Evidence for Mimetic Pressure.

These pressures come from participating firms wanting to look like or imitate other organizations in their processes and functions or structures. These may be inside an industry structure or outside. The focus for these mimetic pressures in the UK rail industry appears to come from within the industry as evidenced by a report prepared by Arup [30]. For example:

**Track**

External quantified benchmarking data have been obtained from a number of European rail comparator organizations, and the cost differentiating factors analyzed. ...

**Signalling**

Qualitative and quantitative external benchmark data have been obtained from European comparator organizations through a number of studies. ...

**Telecoms**

Quantified benchmarking data have been obtained from European rail comparator through Network Rail’s participation in the formal RTC benchmarking group ...

It is not only Network Rail that benchmarks itself against the rail industry. The report “Realising the Potential of GB Rail” [31] commissioned by the DfT and ORR (Office of Rail Regulation, the UK regulatory body), also compared from within the industry:

“International benchmarking has involved selective comparison of the GB rail industry with similar railways in France, the Netherlands, Germany, Sweden, Denmark, the USA, Hong Kong and Australia.”

The report concludes by arguing that the industry consciously lags behind in its application of new technology and unless it addresses some fundamental issues will be condemned to the museum.

Not only does the regulator use within-industry comparators for bottom-up, technological benchmarking, but also for top-down, econometric benchmarking:

“Our PR13 econometric analysis used a subset of the Lasting Infrastructure Cost Benchmarking (LICB) dataset developed and maintained by the International Union of Railways (UIC) for 14 European rail infrastructure managers, including Network Rail, covering the period 1996 to 2008” [32].

Industry interviews also suggested a tendency to look inside the sector.

[There]... ‘seems to be a “norming” effect [of industry bodies], presumably because you have to get many bodies to be broadly aligned (or at least not offend any of them), that the radical or novel is often eliminated’. [Development Director]

Much of this norming may be driven by a mindset that begins with the idea that railways are different.

The railways are different” – actually in many ways they are – almost certainly a lot more than they should be. Rail specific solutions make ‘different’ a self-fulfilling prophecy. Engineers have to invest to enter the market, those with valuable domain-specific knowledge are reluctant to leave’. [Technical director]

This mindset also has implications for innovation.

‘Traditionally, it is extremely hard for a supplier to attempt to innovate outside of that which NR have said they will buy. We’re seeing this increasingly coming through now with the Railway Technical Strategy, ... So long as you fall within the RTS, you’re allowed to innovate, but the RTS is just a shopping list for technical improvements. If you are an established multi-national player, you are in a position to lead, but then this goes against the increasingly perceived wisdom in technology circles that innovation and change comes from the SME’s not the giants’. [Solutions Development Director]
5. Discussion

We consider that here is a substantial body of evidence that within the rail industry that Dominant Design is strong. Regulatory, normative and mimetic pressures are evidenced from press reports, interviews with suppliers and industry members and documentary information. However, as pointed out by one of our interviewees, the rule book is the cornerstone to the safety of the industry. It is considered to be important to have a strong culture of compliance in an industry where oversights in safety cost many lives.

This raises the important issue of whether in an era of rapid technological change at what level of an organizational architecture that maintaining a dominant design is appropriate and at what level it should be challenged.

In considering the impact of dominant design in the rail industry, it is important to distinguish between the layers in the technology architecture. To do this we have used the simple framework proposed by Brown et al [33] in their paper on revolutionizing public service delivery (Figure).

The infrastructure layer is the physical layer that enables the development of a platform. These platforms should be driven by capabilities and re-use of technology and may lead to modifications in business processes as typical organizational structures are inappropriate for platform development and use. Finally, new communities and clients emerge as the data on the platform becomes available.

![Figure 2. Digital architecture, (adapted from [33])](image)

Applying the dominant design of safety at all levels in a period of digital disruption seems deeply problematic. For example, Svaln and Henfridsson [34] compare product and digital innovation (see Table 2).

<table>
<thead>
<tr>
<th>Product Innovation</th>
<th>IT Innovation</th>
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<tbody>
<tr>
<td>Linear processes</td>
<td>Non-linear processes</td>
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<tr>
<td>Behavioural control</td>
<td>Output control</td>
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<tr>
<td>Vertical industries</td>
<td>Horizontal industries</td>
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<td>Teleology</td>
<td>Evolution</td>
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<tr>
<td>Flexibility</td>
<td>Agility</td>
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<tr>
<td>Firm-centricity</td>
<td>Network-centricity</td>
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<tr>
<td>Direct sales</td>
<td>Two-sided markets</td>
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<tr>
<td>Competition over price</td>
<td>Competition over attention</td>
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<tr>
<td>Marginal cost</td>
<td>Fixed cost</td>
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<tr>
<td>Economy of scale</td>
<td>“a mass of niches”</td>
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<tr>
<td>Dominant Designs</td>
<td>Shared platforms</td>
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<tr>
<td>Physical structures</td>
<td>Functional structures</td>
</tr>
<tr>
<td>Complexity of artifacts</td>
<td>Complexity of problems</td>
</tr>
<tr>
<td>Reuse of assets</td>
<td>Reuse of ideas</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>Network</td>
</tr>
<tr>
<td>Change at the level of details</td>
<td>Change at the level of specifics</td>
</tr>
<tr>
<td>Reductionism</td>
<td>Emergence</td>
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<tr>
<td>Modular designs</td>
<td>Generative designs</td>
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<td>Early binding</td>
<td>Late binding</td>
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Some key features of this analysis of the key differences between digital (new) and product (traditional) based innovation are the necessity for non-linear processes and network approaches rather than firm centricity (organizational logic); competition based on “attention” rather than approach and shared platforms rather than “dominant design” (market dynamics); and functional not physical structures, generative rather than modular designs and complexity of design not artefact (architectural design logic).

The rail industry has to do both. It is required to maintain the existing infrastructure of signals, crossings and track and at the same time encourage digital innovation through platforms, organizational systems and how it deals with customers.

This dualism may be true for other large scale capital industries too. For example, Rolls Royce need to maintain the safety of their aero engines whilst at the same time enabling the development of platforms and interfaces. The greatest challenge arises from the
expectations that “fullpull” might create amongst customers. Driver-less vehicles create the potential to meet a customer need for transport ‘on demand’ and personalized. Compare this to trains which are “pushed” (timetabled), suffer from routing restrictions, and the customer has to complete the journey to their destination through other means of transport. App based solutions to transport which the customer pulls towards them can also be seen in Uber, a crowd sourced “taxi” solution.

Alternatives to this model are already in evidence. For instance, blablacar, a French app based car/journey sharing scheme is now considered by SNCF (the French railway company) as the major source of competition, to the extent that they have made an investment in the company. We found little evidence that the UK rail industry is ready to accept the challenges that digital represents. UK transport academic groups acknowledge this and point out that when the transport industry in general is moving away from central control and towards autonomous vehicles (even if “platooned”) the UK rail industry seems to be moving in the opposite direction [36].

6. Conclusions

We contend that digital will be able to disrupt the rail industry in a number of ways from both supply and demand side, and its effects on customers may exist in a world of different pull based solutions. The current dominant design underestimates the (potential) impact of digital and how this will enable all travel customers to pull solutions.

By 2020 an entire generation will have grown up in a primarily digital world [35]. These customers will have a perspective that the power lies with them as resource integrators within a wider network, and a range of suppliers will have access to more usable data and intelligence, enabling them to provide and sell more solutions differently. Value will be created “in context”. Digital business is different in being non incremental and being driven by innovation, not technology, product, artefact or procedure.

The digital economy will affect power relationships between all the stakeholders in the railway directly and indirectly. This changes as the importance of ownership and use of data is realized, and barriers to entry to the transport business are removed. Indirectly it will bring different competitors, players and solutions into the industry, impacting on existing providers, especially those with large fixed costs. We are clearly describing a future at the limit. However we can already see the early signs and enablers of such a digital future; as mentioned above 3D printing and zero hour contracts, and an increasing ability to create value from the long tail through the use of big data and accompanying algorithms. We contend that the argument is not how far but how fast.

References


