



A systems approach for accelerating innovation in regulated service industries

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Even though innovation and regulation might not seem a natural fit, industries such as telecommunications and air travel are examples of areas that are both highly innovative and regulated. This article explains the prerequisites for innovation within an industry, and then considers the barriers that make it challenging for a regulated service industry to meet these prerequisites and how they can be overcome.

For many people the terms “innovation” and “regulation” don’t sit easily together. The latter conjures up memories of lacklustre performance from service providers in industries such as public transport, energy supply and postal delivery, which often have a legacy of state ownership or monopoly power. And even when privatized or opened up to competition, these industries are still thick with commercial, safety and/or environmental regulation. Regulation is said to discourage innovation because it tends to prescribe technological solutions, and because obtaining regulatory approval incurs significant additional development risk, time and money.

Yet innovation and regulation do not have to be opposing forces. For example, the telecommunications and air travel industries are both regulated and, by most measures, highly innovative. They have achieved this because the constituent parts of the industry value chain (e.g. jet engine suppliers, aircraft manufacturers, airline companies, airport operators and air traffic control agencies) have been able to adopt what we call a “systems approach” to innovation. They have been able to form structures and relationships in ways that recognize disincentives and bottlenecks for innovation at each stage in the value chain, and enable joint actions to be taken to overcome these barriers, for example, to reduce the risk of innovating. This systems approach may be contrasted with the traditional approach, in which each constituent part of the industry acts in isolation and blames the system when things fail to change for the better.

In this article we will first explain the prerequisites for innovation within an industry. Then we will consider the barriers making it challenging for a regulated service industry to meet these prerequisites. Finally, we will show what both policymakers – and the regulators linked to them – and companies active in such an industry can do to overcome these barriers.

The prerequisites for innovation

From our work in regulated service industries, we have derived a simple model that sets out the essential requirements for an industry to be innovative (see Table 1).

Table 1		A simple model for effective industry innovation			
Innovation flow	Strategic imperative to innovate	Capability to develop innovations	Means to enable implementation of innovations	Innovation brought into use	
	<ul style="list-style-type: none"> ■ Incentives ■ Return on investment ■ Competitive pressure 	<ul style="list-style-type: none"> ■ System leadership ■ R&D and scale-up capability ■ In-company competence 	<ul style="list-style-type: none"> ■ System integration ■ Ease of testing ■ Risk management 		
Source: Arthur D. Little analysis					

Three building blocks need to be in place:

1. There need to be sound commercial incentives to motivate players in the industry to innovate. This means that the commercial rewards of innovation have to be enough to balance the risks involved. It also means that there has to be a competitive downside in case of failure to innovate.
2. The industry as a whole needs to have the necessary capability to develop innovations. This means that there has to be suitable leadership to establish technology strategy; an available mechanism to conduct research and, crucially, to be able to scale-up product concepts to demonstration stage; and suitable in-company competencies in the basics of effective innovation.
3. There needs to be an effective means of implementing innovations and bringing them into use. This is complicated if the industry is tightly coupled, if the actors' actions impact each other, if testing is difficult and if managing the risks of failure is critical to the system.

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Barriers to innovation in regulated service industries

Regulated service industries have three characteristics that in many cases make it challenging for them to meet these prerequisites for innovation:

- The value chain often has a fragmented structure.
- A single buyer often dominates the market.
- Regulation tends to be restrictive.

Fragmented industry structure

The structure of the industry has a fundamental impact on the capacity of an industry to innovate. In particular, fragmentation can lead to a number of barriers to innovation:

- Difficulty in monetizing the benefits of innovation – for example when the benefits of the innovation accrue to a party other than the originator.
- Difficulty in establishing an effective long-term technology strategy – fragmentation often means that it is unclear who is providing overall leadership, and this makes establishing strategic direction difficult and increases the risk for innovators and early adopters.
- Lack of a suitable means to bridge the critical gap between research/concept development and full-scale trial and demonstration.

For example, fragmentation acts a key barrier in many European railways, where a split has been made between train operations and infrastructure provision. For example, regenerative braking technology is part of the train and requires investment in rolling stock, yet the energy saving benefits accrue to the infrastructure provider.

Fragmentation is much less of an issue in industries for which infrastructure is less dominant in the system, such as automotive and air travel. For example, in air travel, standards for airports and air traffic management are

largely global and uniform. Aircraft innovation is dominated by OEMs that have strong commercial incentives to innovate. Similarly, in the power industry investment in more efficient generating plant accrues benefits to the investors.

Buyer dominance

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Fragmentation in an industry need not be an insuperable problem if market mechanisms are working effectively. However, if there is a major market imbalance, especially dominance from a single buyer, then innovation may be restricted. The following situations may occur, for example:

- Suppliers lack incentives for innovation if they are at the mercy of a single buyer, especially if the buyer is in a monopsony position (monopoly buyer), and is able to influence technical standards such that innovations would not be suitable for buyers in other global markets.
- A dominant buyer typically has undue influence over system leadership, such that system-wide innovations may be discouraged unless they benefit the buyer's part of the system.
- This may further manifest itself in excessive control on approvals and acceptance of innovations onto the system, with supplier innovations being at the mercy of buyer approval – which may mix commercial and technical criteria.

For example, in the rail industry the organization that controls the railway infrastructure is the dominant buyer. In the UK the rail infrastructure management organization also owns a major part of the technical standards and dominates acceptance of new infrastructure innovations onto the railway, and also, to some extent, rolling stock innovations. It could be argued that regulation has not dealt adequately with its monopoly position. On the other hand, for suppliers to the infrastructure manager, the buying decision and the approvals decision are, for all practical purposes, identical when there is only one buyer.

By way of contrast, the air travel industry – which is less infrastructure-intensive – is dominated by a small number of OEMs (i.e. Boeing and Airbus), which act as de facto design authorities. Similarly, in the automotive industry there are several large OEMs served by a number of powerful global tier 1 suppliers that drive innovation in the industry.

Restrictive regulation

The impact of technical regulation on innovation is a subject that has been fairly extensively studied over the last decade or so, although there are still major barriers in existence today:

In the automotive industry environmental regulation in Europe has typically been beneficial to innovation, by setting goal-based standards with reasonable lead-in periods to achieve compliance.

- Safety and environmental regulation can act as a barrier to innovation if it is too prescriptive in terms of allowable technological solutions, and if it adds excessive cost and delay to approval processes through red tape. Heavy penalties for non-compliance often drive risk aversion.
- Commercial regulation is less often cited as a barrier to innovation, even though in some cases it can have an even greater impact than safety and environmental regulation. For example, commercial regulation typically constrains investment timescales – if there are limited franchise periods for an operator, there may be little incentive to invest in anything other than innovations with an immediate short-term payback.

For example, in the automotive industry environmental regulation in Europe has typically been beneficial to innovation, by setting goal-based standards with reasonable lead-in periods to achieve compliance. Energy regulation has sought to focus on encouraging innovation in low-carbon technologies. While there have been some successes, over-optimistic projections on technology take-up and successive policy measures favoring particular technologies have led to an unstable future, whereby security of supply and excessive technology cost pose major threats. In the UK rail industry, increasingly severe safety legislation together with public and media scrutiny has led to operators adopting a conservative and risk-averse approach to innovation. This is exacerbated by short franchise periods for

train operators, often five years, compared to, for example, the duration of spectrum licenses in the telecommunications industry, which are typically 15 to 20 years.

Overall, the key to addressing these barriers lies in recognizing and understanding the overall system and its dynamics – as opposed to each constituent part acting in isolation and blaming the system when things fail to change for the better. Both policymakers and companies have a role to play (see Table 2).

Table 2	Actions to address the barriers to innovation in regulated service industries	
<p>What policymakers can do</p> <ul style="list-style-type: none"> ■ Ensure there is suitable systems leadership ■ Evolve better safety and environmental regulation that promotes innovation ■ Address key innovation barriers caused by poor commercial regulation ■ Avoid accretion of standards 	<p>Innovation in regulated service industries</p>	<p>What companies can do</p> <ul style="list-style-type: none"> ■ Articulate a clear benefit for the system as a whole, and your part in that benefit ■ Engage early with customers on innovation development ■ Seek greater influence on technology strategy through partnerships ■ Lobby constructively for better regulation
Source: Arthur D. Little analysis		

What policymakers can do to address the barriers

Policymakers have significant influence over the capability of a regulated industry to innovate. A deep systems understanding is key to creating a stable and positive business environment. We would highlight four key areas on which to focus.

1. Ensure there is suitable systems leadership

A prerequisite for innovation in complex systems such as rail or air travel is that there is a suitable mechanism for the exercise of overall technical leadership at a system-wide level. This is necessary to establish long-term technology strategy, to enable system-wide innovation benefits to be identified and incentivized, and to resolve constraints and barriers at interfaces. Governments face the dilemma that privatization, whilst enabling major benefits in terms of

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effectiveness and efficiency, does not generally facilitate leadership at the overall system level. Often the result is piecemeal interventions and ad hoc policymaking by government that only causes instability and short-termism. The energy and rail industries could be seen as examples of this in many countries.

Governments may need to accept that they have to be the “owner” of a public service system, on behalf of the public, at the overall system level. For example, in most countries the air traffic control service provider is usually within government control or the government maintains a significant influence. The move to smart grids and smart devices in the power industry will require careful consideration of the architectures and the interfaces, especially considering the dynamics of the system. This will require leadership and co-ordination of the governance processes by which architectures and standards evolve.

2. Evolve better safety and environmental regulation that promotes innovation

Governments and policymakers can do much to ensure that regulation acts as a driver for innovation rather than a barrier preventing it. For example, a number of studies have shown that good regulation:

- Sets outcome-based ‘stretch’ targets that are technology-neutral
- Uses sufficiently long phase-in periods to allow industry to react
- Provides incentives or risk mitigation to support early adoption
- Involves the industry in developing of regulation
- Provides clarity and precision on what is, and is not, acceptable
- Guarantees policy stability over a long period of time, avoiding policy reversals and politically motivated changes in direction.

3. Address key innovation barriers caused by commercial regulation

Policymakers need to recognize and address how commercial regulation may be acting as a block to innovation. This means, for example:

- Disrupting monopsonies, either by breaking them up into less powerful parts or taking key system functions operated by monopsonies back into government
- Finding ways to overcome the negative impact of short franchises and planning periods, adding flexibility to the ways in which franchise provisions are developed, negotiated and re-negotiated, trading off uncertainty, flexibility and the ability to capture benefits in future. For example, the power industry regulator has specifically promoted investment in R&D in the UK within the terms of the settlement with key players
- Developing and imposing contractual mechanisms between different players in the system to enable originators of innovations to be adequately rewarded for their investment, even when the benefits accrue to others in the system. Such mechanisms need also to minimize the adversarial win-lose thinking that so effectively blocks innovation.

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The rail industry in many countries is an example of where such policies have failed to be adopted.

4. Avoid accretion of standards

In some public service systems there is a tendency to build ever-greater numbers of standards with increasing complexity, usually as a response to an unwanted event, although also more recently in order to pursue greater global standardization. In many cases this has led to an accretion of standards, with older standards simply remaining rather than being superseded and replaced. The consequences are similar to the situation in taxation and in case law – there is a high dependency on experience and deep insight and the outcomes are difficult to predict reliably. This greatly increases the time, cost and risk as-

sociated with developing and implementing innovations. The “newer” industries such as telecoms have been less susceptible to this problem, while other industries such as rail have continued to suffer.

Promoting standards that focus on key requirements places greater demands on specifiers, authors and users of standards, but the benefits to industry can be considerable: innovation is enabled, markets are opened up and the different participants within the industry are better able to procure, commission and implement the most appropriate technology, processes and systems for their purpose.

What companies can do to address the barriers

As an individual company in a regulated industry it may seem to be difficult to exercise leverage over the system as whole. However, we see four areas where companies can create advantage for themselves whilst recognizing their place in the system.

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1. Articulate a clear benefit for the system as a whole, and your part in that benefit

Companies that fail to understand the system of which they are a part often fail in their innovation efforts. For example, a manufacturer may develop an innovation that it believes its main customer wants, only to find that the specific targets the customer has to meet through regulation mean that the innovation scarcely provides commercial benefit to the customer, or else introduces risk that the customer is not incentivized to take.

Another pitfall is that an innovator invests in product development from which others in the system skim off the benefit. This is typified by the debate between the role of the content provider and the role of the distribution channel in music and publishing – who invests and who harvests? This battle continues to rage a decade after the peak of the dotcom boom and bust.

Yet another problem is that legacy investments have a life of their own that may block the adoption of something new for reasons of spares holding, training or even just

familiarity. Some parts of UK industry that had massively invested in early steel-making methods found it difficult to respond when the invention of the Bessemer converter transformed steel-making in the latter half of the nineteenth century. Early movers need mechanisms to prevent getting trapped by their own success.

A better approach is for companies to develop a deep understanding of the system, including where they sit, where their customers sit and what the drivers and constraints affecting their customers are. Having developed this understanding, the innovator can then articulate the benefits of his or her innovation much more clearly to the customer, whilst at the same time building in appropriate contractual provisions to ensure that they retain a substantial share in those benefits.

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An example of such an innovation in the rail industry is driver advisory systems. This technology provides cabin display data to the driver on optimum speeds, acceleration and braking profiles. At its simplest, based on track and rolling stock data this technology can help to optimize fuel efficiency by advising the best drive profile. However, there are broader benefits to be obtained through linkage with traffic management systems, which could allow features such as real-time flexing of timetables, network capacity optimization and reduced cautionary signal running. These are benefits to the infrastructure manager rather than the train operator. Such benefits may, however, be so large for the infrastructure manager that they become a force for earlier adoption.

2. Engage early with customers on innovation development

Linked with the above, companies that tend to have the most innovation success in regulated systems are those that have early and close engagement with their customers on innovation development. This means embracing the principles of “open” or “co-” innovation and being prepared to form partnerships with customers and others at an early stage in the innovation cycle. This may be contrasted with the more traditional approach of in-house product development, protection of IP, then engagement with the customer to secure interest.

Fragmented systems tend to struggle to develop a long-term technology strategy, or else the strategy is distorted by the dominance of one or more partners. Companies that are able to build their position and influence at a strategic level are more likely to have innovation success.

For example, a UK company developing novel lightweight signalling systems found that engagement with its key infrastructure customer early in the concept engineering stage greatly accelerated the product development and testing process. Similarly, in the power industry early engagement with the regulator has helped subsystem component supply companies to position their innovations so that they can be easily adopted by the end customer.

3. Seek greater influence on technology strategy through partnerships

Fragmented systems tend to struggle to develop a long-term technology strategy, or else the strategy is distorted by the dominance of one or more partners. Companies that are able to build their position and influence at a strategic level are more likely to have innovation success. Developing strategic partnerships, either with other parts of the supply chain or even direct competitors, is an effective way to increase influence. As globalization progresses further in industries such as rail and power, global alliances and partnerships will be even more essential.

The aerospace industry has a long record of building collaborative partnerships up and down supply chains and even among competitors for pre-competitive research and development. In the UK the effective development of discussion forums has enabled the creation and pursuit of a strategy that underpins technology development programs. The Energy Technologies Institute is another example of a collaboration between key players to develop strategies and to achieve leverage of private and public funding to accelerate developments. The integration of knowledge transfer partnerships and networks enables these initiatives to both identify and map out the early emergence of technologies and innovations and also to disseminate a coherent vision of the future to key stakeholders in government.

4. Lobby constructively for better regulation

Companies often waste large amounts of time and energy complaining to government about their individual positions in the system, often blaming their customers for their inability to evaluate and progress acceptance of innovations

offered to them. A more constructive approach is to understand how regulation, especially commercial regulation, affects the system and the behavior of those within the system. Once understood, companies can devote more time to lobbying and constructive dialogue with regulators about how key aspects of the regulatory regime could be improved. For example, in Europe manufacturers in the automotive industry agreed with the European Commission a set of voluntary targets to reduce carbon dioxide emissions from passenger cars. By taking a proactive approach the industry was able to discuss constructively with the Commission the level of ambition that could be achieved without disproportionate cost.

Insights for the executive

Innovation in public services is increasingly critical as a means of enabling greater demands to be met with reduced public funding. Innovation in highly regulated public service industries can be difficult due to factors such as the influence of regulation on technology prescription and the additional time, cost and complexity of obtaining approvals. However, this does not always have to be the case, as illustrated by the strong innovation performance of some regulated industries such as air travel and telecoms. In order to tackle the problem of how to make poorly performing industries such as rail more innovative, it is important to develop a deep understanding of the industry as a “system”, in which each of the parts are interdependent. By using a simple three-part model for the basic elements of what is needed for a system to be innovative, policymakers and companies can better diagnose the barriers preventing better innovation and identify critical actions for improvement.

For policymakers, key priorities include:

- Ensuring there is suitable systems leadership
- Evolving better safety and environmental regulation that promotes innovation
- Addressing key innovation barriers caused by poor commercial regulation

- Avoiding accretion of standards.

For an individual company in an industry, progress can be achieved through:

- Articulating a clear innovation benefit for the system as a whole, and its part in that benefit
- Engaging early with customers on innovation development
- Seeking greater influence on technology strategy through partnerships
- Lobbying constructively for better regulation.

Like many challenges involving multiple stakeholders, there are no easy or instant solutions. But understanding the dynamics of the system – rather than just bemoaning the behavior of the other players involved – is the starting point for sustainable improvement.

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