

# The Limits of Operations: Understanding the Competiveness and Resilience of Firms in the Global Auto Industry

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## Abstract

This paper explores the limitations of an Operations Management (OM) perspective in understanding the resilience of auto producers. Many influential OM models have emerged from the auto industry, yet these do not appear to be effective in predicting auto company failure. Drawing on case studies of failures and survivors, we conclude that operational effectiveness is only one of several factors that explain resilience, alongside scale, market reach and stakeholder support. Together, these parameters define a “survival envelope” which indicates an auto firm’s resilience. We operationalize these concepts into a resilience index of major auto firms.

**Keywords: Resilience; auto industry; competitiveness**

The auto industry figures significantly in research on competitiveness within the field of Operations Management (OM). From the early days of Ford’s experiments with the standardisation of parts and the moving assembly line, through to the interest in the Toyota Production System and lean production from the 1980s onwards, the auto industry has provided models for operations design, organisation and management in many other sectors (Monden, 1983, Womack et al., 1990, Womack and Jones, 1996, Fujimoto, 1999, Womack and Jones, 2005).

Yet, despite its scale, the auto industry is under stress. Two major car companies, Rover and Saab, have failed since 2005, and in 2009 GM, for decades the largest car company in the world, was bailed out by the US Government, along with Chrysler. There might have been even more auto company bankruptcies following the 2008 financial crash, had it not been for support by many governments, even those ideologically opposed to intervention. Toyota, the star of the auto industry (and exemplar for the OM community for more than two decades) faced its first ever loss in 60 years in 2008 and on top of that suffered public relations disaster involving large-scale product recalls in 2010.

OM-based analyses of companies typically focus on the efficiency and effectiveness with which they run their core operations – for car makers this means how well (and cost-effectively) they design, build and distribute cars. These capabilities are of course important, but implicit in much of this writing is the assumption that high operational

effectiveness guarantees survival and conversely that weak operations are likely to lead to failure. At face value this makes sense – companies that are not capable of producing products or services to acceptable levels of quality or of selling them at competitive prices will, in the long term, struggle to survive. However, in the auto industry companies that have embodied many of OM's best practices in manufacturing and new product development, such as Toyota and Honda (Womack et al., 1990, Clark and Fujimoto, 1991) have not, generally, taken over the world as their promoters suggested they would; nor have companies that show comparatively poor operational performance disappeared, as the continued prominence of General Motors demonstrates (Womack et al., 1990).

In this paper we address this puzzle, and explore the limitations of the OM frame of reference in explaining competitiveness in general, and resilience and propensity to survive in particular. We locate our analysis within the global auto industry.

### **Research Approach**

Our approach comprises four main parts. First, drawing on secondary sources, we reviewed the evolution of the auto industry since its inception, observing the characteristics of those firms that appeared dominant at particular points in the industry's history. Secondly, we performed case analyses of the two major auto firms to most recently experience collapse, namely Rover in 2005 and Saab in 2011. In the case of Rover we conducted interviews with around 40 senior managers and executives (including four ex-CEOs) actively involved in the company between 1968 and its collapse in 2005. We also conducted an extensive review of secondary sources and used these materials to develop a comprehensive account of the company's decline and collapse (Oliver et al., 2008, Holweg and Oliver, 2016). We followed a similar process for Saab. The research on Saab was conducted primarily using secondary sources, but included an interview with one of Saab's ex-CEOs. As with the Rover material, we developed a detailed account of Saab's history (Holweg and Oliver, 2011, Holweg and Oliver, 2016). Thirdly, we conducted detailed case studies of two auto firms that came close to collapse but which came back from the brink and survived, namely Nissan in 1999 and Chrysler in 2009. The Chrysler and Nissan cases largely drew on secondary sources plus additional accounts (Ingrassia and White, 1995, MacDuffie and Fujimoto, 2010, Ingrassia, 2011, Vlastic, 2011). Finally, we reviewed 13 major crises (including the cases referred to above) and examined the causes and resolution of these. We then developed a conceptual framework in order to explain the patterns that we saw in the data.

### **The Global Auto Industry**

The auto industry has several features that, to varying degrees, underpin our arguments concerning the limits of an OM perspective in explaining failure and survival. The first of these is persistent global production overcapacity; there is capacity to produce more vehicles than there is demand for and this is a long term issue for the auto industry.

Second, sales of cars are heavily affected by the economic cycle – the replacement or acquisition of vehicles can usually be deferred if money is tight, amplifying the peaks and troughs of the economic cycle. This is significant in the context of industry overcapacity and squeezed margins, because it means vulnerability during downturns.

Third, cars, and the firms that make them have considerable symbolic value, personally, nationally and corporately. This results in strong economic and non-economic incentives to enter car-making and equally strong barriers to exit, one of the reasons for persistent overcapacity in the industry. Similarly, cars can represent

important ‘identity’ items for many people – a car can be a means through which to express oneself, not merely a mobility device. Brand counts for a great deal in purchase decisions, and develops and erodes only slowly, creating legacy and lag effects.

Fourth, cars are complex products – they contain multiple technologies that must be acquired, developed, integrated and assembled into complete vehicles. Car production therefore requires a formidable capability to coordinate and control. Cars operate in varied and demanding environments – they have to function reliably for many years with minimal maintenance. Much modelling, testing and proving is needed before products are released to the market, and high levels of support are required thereafter. It is this fourth area that has received the lion’s share of attention within the OM community, in particular processes such as assembly, supply chain management and new product development. We argue that this has fostered an unspoken assumption that the answer to surviving and prospering in the auto industry is essentially to ‘design and build better cars’.

We argue that together these conditions hold auto companies in a ‘web’ of forces, the net effect of which is to moderate the relationship between the operational performance of auto firms and their resilience. These forces relate to the context of the auto industry, to the relationships auto companies enjoy with their stakeholders as well as the ways in which auto firms configure and manage their operations. We summarize these ideas in Figure 1 and explain them in the text that follows.

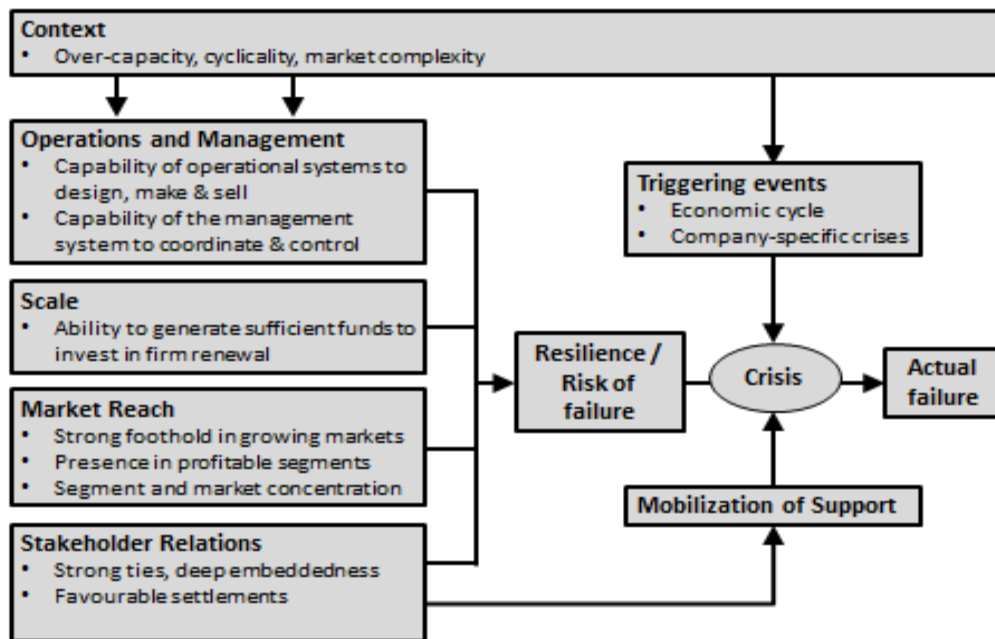


Figure 1: Resilience and Survival in the Auto Industry (Holweg and Oliver, 2016)

### Context

Context is important in explaining why many firms in the auto industry, even major ones, have periodically faced crises. Despite significant growth in total global auto sales, particularly in developing economies such as China, aggregate global productive capacity has tended to outstrip demand. In some regions this problem has been particularly acute (e.g. in Europe, especially in the years following the 2008 financial

crisis). This overcapacity depresses the profitability of automakers, particularly those in the volume segments of the market where competition is fiercer and prices lower (Froud et al., 2002, Froud et al., 2006). Combined with the swings of the economic cycle, to which sales of autos are especially vulnerable, this means that car makers can expect to face financial squeezes during the troughs of cycle. To these conditions one can add increasing complexity of markets in terms of both varieties of territories and market segments to be served, which in turns drives product variety, posing a further challenge to auto producers.

### *Operations*

The central focus of the operations perspective concerns the capability to design, produce and distribute vehicles to competitive standards, and these processes typically take centre stage in much OM research, with major programmes, such as MIT's International Vehicle Motor Programme, proving very influential in the field (Womack et al., 1990, Holweg and Pil, 2004). Clearly, car companies must be capable of producing cars to competitive standards and the operational practices necessary to do this are generally applicable, across companies and countries, albeit with some variations with respect to brand values and market segment. Yet our analysis of secondary sources suggested that whilst operational weaknesses may cause a firm to stumble, they do not automatically condemn it to failure and that other explanations are therefore required.

### *Market Reach*

By *market reach* we mean the presence of an auto firm in diverse markets, both in terms of geographies and segments. Market reach is important in understanding resilience in the auto industry for two reasons. Long term overcapacity in the auto industry means fierce competition and hence low margins, particularly in territories where the market is flat and players are fighting to retain market share. This problem is particularly acute in certain segments, where there may be seven or eight car makers with products that directly compete with each other. A presence in markets and/or segments that are growing or where there are fewer serious contenders (such as some premium segments) is therefore highly advantageous to profitability (Froud et al., 2002) and hence to resilience. Similarly, a product portfolio that covers a number of segments and territories limits exposure to risk from a slump in demand in a particular market.

### *Scale*

*Scale* refers to the ability to realise the benefits of economies of scale, at both product and platform levels. The auto industry is clearly an industry for which scale is important, in that, other things being equal, unit costs fall as production volumes increase. However, platform and component sharing between different models is a way of achieving economies of scale under the skin, whilst offering apparently varied products to different market segments. Off-the-shelf, or lightly customised systems, from major suppliers reduce the amount of development work that the car makers need to do. Thus, although greater market segmentation, with lower volumes of sales in each segment, might look like a reversal of the principles of economies of scale, often these now appear elsewhere in the system, at the level of the platform, module or component.

Reconciling the demands of scale with those of market reach can be challenging, and much research and theorizing within OM can be seen as a response to the need to reconcile this basic tension.

### *Stakeholders*

An obvious response to what we have said so far is: ‘So why are there not more failures in the auto sector?’ In many sectors, the typical response to these conditions would be consolidation through company closures, mergers and acquisitions. Yet, despite predictions to the contrary during the 1990s, the auto industry has seen relatively little consolidation. We argue that this can be explained an additional concept, that of *stakeholder support* (Freeman et al., 2010). The stakeholder perspective recognises that all organisations exist within a set of stakeholders who may have an interest (or stake) in their operation and its continued existence. Auto firms may be classified as heavily “embedded” enterprises, by which we mean that they exist in a relatively complex and dense web of “settlements” with multiple stakeholders, such as labour, investors, suppliers, customers and the state.

An organisation’s settlements with its stakeholders ‘tether’ it to a particular competitive position via a collection of understandings and agreements that can be difficult or painful to break, and that may constrain action on some occasions, but provide support on others (Holweg and Oliver, 2016). For firms in crisis, one of the options for survival is to seek an extension of support from some of their stakeholders, probably in conjunction with breaking and renegotiating the settlements with others. This can buy time for recovery. We suggest that the ability to draw on this support is particularly important in intensely competitive, high fixed-cost industries that are subject to swings of the economic cycle, of which the auto industry is a prime example.

Having mapped out our conceptual framework we now turn to how these concepts may be operationalised.

### **Operationalising the Measures**

In this section we operationalize the concepts described above, using publicly available data. In order to do this we construct a simple ‘resilience index’, shown in Table 1 and apply it to 14 major auto firms for whom we could obtain complete data. The main exclusions were auto companies that are part of larger industrial groups, for whom key data are not reported separately. Where single companies have multiple brands (e.g. VW or GM) data for the whole group are used. The index uses public data to generate proxy measures for the four main components of our model of resilience, namely: operational capability, scale, market reach and stakeholder support.

To measure *operational capability*, we use two measures, revenue per employee and scores on the JD Power quality survey. Revenue per employee provides an approximation for productivity, with the caveat that it is influenced by vertical integration, which cannot easily be corrected for. The measure of quality picks up the incidence of vehicle defects and is therefore sensitive to care, thoroughness and accuracy in processes of design and manufacture.

We measure *scale* in two ways – by total vehicle production, in units, and by the average production volume by per platform. The rationale for using volume per platform lies in the argument that a fundamental challenge for auto firms is to simultaneously maximise variety (and hence market reach) and economies of scale (thereby minimising costs). Well-executed platform strategies (manifested by high production volumes per platform) therefore provide a more subtle indication of economies of scale than total volume of units produced.

*Market reach* is gauged in two ways. The first is the Herfindahl-Hirschman index, which measures the distribution of a company’s sales across different national markets. Companies whose sales are dispersed relatively evenly across many countries, thereby reducing their reliance on any single economy, score relatively well on this index. This

measure is significant because of the problem of economic cycles for the auto industry – those companies whose sales are spread most widely across multiple countries are less likely to be vulnerable to these. A limitation of this measure is that we have used dispersion of sales across *countries*, rather than entire regions. Thus a company like Renault, whose sales are spread across many countries in one region (Europe), scores very well – despite the fact that it has no presence in the US or Japan, other than through its partner Nissan. However, if countries in a region move through the economic cycle in unison (as happened in Europe following the global financial crisis) the hedging effect of dispersion is clearly eroded.

The second measure of market reach is the percentage of sales that are in the five markets that have shown the fastest growth in the period 2008-2013 – China, Brazil, India and Thailand. We have, with some reservation, included the US as the US market has shown rapid growth since 2008. However, this growth represents an upswing after a deep trough in a mature market, rather than the long term growth and development of a new market. A strong presence in growth markets is important in the context of overcapacity – auto firms who are early movers into emerging markets face many challenges, but also may enjoy the benefits of reduced competition and hence enhanced margins – at least for a while.

*Stakeholder support* is the most difficult element of the model to operationalise in a clear, simple and transparent way. Companies have multiple stakeholders – labour, suppliers, customers, financiers, any or all of whom can provide support at times of need. Assessing the likelihood that these stakeholders will actually provide help when the chips are down is problematic – in 2008-9 Chrysler and GM went through many nail-biting months as their bailouts were discussed, debated and negotiated by their stakeholders, and the final outcome was by no means clear or assured at the outset. Moreover, stakeholder support, particularly in a crisis, often involves the breaking and re-negotiation of existing settlements. There is therefore often a highly political element to the process - outcomes evolve from a myriad of interactions amongst the actors concerned and are therefore difficult to predict in advance. Again, the 2009 rescue of Chrysler is instructive in this respect. Chrysler showed persistent weakness, was located in a strongly free-market political and economic environment, had been bailed out before and was seen by some powerful political actors to embody much of what was wrong with the US. On paper, Chrysler should *not* have been bailed out. But it was, conditional on a deal with Fiat, under the banner of saving an American icon and American jobs. In this case, patriotism trumped free market ideology – just.

Faced with these issues, we opted for two financially-orientated proxies for stakeholder support - credit rating (derived from Moody's credit ratings) and closely-held shares as a percentage of total shares. We use credit rating as an indicator of capital market confidence in the ability of a company to meet its obligations to its financiers, on the grounds that such confidence will be a factor in determining whether support is offered, although this measure does not of course pick up support that is provided in spite of poor short-to-medium term financial prospects.

'Closely held shares' typically refer to (voting) shares that are held by shareholders who are close to the company and which are not traded publicly, as common shares are. Examples of closely held shares include cross-holdings of shares by companies in the same keiretsu group in Japan; or family-held shares with special voting rights (as in the case of the Ford family, who hold 40% of the voting rights in Ford, or the 62% voting rights held by the Quandt family in BMW). We use closely held shares as a proxy for a long-term commitment to the firm, manifested as a propensity to provide support in the face of financial and other adversity.

For each measure we have converted the raw scores into z-scores, which express each company's position in terms of the distance above or below the mean score of all companies on that measure, and then combined all four measures, giving equal weight to each, to provide a simple league table of resilience.

A company's position in the table represents our estimation, based on the proxy measures of our resilience index of (a) the probability that the company is likely to find itself seriously challenged in the medium to long term and, (b) its propensity to survive a crisis should one hit. Table 1 provides a summary of a company's profile in terms of its operational performance, scale, market reach and stakeholder support.

Resilience Rank		Operational Efficiency	Scale	Market Reach	Formal Stakeholder support
1	Hyundai/Kia	High	High	High	Medium
2	Toyota	High	High	Low	High
3	Honda	Medium	Medium	Medium	High
4	General Motors	Medium	High	High	Low
5	Ford	High	Medium	High	Medium
6	BMW	Medium	Low	High	High
7	VW	Low	High	Medium	High
8	Nissan	Medium	Medium	Medium	Medium
9	Tata (Jaguar Landrover)	High	Low	Medium	Medium
10	Zhejinag Geely (Volvo)	Medium	Low	Low	Medium
11	Fiat-Chrysler	Low	Medium	Medium	Low
12	Daimler (Mercedes)	Medium	Low	Medium	Medium
13	Renault	Low	Medium	Low	Low
14	Peugeot-Citroen	Low	Medium	Low	Low

Table 1: Resilience Index Applied to 14 Major Car Manufacturers

No company tops the table on every single measure, indicating how difficult it is to have strengths in every single area. This of itself shows why companies who may not be particularly strong operationally show remarkable resilience – the effects of scale (being big) and market reach (being in the right places at the right time) can have a considerable compensating effect.

The star performers of table are Hyundai, Toyota, Honda, GM, Ford and BMW, all of whose resilience quotients are cumulatively more than one standard deviation above the average. Those in the lower zone of the table (on average more than one standard deviation below) are Fiat-Chrysler, Daimler, Renault and PSA.

At the very top is Hyundai Motors. Stringent in its organisation and disciplined in its operational execution Hyundai has strong operational capability. It has hired key talent from VW for its product design, and so in many ways now stands as a powerful hybrid between Toyota and VW. Its most recent growth phase came during the recent years of austerity, with small economical cars and the promise of long warranties. Some commentators see Hyundai's rise as a temporary boost, a consequence of the austerity of the post-financial crisis recovery years, but it interesting to note that Toyota also grew in a very similar way during the post-oil shock years in the 1970s and went from strength to strength in the decades thereafter.

Next come Toyota and Honda, demonstrating that excellence in operational execution still matters, and does provide a competitive advantage. Toyota's foothold in the hybrid market means that it well-equipped to defend its leading position and Japan provides a large local market for low-emission vehicles; 30% of sales of new cars in Japan are hybrids.

GM and Ford are in 4<sup>th</sup> and 5<sup>th</sup> place, respectively. Structural reforms to fix legacy healthcare costs in the US have been enacted, and their respective scale and global market reach (especially GM's) contributes to their resilience. GM's ability to seek and colonize markets has been a key strength that compensates for its operational mediocrity that has been criticised by analysts for the best part of three decades (Womack et al., 1990). Ford comes out as very competent operationally and as such is likely to hold its position in the US and Europe, but its 'back-to-basics' strategy following the financial crisis may limit market reach in the longer term.

BMW appears as the strongest European manufacturer, consistent with its strength of brand and strong skills in design and execution of premium products, which limit direct competition and protect margins. A greater surprise is that it comes in ahead of VW, which is five times its size. VW is capable of executing multiple brands very well, and uses its platform-sharing well to its advantage. It also shares a very strong position in China with GM. However, VW's weak position in the US and its low margins on its volume brands suggest weakness in the form of high costs of execution due to internal complexity and the retention of much employment in Germany. Product proliferation in pursuit of market reach, it seems, may have exceeded optimal economic trade-off for VW, even before its bungled 'clean diesel' strategy and associated reputational damage that emerged in late 2015. The full consequences of these are still to be seen.

Daimler's relatively low position is perhaps the biggest surprise of the index, but against the criteria, Daimler exhibits vulnerability on several counts. It does not show high productivity (although it announced a major cost cutting programme in 2014); it shows average quality; it does not enjoy significant scale, although the strength of its brand means that high prices compensate for this; and its sales, somewhat surprisingly, are concentrated in a few regions (North America and Europe) – more so than those of many other manufacturers.

Despite their alliance Renault and Nissan still report their results separately, and hence feature individually in the index. According to the index, Nissan is the stronger company of the two partners. If the two were treated as one company, they would appear in the index in Nissan's place in the rankings, although their combined overall score would rise (due to greater scale and market reach) placing them on the industry average. Renault on its own however seems vulnerable. Renault-Nissan has made a bold bet on electric vehicles, but has already missed the ambitious sales targets that it announced on the back of this. The difficulty of making major strategic shifts (such as a big swing in sales to electric vehicles) illustrates our 'embeddedness' argument – car companies are tethered to their existing context in ways that can be difficult to sever.

Tata Motors now owns Jaguar Land Rover. Apart from some scale advantage there are no obvious operational synergies between Jaguar Land Rover and its parent Tata, and Land Rover's current success probably owes more to delayed benefits from Ford's ownership and hard work (2000-2008) than it does to Tata. The main deciding factor will be whether Jaguar Land Rover will deliver the capital, engineering capability and brand strength to sustain itself without occasional, and substantial, cash injections from its parent.

Volvo Cars, under the ownership of China's Geely is in a difficult place, somewhat akin to where Saab was before its collapse, but with greater scale and market reach. Its



brand is not-quite-premium and its markets are historically focused in the US and Europe (and amongst limited groups of consumers in each). Although Volvo's historically sober, understated brand values sit well in Northern Europe and certain parts of North America, it is not clear that they sit so comfortably with the needs and preferences of the Chinese market, where Geely's hopes of growth in volumes largely lie. If this is so, the question is how long it will take for the issue to become apparent, and how Geely will deal with it when and if it does. At around 400,000 units a year Volvo is still small, so lacks scale economies, and of course can no longer share platforms as it could when it was part of Ford.

The lower zone of the table is occupied by Fiat-Chrysler and PSA, which reflects the strategic issues both firms are facing. Chrysler remains weak outside the US, as is Fiat outside of Europe (with the exception of Brazil). Neither has a strong presence in China and the opportunities for synergies appear limited, part perhaps other than by Fiat supplying small car platforms to Chrysler for the US market. History shows that Chrysler must be at risk in the next US downturn; the question is whether FIAT by that time will have the earnings to both sustain itself and support its American sibling. This looks unlikely unless FIAT's position in Europe and its other markets improves significantly (and quickly).

Chrysler is also unlikely to command further US government support. The Group has already sold off Ferrari to reduce debt and fund new product development and has ambitious – already appearing as overly ambitious – targets for volume growth from its Jeep and Alfa Romeo brands. Chrysler, and possibly FIAT's, volume cars businesses therefore appear to be at risk in the long term.

PSA is dependent on the middle-lower end of the mature European market where it competes directly with several strong players there are a lot of. PSA has no presence in the US, and is not particularly strong in emerging markets, having had a troubled early start in China. Strong labour unions in France make reform difficult, but the interventionist French state may continue to provide a safety net in terms of stakeholder support – but at the price of limiting the firm's strategic options. Our analysis suggests that PSA's attempt to launch the premium DS brand in 2015 in order to grow sales and margins will face headwinds due to brand legacy effects.

The resilience index thus represents a means of applying and quantifying our conceptual model of resilience. Its purpose is to broaden the discussion of issues of failure, survival and resilience beyond the realm of traditional operational analyses and to serve as an early warning system to identify firms that are likely to be most - and least – likely to face a crisis in the medium to long term, as well as to withstand a crisis should one come their way.

## **Discussion and Conclusions**

In this paper we have attempted to present a way of thinking about competitiveness and resilience that goes beyond the bounds of traditional OM thinking by introducing a number of factors that exist around, rather than purely within, operations. We think that these are important, because they highlight some of the pressures and constraints within which operations must be designed and managed. They also indicate that whilst traditional OM ideas may be important in understanding productivity and quality, non-traditional ideas may be necessary to understand processes of failure, survival and resilience.

Viewed through this lens, a number of practices currently in vogue within the OM literature, particularly in the auto industry, (such as modularity and platform sharing) can be understood as responses to the powerful forces engendered by the sometimes

competing requirements of market reach and economies of scale contained in our conceptual framework.

Our case studies (not reported in detail in this paper due to space limitations) illustrate how factors such as lag and legacy can ‘tether’ companies to their pasts. On the positive side, this means that organisations like car companies rarely die suddenly, but tend to enter long periods of decline – over 40 years in the case of Rover - a decline that gradually sees their assets and capabilities erode as successive crises eat away at their core. We ascribe this to the ‘embeddedness’ of car companies – the status quo is maintained by multiple connections to stakeholders and the environment. It can take a long time for these connections to fall away, and it may not even be all that obvious that they have, until a crisis comes along and reveals it. This means that change in the industry is likely to be slow and incremental because cars touch many aspects of people’s lives, all of which must absorb and adjust to any change. What this implies is that the car industry as we know it, with its incumbent firms, is unlikely to change radically in the foreseeable future.

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