

Trend study

IoT in the Driving Seat of Digital Transformation in Transport

How can European companies remain competitive in a disrupted transport ecosystem?

Dr Milos Milojevic
Industry Analyst

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Preface

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86 per cent speaks for itself

These days three letters are critical to a business's success: IoT. The connectivity of devices, machines and goods to the Internet and to each other promises up to 70 per cent less downtime, much more efficiency and a completely new proximity to customers. At least that's what is possible, but only a third of the businesses surveyed in this study first experienced a positive IoT balance. The IoT's potential for the transport industry has not yet been exhausted.

PAC analysts found that security concerns are the biggest hurdles on the way into the IoT. But it is also clear to European businesses that the digital world waits for no man – propensity to invest is higher than ever before. Three out of four companies want to increase their IoT budget in the next three years.

Smart ticketing, mobile payment, telematic solutions, predictive maintenance and the connectivity of goods are the biggest trends in the transport sector. The only question is: How can these technologies be used in a profitable and risk-free manner? With 15 years of experience of integrating ICT we can safely say: The one solution that fixes all IoT problems does not exist. On the contrary, it's much more complex. IoT- and cloud-based solutions need to fit a company's specific requirements, target groups and not least of all the existing IT landscape, so that data can flow and the desired results be delivered. For full end-to-end security, all IoT components – from networks to hardware – must be secure.

In order to exploit the potential of IoT with confidence what really counts today are experienced partners. This is why 86 per cent of transport companies rely on the collaboration of IT service providers.

Interested in more information about the Internet of Things? Then click on iot.telekom.com/en!

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IoT in the driving seat of digital transformation in transport

INTRODUCTION

Transport in Europe is a very fragmented and highly competitive industry with a rising number of innovators adopting Uber-like business models. In such environments, customers are being offered a wide range of affordable transport options, which increase the pressure of high operational costs on incumbents as they can now find themselves struggling to win and retain customers. To release the pressure, increasing operational efficiencies and improving the customer experience will be at the top of their agenda.

Transport players have traditionally poured most of their investment into their fleets of vehicles, be they planes, ships, trains, buses or cars. Many have decades-old legacy IT systems, which were not traditionally used to provide insights into their fleet operations, but rather to enable core business processes. However, as the IT landscape has evolved, a new set of digital technologies and solutions based on the Internet of Things (IoT) has emerged, aiming to bring new efficiencies to the bottom line and potentially expand the top line. These solutions bring a paradigm of connectivity into the business, and enable the integration of people, fleets and processes into a single point of view, paving the way for transport companies to obtain valuable business insights. By adopting IoT-based solutions, additional operational insights into the enterprise can be gained by integrating these solutions with existing enterprise IT applications. As a result, further optimizations and efficiencies can be achieved and new business models or revenue streams can be developed.

However, are transport companies aware of these opportunities, and how far along the road of innovation are they when it comes to moving forward with IoT? What do their IoT roadmaps look like? This study sets out to explore how European transport companies are approaching IoT initiatives from an investment, implementation and strategy perspective. Based on interviews with 200 senior CXO-level business and technology decision-makers, this report explores the impact that IoT has on driving the digital transformation of rail, road, air and water transport companies forward. The study outlines specific IoT use cases from the industry that companies have recently undertaken and, as such, presents vital and interesting reading for senior decision-makers at European transport companies who are looking to better understand the progress their peers are making on the increasingly important topic of IoT.

77% of transport companies in Europe see IoT as very important for their future growth and strategy, but are they ready to move forward?

KEY FINDINGS



83% of companies plan to increase their spending on IoT over the next three years.

The most popular IoT use cases that companies have already invested in are security and theft protection, telematics, connected cargo and predictive maintenance solutions.



77% of companies see IoT as very important for their future growth and strategy.

This shows a degree of maturity of IoT adoption in the sector as IoT initiatives are already bearing fruit and companies are recognizing its long-term potential.



58% of companies are beyond planning stage with IoT initiatives and 31% are already generating business impact with IoT.

Operational efficiency and ultimately cost reduction are the major business impacts companies have initially achieved.



70% of companies see ageing IT estates and new technology adoption as a major challenge.

Legacy IT estates slow down innovation but there is a clear appetite for innovation as 56% of companies see themselves as either early adopters, innovators or leaders when it comes to the adoption of digital technologies.



Data security and privacy concerns are top of the list of challenges slowing down IoT adoption, while improving repair and unplanned downtime are major drivers forward.

Larger players are more advanced in IoT adoption and consider it more important for their growth than smaller ones.



Software and platform providers are seen as strongly involved in IoT initiatives by 86% of companies, meaning they are involved more often than any other type of third party.

This reflects solid in-house IoT development capabilities. Even so, 64% of companies also collaborate with IT services players, and PAC expects their involvement to increase over time as they offer end-to-end capabilities and can bring more value in terms of collaboration. This is especially important because, in forward-looking initiatives, companies will need more help unlocking extra value from the business, for example in the development of new services, and IT services companies will be better placed to provide support on this journey than other third parties.

KEY TRENDS

Summary of key trends by industry

Airline transport	Airlines are front-runners when it comes to IoT adoption. 63% of companies are already at a medium or advanced stage, more than double the corresponding figure in any other sector. 78% feel like either innovators, leaders or early adopters of digital technology. 93% see IoT as very important for future growth. Several exciting examples of IoT solutions are presented later in this report.
Railway transport	55% feel like late adopters of digital technology and only 25% generate business impact with IoT, but 96% will increase IoT spending in the next three years. For 50% , one of the major challenges is the new competitive landscape. Companies have invested mainly in IoT-based security, telematics, smart ticketing and connected cargo solutions, some of which are discussed in this report together with real examples from the industry.
Maritime transport	85% see achieving better operational efficiency as a major driver of IoT initiatives. 68% see IoT as very important and 83% plan to spend more on IoT in the next three years. IoT solution design, prototyping and implementation is a major area of support for 83% of companies. This report outlines some examples of shipping companies investing in IoT.
Road transport	55% feel like leaders or early adopters of digital technology. 23% have delivered business value with IoT, but 80% plan to increase IoT spending in the next three years. The most implemented IoT solutions are security (39%), connected customer solutions (39%) and smart ticketing (35%). This report discusses some IoT success stories in the road transport industry.

Summary of key trends by region

France	37% have run IoT initiatives beyond pilot stage and 90% see improvement of fleet servitization as a major driver of IoT initiatives. 83% will increase IoT spending over the next three years. 95% collaborate with software players.
Germany	73% see IoT as very important for the future. 53% have invested in smart ticketing, 50% in connected customer solutions, 48% in telematics and 46% in connected logistics and security solutions.
Nordics	Only 28% are beyond pilot stage with their IoT projects and 50% see themselves as late adopters of digital, but 85% plan to increase their IoT spending. 45% have invested in IoT security solutions.
UK	37% have IoT projects beyond pilot stage that are generating business impact and 85% will increase their IoT spending. 47% have invested in smart ticketing, 46% in security and 42% in telematics IoT solutions.
Benelux	Less open to collaboration with third parties than other regions. 55% consider themselves to be laggards or late adopters of digital technology. 48% have invested in telematics and 46% in security IoT solutions.



IOT ON THE DIGITAL TRANSFORMATION AGENDA

Transport companies operate large fleets of vehicles and therefore most of their costs go into maintenance, which is often based on decades-old processes.

On the other hand, and especially in sectors such as air transport and road transport where plenty of low-cost operators compete, and passengers can be extremely demanding while showing very little loyalty, fierce competition puts the customer experience capabilities of companies to the test. Ultimately, this experience will be the decisive factor for customers when selecting a transport operator. Furthermore, a rising number of startup players are restricting transport companies' ability to remain competitive in the market. For example, **BlaBla Car**, with hundreds of millions of euros of investment, has introduced innovative concepts such as ride sharing.

By improving operational efficiency and reducing costs, transport companies will be able to invest more into customer-facing initiatives that can bring them growth in the long term. With the latest developments in the technology domain, companies should be able to move up the value chain and embrace innovations that can bring them additional agility. This situation puts IT players in the first row when it comes to leading the market and shaping the industry.

IoT solutions can have many applications across the enterprise but probably the most obvious one is to use them in vehicles (and parts of vehicles) to unlock valuable data streams that can be used to improve operations. For example, without IoT solutions, transport companies would service their vehicles at regular pre-scheduled services as part of a so-called preventive maintenance approach. However, often faults could occur between services, causing

unplanned downtime until the vehicle was repaired or replaced. This approach would reflect badly on the business by causing delays, or even the imposition of penalties by the authorities, resulting in the issue of refunds to passengers. On the other hand, with a predictive maintenance approach using IoT solutions, real vehicle data can be streamed and processed with predictive algorithms so the company can determine when a failure might occur and repair or replace parts of the vehicle just before they fail. Alternative examples of IoT applications include connected containers or cargo, which enable real-time monitoring of the location and condition of freight.

Transport companies are quite open when it comes to implementing IoT and adopting the digital mindset, and many of them are already forging ahead with their IoT deployments. For example, **Trenitalia**, the largest Italian train operator, expects to reduce the maintenance cost of its rolling stock by 8%-10% by analyzing the operational data coming from train sensors on its IoT platform. In the airline sector, companies like **Virgin Atlantic** have equipped planes and cargo equipment with IoT to collect flight data in order to detect mechanical issues before they even happen. This will be positively reflected first of all in safety, but also in the customer experience as it will reduce delays. The American car rental company **Hertz** has equipped its European vehicles with IoT connectivity to enable hourly rental services and to provide customers with a direct connection to the service center, as well as the ability to rent a car using a mobile app. Maritime companies are also moving forward with IoT, **Maersk** being a good example. The Danish giant has connected its refrigerated containers via an IoT solution to collect data such as temperature, power supply level and location, which is then being analyzed in the cloud. The result is reduced time needed for inspections, which brings reduced costs, better operational efficiency and even reduced CO2 emissions.

The bottom line of the major benefits IoT can deliver to transport companies is very well encapsulated by the Head of Remote Container Management at Maersk Line, Catja H. Rasmussen, who according to Internetofbusiness.com stated: "Since we launched RCM in 2015, we have generated significant operational savings, matured our internal processes and gained operational experience in handling the data" (where RCM is a Remote Container Management system based on IoT).

Moreover, the relative simplicity of implementing and trialing solutions in the transport world is an advantage because companies' fleet operations are quite decentralized and the prototyping of solutions with a single vehicle is fairly straightforward. Additionally, scaling the solutions across an entire fleet is not as challenging as in other industries where the scaling of a solution involves working on complex processes, for example in the manufacturing sector. Furthermore, the real-time connection that IoT brings can also provide insight into workforce operations, which can be used for its improvement and to enable more efficient productivity.

IoT in action: Trenitalia

This Italian national train operator turned to IoT to reach new levels of operational efficiency by reducing the unplanned maintenance of its rolling stock, which reflects on reduced downtime and labour time spent, as well as on avoiding the penalties for delays. The company analyses the data coming from thousands of sensors in order to predict failures and establish dynamic maintenance models. Expected savings in maintenance costs are in the range of 8% – 10%.

Are these examples a good indicator of wider progress and success when it comes to IoT, and to what extent are European transport companies involved with IoT initiatives?

This study aims to explore the existing appetite of European transport companies for IoT solutions and their current approaches to moving forward with implementation. Furthermore, the study examines which specific IoT applications companies have already invested in, their plans to invest in the future, and the major drivers and challenges of IoT initiatives.

These findings are based on interviews with 200 senior business and IT decision-makers from large and medium-sized companies that transport passengers and/or goods via railways, roads, air or water. A more detailed breakdown of the sample is available at the end of this document.

One of the first key questions to set the scene for the rest of this report is to discover how important IoT is for European transport companies.

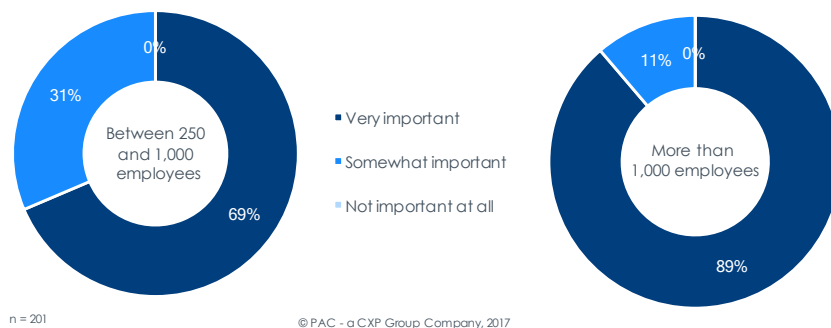


Fig. 1: Do you see IoT technology and solutions as very important, somewhat important, or not important at all for your future growth and strategy?

The vast majority of companies see IoT solutions as very important to their strategy, regardless of region or type of transport.

Still, the importance of IoT varies slightly between companies of different sizes, and generally it is greater for larger companies. This is mainly because larger companies have significantly larger budgets to spend, but they are also under greater pressure to change and innovate when it comes to customer experience and keeping up with market headwinds. Diving deeper into the results, we can see that more companies in the airline sector (**93%**) perceive IoT as very important than in any other sector, whereas in maritime transport only **68%** consider it important. Such a perception comes from the fact that the airline industry is both extremely customer-facing and very competitive, with low cost airlines in Europe offering plenty of choice to customers. Therefore, investing in solutions that can improve the customer experience, for example by reducing delays or increasing safety, is an imperative for airlines. This is not the case for maritime transport as the market is less crowded and customer expectations are not as high. Another avenue to explore for airline companies is

the improvement of baggage handling. IoT could be the enabler to get this right without losing any baggage. For example, **Airbus** and **Lufthansa** have collaborated with German luggage manufacturer **Rimowa** to develop a range of smart suitcases with e-ink and Bluetooth connectivity to connect to other airport applications such as luggage check-in. Applications such as smart baggage tracking could enable better luggage tracking and reduce or even eliminate baggage loss, a problem that has a particularly negative effect on customer experience. Other applications where companies could improve customer experience include interacting with in-vehicle food and drink ordering services via handheld devices, such as tablet, and wireless connectivity. This would not necessarily require internet connectivity as it is often limited, especially in trains and planes.

To better understand the overall importance of IoT to the transport sector, we should take a step back and look at the bigger picture in terms of the industry, as well as the underlying challenges putting pressure on companies today.

70% of companies see legacy IT as the major challenge, while fleet operation costs are major challenge according to 48% of companies.

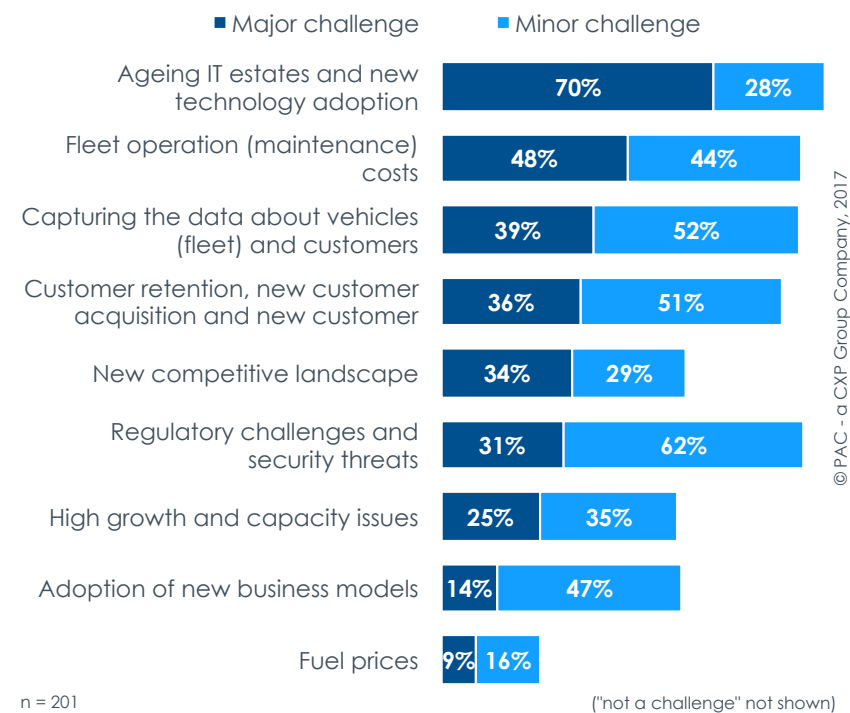


Fig. 2: Which of the following are a major, minor or not a challenge for your company in 2017?

European transport companies face some serious challenges in their operations, and these provide fertile ground for innovation and adoption of the latest technology-enabled solutions. The burning issue for the vast majority of them is legacy IT, which makes operations inefficient and potentially complex. Therefore, future IT investments need to be flexible and scalable, but also capable of integrating into some of the existing IT landscape.

The second biggest challenge when looking at the consolidated results across industry sectors and countries relates to the operational

costs of fleets. This challenge is felt particularly strongly in the Benelux region (**60%**) and France (**55%**), whereas in the Nordics (**53%**) and Germany (**43%**), customer-related challenges around acquisition and retention prevail.

From an industry perspective, the challenges facing companies differ depending on the type of transport they work with. For example, in the airline sector more companies see customer retention and acquisition, as well as capturing data about vehicles and customers, as a very important challenge than a somewhat important challenge. This can be explained by the vast number of low-cost airlines in Europe, which forces companies to invest to keep their customers happy but also to learn more about them through their data. Similarly, even rail companies recognize the threat of the budget airlines, which is probably the reason why **50%** of them see the new competitive landscape as a major challenge. The competitiveness of the market can perhaps be traced back several years to large-scale consolidations between giants like British Airways and Iberia, and Air France and KLM. A more recent example of the fierce competition in this sector is the 2017 bankruptcy of Monarch Airlines. In maritime transport, operational costs are seen as a major challenge by **63%** of companies, which is a reflection of somewhat slower technology adoption. Existing challenges bring the need for innovation across all industries, which is now more accessible than ever thanks to a wide range of digitally-enabled solutions that companies can use on their digital transformation journeys.

Are the challenges facing transport companies serving as a driver of innovation when it comes to digital transformation?

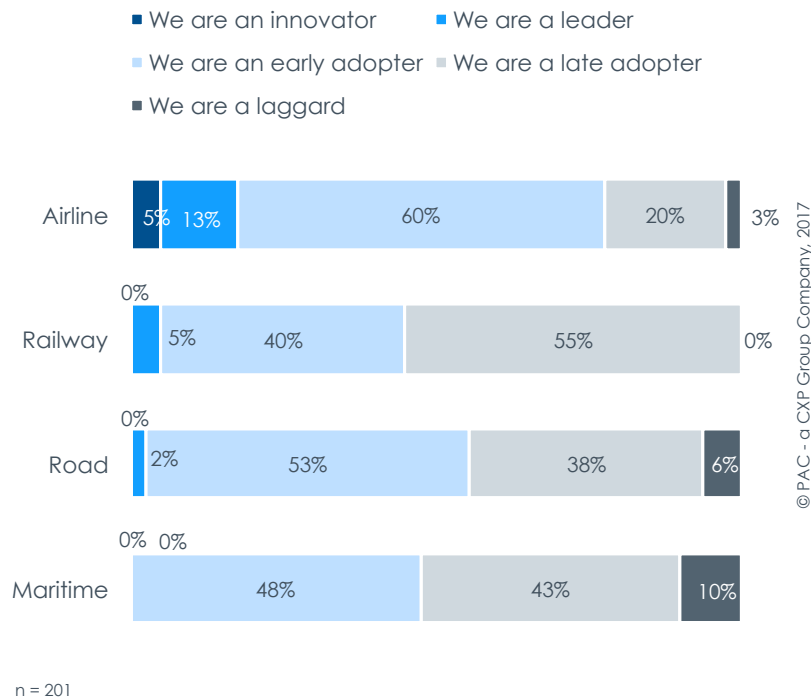


Fig. 3: When it comes to the adoption of digital technology, how do you rate your company?

The results show significant differences in self-perception when it comes to the adoption of digital technologies. Larger organizations are more inclined than smaller companies to perceive themselves as innovative. This comes as a consequence of the pressure from the aforementioned challenges, to which larger companies are more sensitive than smaller ones.

Industry-wise, the clear leader is the airline sector: more than **75%** of airline companies view themselves as an innovator to some degree. Road transport companies follow in second place. On the other hand, more than half of rail and maritime transport companies consider themselves either late adopters or laggards. This is because trains and ships are much heavier and larger than road vehicles, and they already have various advanced inbuilt systems which make the implementation of additional technology far more complex. Still, there is a room for innovation in these industries as well, especially in connecting the supply chain and enabling higher levels of security and traceability with IoT solutions.

In the adoption of digital technologies, most airline companies see themselves as innovators, while rail and maritime companies see themselves as late adopters or laggards.

With a clear need for innovation and real challenges to solve, the potential benefits that IoT solutions can bring are significant, but what is the current level of adoption of such solutions?



Fig. 4: Which of the following options best describes the current status of your IoT initiatives?

Once again, smaller companies are lagging behind their larger peers when it comes to reaping the rewards of IoT solutions. A solid **50%** of larger companies have already achieved tangible business results with their IoT initiatives. Still, only **5%** are at an advanced stage where they have enterprise-wide IoT strategies. These results reflect the possibilities that IoT can bring to companies and show that IoT can indeed have a positive impact on the business. Moreover, running a number of pilot projects brings about the opportunity to scale the successful ones. It is also important to outline that for some companies, especially those in the road transport business, the implementation of IoT solutions is not as complex, which should act as an additional incentive for companies in this sector to at least trial some kind of IoT initiative. This is also confirmed by some of our respondents to the survey. According to one, "Ease of implementation and clarity in terms of usage have always been a unique feature of IoT".

These trends are in line with what PAC sees in the industry: the transport sector shows higher levels of maturity, especially when compared to other industries such as manufacturing. Indeed, we are seeing more and more deals being signed between the vendors and transport companies on the back of IoT initiatives.

The maturity of the transport industry in Europe in terms of technology is reflected in similar adoption rates between the regions. From an industry perspective, the airlines are the clear leaders with more than **60%** of them generating real business impact with IoT. Many airlines

63% of airline companies have generated business impact with IoT, while others are lagging behind: railway companies 25%, maritime companies 23% and road transport companies 23%.

are working on their IoT initiatives way beyond simply optimizing the operations of their planes. They are also using IoT to boost the productivity of ground staff and cabin crew. For example, **EasyJet** has invested in smart uniforms designed to provide staff with more relevant information as well as increasing safety for its engineers. On the other hand, companies in other sectors are some way behind in the adoption of IoT, where only **25%** in railway, **23%** in maritime and **23%** of road transport companies generate business impact. This could also be caused by a lack of the strategic internal capabilities required to deliver a proper business plan for such investments.

Many transport companies are going through some stage of digital transformation, but will IoT be the significant driver and are companies willing to spend more for such solutions?

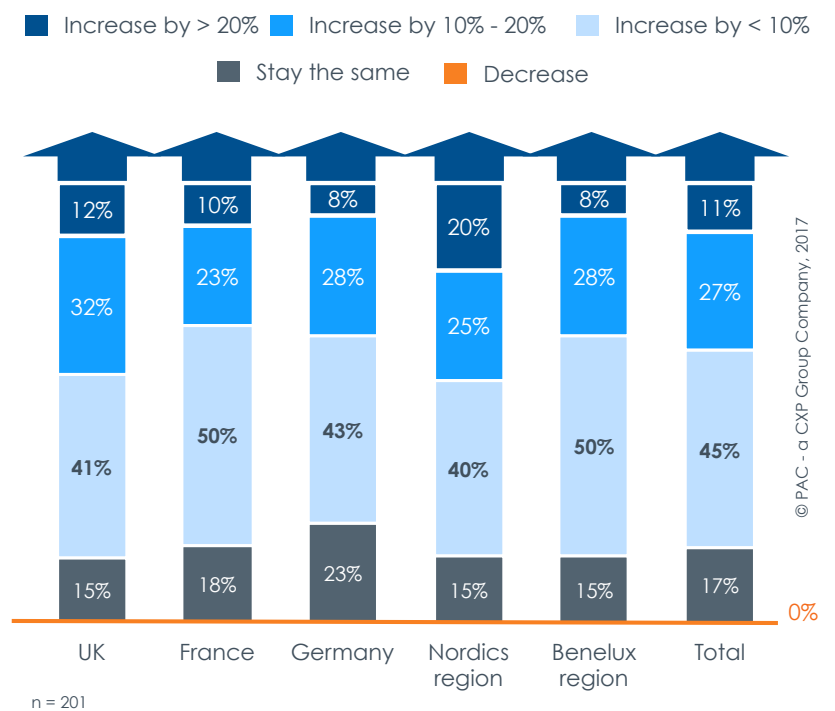


Fig. 5: How will your IoT investment develop in the next 3 years?

Willingness to spend more on IoT solutions is clear across all regions in Europe with more than **80%** of European companies claiming they are ready to increase their spending over the next three years. This shows that companies see IoT as an important driver of their digital transformation initiatives in the mid to long term. The amount of digital budget being spent will certainly depend on their IoT strategy, but also on the department signing off the budget for IoT initiatives.

“Ease of implementation and clarity in terms of usage have always been a unique feature of IoT.”

(Quote from a survey participant)

IoT in action: easyJet

easyJet , the UK-based low-cost airline, has invested in the development of IoT-enabled smart uniforms with a range of embedded sensors as well as LED lights and microphones to enable better communication between staff. Engineering crew uniforms will also have inbuilt cameras, microphones, air quality sensors and barometers in order to monitor the work environment and make it safer.

From an industry perspective, it is interesting to note that more companies in the rail industry than in any other transport sector are willing to increase their spending on IoT. This comes as a consequence of competition and high operational costs, as transport by some other means has become more affordable so companies need to invest more to stay competitive.

PAC believes that when considering IoT investments, companies should define a strategy that sets out the road to implementation, considers associated costs and benefits, as well as setting expectations in terms of timeframes and return on investment. As IoT solutions bring additional layers of insight into the business, proper performance indicators and measures of success should be set in order to measure their outcomes. Moreover, we see innovation in vendors' business models when selling IoT solutions, which are often oriented on outcomes and charge customers based on outcome-based business models. For example, vendors might charge a percentage of the saving they are able to deliver to a customer with their IoT solution. Also, it is worth mentioning that some companies perceive themselves as late adopters or laggards while at the same time planning to increase their IoT investments. This leaves plenty of scope for innovation as long as there is a proper IoT strategy in place, which is supported by management, and a willingness to implement and manage the change. Vendors should also sharpen their focus for these industries, come up with vertically-oriented solutions and lead companies along this route.

In all European countries, IoT initiatives are being driven by lines of business with the exception of the Benelux region where decisions are more frequently driven by IT departments.

Unlike traditional IT decision-making, which resides within IT departments, PAC sees IoT decision-making swinging more towards lines of business in Europe, but are trends the same in all markets?

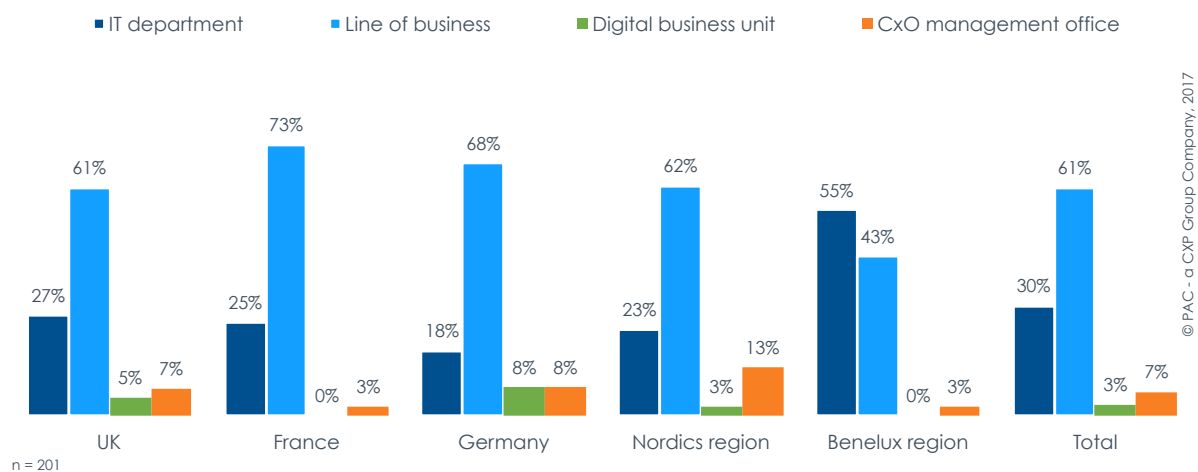


Fig. 6: In which departments of your organization are the budget decisions for IoT initiatives made? (single answer)

As with most digital transformation decision-making, IoT-related decisions are mostly driven directly from lines of business. This applies to most countries with the exception of the Benelux region where decisions are still more usually driven from IT departments. Despite the

split of IoT decision-makers within the industry, PAC believes that in order to move forward on their digital transformation journeys, companies need to embrace closer working relationships between lines of business and IT departments. Moreover, the innovations happening at the edge of businesses need to be incorporated into the core of the organization and IT departments should collaborate with the boardroom, as this is the best way to scale innovation. As a liaison between these stakeholders, companies often establish dedicated business units and Chief Digital Officers to steer strategy and change.



TAILWINDS AND HEADWINDS FOR IOT ADOPTION

IoT solutions can be used in more than one way. Indeed there are more than 550 use cases available in the [PAC IoT Innovation Register](#). Great examples of IoT use cases include solutions that provide insights into fleet or asset operations and can enable applications such as predictive maintenance. A good example from the industry comes from French national railway company **SNCF**, which processes data coming from sensors on trains and tracks in the cloud, where predictive maintenance algorithms are run to detect potential failures. Therefore, companies can be prepared to service their vehicles before they experience any faults and therefore reduce any unplanned downtime and associated delays. Another good use case comes in the form of connected worker solutions that provide real-time insight into the workforce and promote better collaboration and safety. For example, UK-based logistics company **ATL Haulage** has implemented a telematics IoT solution which provides better engagement of its drivers by incentivizing them with the best driving record. The platform considers drivers' performance and fuel usage to reward the best performing drivers. On the other hand, IoT can be used to develop new business models as well. A great example of this is the way in which car rental companies have expanded their traditional daily rentals business models to include hourly rentals, or even a car sharing concept similar to those that innovators such as Zipcar use. For example, German car rental company **Sixt** has launched a joint car sharing venture with BMW, which is enabled by IoT.

Almost 70% of companies see cost reduction as a significant driver. Product improvement is the second most important driver.

What are the major drivers of IoT investments for European transport companies?

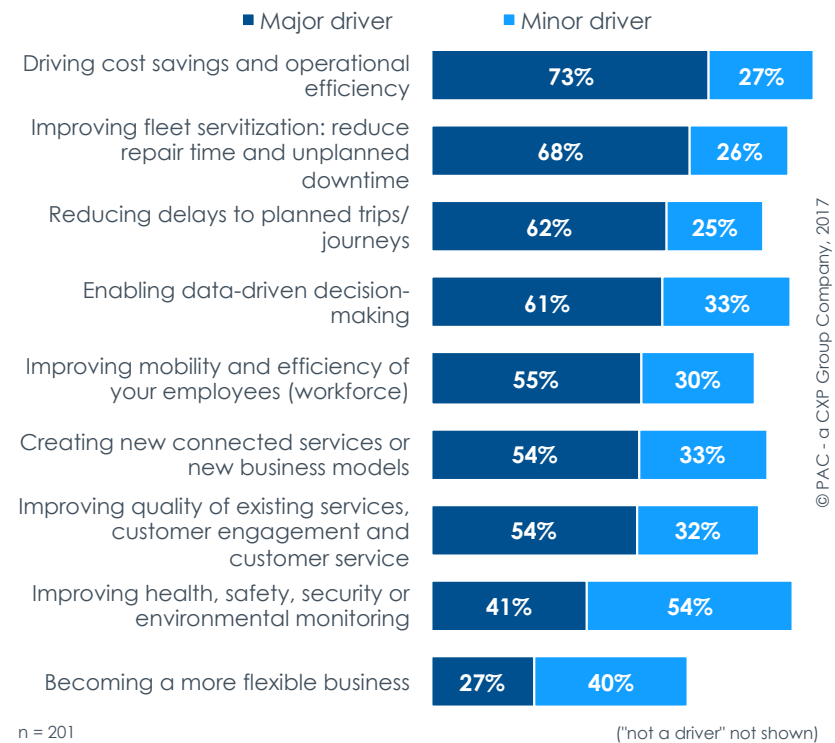


Fig. 7: What are the drivers for your IoT initiatives?

The most important driver to the largest number of companies is the achievement of better operational efficiency, which is also seen as one of the major overall challenges for the transport sector. A similar proportion of companies see achieving better servitization and becoming able to reduce unplanned downtime and delays as the major driver of IoT adoption. This doesn't surprise us at all as many companies have tight margins and generally operate very expensive vehicles that are transporting either passengers or expensive cargo. Therefore, companies are prepared to spend a lot on ensuring the timely servicing of vehicles in order to meet strict safety regulations.

Achieving operational efficiency and reducing repair time and unplanned downtime are the two major drivers of IoT adoption.

“IoT will be very useful in our industry and can solve various challenges of cost and maintenance.”

(Quote from a survey participant)

These two drivers can also be seen to be dominating the industry as most IoT investments in the transport sector are channeled towards improving the efficiency of fleets, which leads to reductions in downtime and delays. Other important drivers include enabling data driven decision-making and the development of new services and business models. The former reflects the fact that some companies are yet to invest in IT technology to connect their fleets with other enterprise applications, and therefore see IoT as an opportunity to

obtain valuable data that can later be used for business optimization. The latter shows that many are seeing the bigger picture with IoT technology and the potential to expand its use beyond optimization of their current business towards unlocking new revenue streams.

It is also important to note that more than half of the companies surveyed see the development of new business models and services as a major driver of their IoT initiatives. With advancements in autonomous technology, this will become even more common as companies will be able to leverage autonomous driving to develop new business models, which will emerge especially with the rise of smart city projects in the long term. Even in the shipping industry, autonomous ships are becoming a reality. Indeed, **Maersk** already operates autonomous ships. These are equipped with the latest technologies and the company estimates autonomous shipping can reduce transport costs by up to 22%.

From a regional perspective, most of the companies surveyed in the UK (**68%**), Germany (**75%**) and the Benelux region (**80%**) see cost savings and achieving operational efficiencies as their primary driver. On the other hand, companies in Germany (**90%**) and the Nordics region (**75%**) see improved servitization as a major driver.

How do major drivers of IoT adoption translate into investment, and into what specific IoT solutions have companies already invested and plan to invest further?

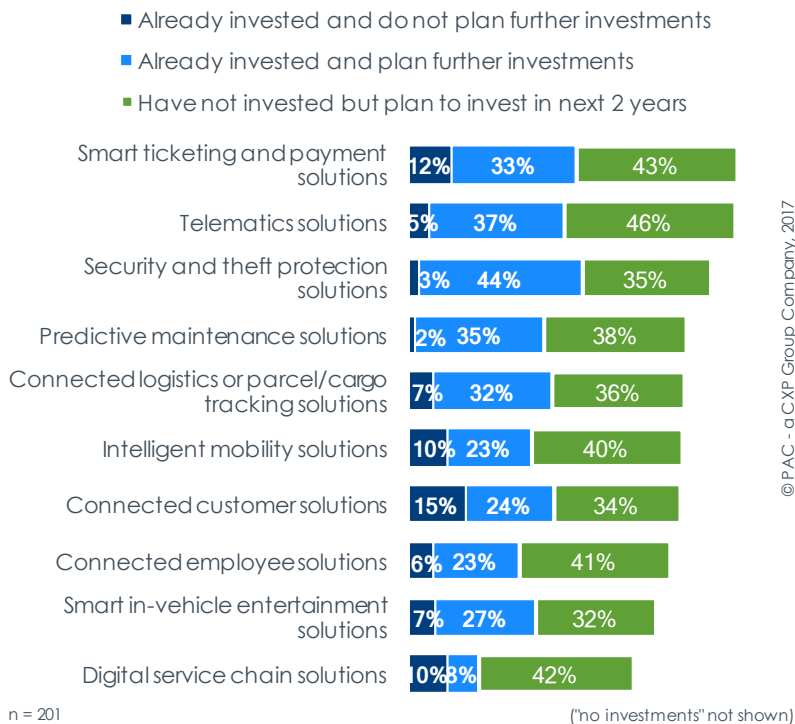


Fig. 8: Have you already invested in different IoT solutions and applications areas and do you plan to invest within the next 2 years?

Almost half of the companies surveyed have already invested, and some even plan to invest more, in IoT. The most popular applications are tailored around three very important topics: predictive maintenance and telematics, security and protection, and smart ticketing and payments. Overall, this is very much in line with what PAC sees in the buyer community, and is mostly related to the importance of these solutions to the business of transport companies. Ticketing and payments solutions provide the major revenue stream for transport players, so the current level of investment and innovation with IoT in these use cases is understandable. Similarly, security and theft protection are a must for all types of transport companies. Moreover, security-related IoT solutions can be coupled with connected logistics and cargo solutions to provide full transparency regarding the location and the condition of cargo. These solutions can also enable the collection of valuable data about the external environment such as temperature, traffic conditions and transport routes, which can all be used to improve existing operations, for example by predicting the demand for certain goods.

These results are very optimistic and point to an interesting future for transport players. A key reason behind this high level of adoption and future plans comes from the fact that it is relatively straightforward for companies to test whether an IoT solution will work on a limited number of vehicles or employees, and then scale it accordingly. There are also some very interesting use cases coming from the industry, which reflect the survey findings revealing a demand for more innovative IoT solutions. For example, the Dutch airline **KLM** uses an IoT solution to connect the critical equipment its mechanics use so they are always aware of its location. This can significantly reduce service time and therefore increases the utilization of planes. Another example comes from the UK bus operator **Stagecoach**, which uses IoT to make real-time ticket transactions available to headquarters by connecting ticket machines with the depot when buses reach it.

What are the blocks on the road to IoT?

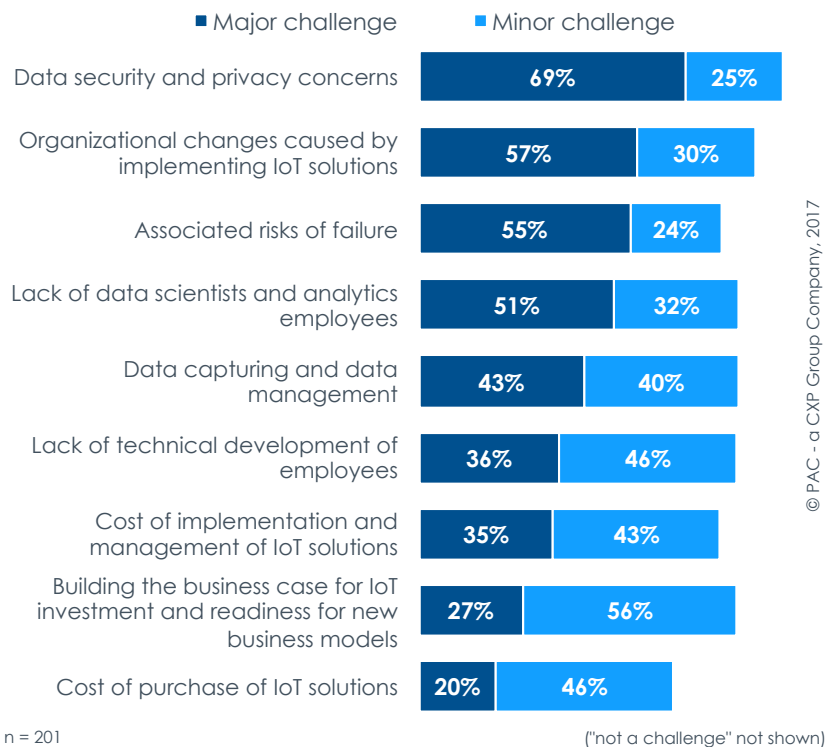


Fig. 9: What are the challenges in terms of your IoT initiatives and strategy?

“Security is the major challenge for us.”

(Quote from a survey participant)

When it comes to challenges slowing down IoT adoption in European transport, there are several major factors to point out. As expected, data security and privacy concerns are considered a major inhibitor by most companies. This is due to the rising level of threats in both the cyber and physical worlds, where protecting the privacy of customer data has become a real challenge while, at the same time, regulations are becoming even more strict. This is especially important because the adoption of IoT significantly increases the number of endpoints that could be potential points of breach in the future. Another important challenge that might slow down adoption is the risk of failure, which is why vendors need to have innovative business models, for example based on the outcomes an IoT solution can provide. The cultural shift that will happen due to employees' perception of new technology is also an important challenge that IoT will inevitably bring. Since IoT often makes processes involving people more transparent, disquiet among employees and a fear of being monitored may arise. This is especially the case in markets where works councils are very influential, for example in France and Germany. Well-established processes might change as well, resulting in the need for companies to train their workforces in the newly

Major challenges slowing down the adoption of IoT include data security and privacy concerns, as well as the organizational changes that IoT might bring.

adopted technologies. One final major concern could be a lack of personnel with the requisite analytical skills to take full advantage of new IoT solutions. One of the end products of IoT solutions is data, which must be analyzed by trained users in order to maximize its value. Therefore, when introducing new IoT solutions, companies should also boost their analytics teams to ensure they are capable of handling the large quantities of data that are being unlocked with IoT. It is also encouraging to see that challenges related to the cost of purchase, implementation and management of IoT solutions do not represent a major concern for most companies. This reflects a readiness to reach new levels of efficiency and build a business case for these investments, which is also indicated by our survey results.

There are few major deviations in responses from different countries in Europe. Industry-wise, it is interesting to note that companies in the railway sector are not as concerned with data privacy but see organizational challenges as a much bigger problem. This is probably because the amount of customer data they collect is not as large as in other industries, while processes in the industry are very well-established and would require significant effort to change them. Apart from security challenges, more companies in air transport and road transport than in other sectors also see the risk of failure as a major concern. The reasons behind this probably lie in the pressure on fleet utilization and the very high capacity load of these companies, hence any undesirable problems with an IoT solution implementation would significantly reflect on the business as well.

PAC's position on investment into IoT is that companies should work on IoT implementations at three different levels. The starting point is prototyping and putting together the evidence that a benefit can be achieved. Such solutions can be scaled over the entire fleet in the next level of engagement, which should enable a large amount of data to be processed and potentially lead to wider optimizations. The final step is to use the available data, the existing fleet and innovative IoT solutions to examine and potentially develop completely new business models. To progress to and through any of these stages, companies will need a hand from the vendor community, but the level of engagement between them will depend on the companies' internal capabilities as well as on their IoT strategies.



THE ROAD TO THE NEXT LEVEL OF EFFICIENCIES

In order to reach the next level of operational efficiencies with IoT, transport companies will very likely need a hand from the vendor community, as most of them will find it inefficient to develop IoT solutions in-house. The choice of vendors that could lead them on their IoT journey is pretty wide thanks to the diversified and fragmented IoT ecosystem, which is attracting a rising number of vendors. The choice will include the likes of IT services companies, software and platform providers, hardware companies, telecom operators, and even digital agencies and academia, as well as a deep pool of innovative startups.

With which third-party players do transport companies mostly collaborate?

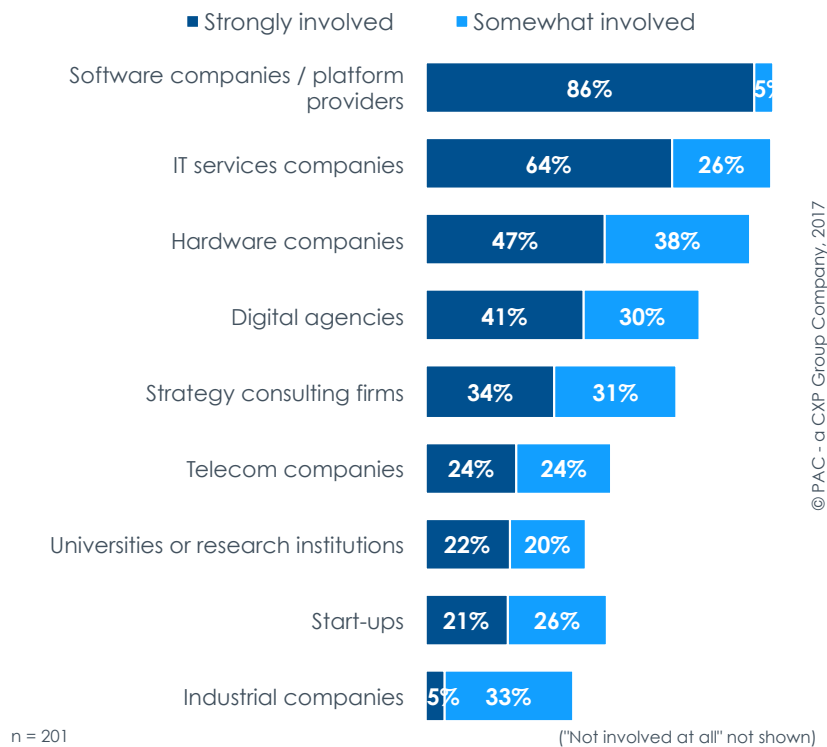


Fig. 10: To what extent are the following third parties involved in developing your IoT strategy and initiatives?

The overall European results show that transport players mostly turn to software companies or platform providers. This reflects the confidence transport companies have in their in-house capabilities to the degree that many can develop IoT solutions on their own, or at least experiment with IoT, using one of the numerous IoT platforms available on the market. This finding is in line with the challenges evaluated above, which revealed that companies are not too worried about their internal technical development capabilities. Next in line are IT services companies, and these are often approached by the transport companies that don't want to dedicate too many of their internal capabilities to the development of end-to-end solutions, but prefer to count on the support of IT services players. Many IT services vendors have developed comprehensive end-to-end solutions for the transport sector. They are more likely to be approached by the companies needing a hand across the lifecycle of a solution from initial development and implementation to management of the solution. Hardware companies are also in the game: many have embedded IoT capabilities into their products, which have gone on to be deployed in a transport environment. Solid involvement of digital agencies in IoT initiatives indicates a certain readiness on the part of the sector to use IoT-based solutions not just to improve internal operations but also to enhance the customer experience. Not as many companies are collaborating with strategy consulting companies, which indicates strong confidence in their

The companies most frequently approached by the transport sector for help with IoT are software and platform providers. 86% of companies were strongly involved with them in developing IoT strategy and initiatives.

internal capabilities to develop a business case for IoT investment which is in line with the previous evaluation of challenges that slow down adoption. The development of a business case for IoT investment is considered as a minor challenge. It is somewhat surprising to find that collaboration with startups remains at a very low level, which reflects a certain level of conservativeness. Still, things are beginning to change and some of the large European airlines have developed dedicated accelerator programs to collaborate with startups. A great example is **IAG Group**, the parent company of Iberia and British Airways, which launched Hangar 51, an accelerator dedicated to collaboration with IoT, blockchain and analytics startups. Similarly, **Virgin Trains** put £25 million into the launch of its Platform-X accelerator, which encourages innovative companies to solve business challenges in the railway industry.

The collaboration trends with third parties are fairly uniform across all the European markets we examined, with the exception of companies in the Benelux region who showed a slightly more cautious approach to working with third parties. Software and IT services companies dominate within all the transport sectors when it comes to collaboration.

PAC believes that the diversity of the IoT ecosystem definitely provides a wide set of choices for transport companies seeking the right road to deploying an IoT solution. Still, too many stakeholders might make this task more difficult for the companies that do not have extensive in-house IT and strategy capabilities. Such players will need guidance, and present a good opportunity for IT services players. PAC also believes that the importance of IT services players will increase over time as they have strong vertically-oriented consulting capabilities which will be required when making a business case or developing new services. They also aim to provide flexible business models (e.g. outcome-based). Furthermore, they often propose co-investment approaches for IoT solutions whereby they take on part of the solution development costs to make it more affordable for the client, but also to reuse the solution with other clients. This approach fosters collaboration between transport companies and providers and is a positive step towards solving the real business challenges that specific businesses have.

For which IoT-related tasks are transport companies seeking out support from third parties?

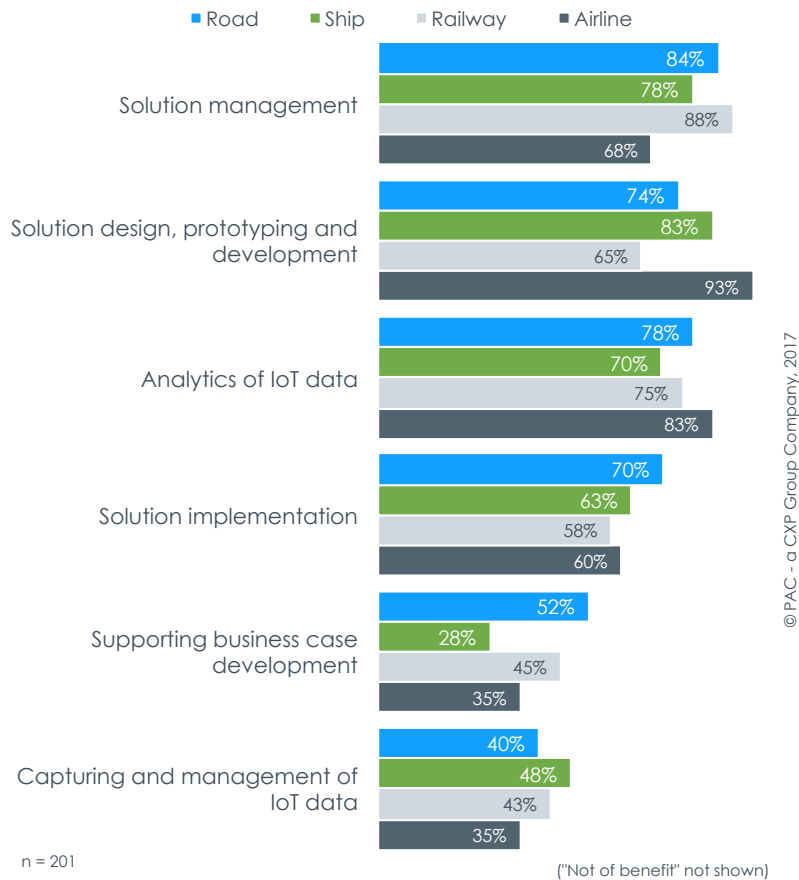


Fig. 11: What type of external help would be of greatest benefit in supporting your IoT strategy?

There are three key areas in which most transport companies need support when it comes to collaborating with third parties: solution design, solution management and analysis of IoT data. Help around solution design and solution management is usually needed by companies that lack the relevant in-house resources. These companies are most likely to work with IT services providers on such engagements. This survey has already revealed that an internal analytics skills shortage is considered a significant challenge in moving forward with IoT initiatives for more than half of companies, so help with IoT data analytics would be useful to many of these. An important piece of the IoT puzzle is getting the data into the right format, structuring it in order to enable productive analysis and managing it in large volumes. PAC sees that transport companies often have challenges in obtaining data from various sources, which is also borne out by the survey results.

Apart from solution design, prototyping and management, the analysis of IoT data is the most common type of engagement transport companies are looking for with third parties.

“Proper management and execution is much in need.”

(Quote from a survey participant)

Results by country vary little in this regard, with the exception of the Benelux region where transport companies seem to have stronger in-house capabilities for making IoT work. By industry, more than 90% of airlines say they could use help in solution design, which reflects the IT outsourcing maturity in this sector in some countries. More than 80% of maritime transport companies need the same type of help, which is to be expected as laying out a solution for complex vessels can be challenging.

Obtaining the full benefits of IoT solutions depends on a company's ability to integrate data streams coming from IoT into wider enterprise applications. To do that deploying a central enterprise-wide IoT platform will be of critical importance, as this could provide a single view of all operational equipment, but could also contribute to better enterprise performance if properly integrated into core business applications.

PAC suggests that once an IoT strategy has been clearly defined, transport companies should make themselves aware of the vendor ecosystem but also foster innovation internally. The former should involve setting up requests for proposals that can quantify the outcome values and expected timeframes. Moreover, they should be looking at the solutions and vendors that can move them up the value chain by introducing a new service or business model on the back of the IoT solution. The latter, should be done by stimulating entrepreneurial activities via internal and external hackathons, and possibly even by setting up dedicated funds for investment into startups. Such initiatives could activate their ecosystems and attract a new set of partners together with whom the realization of the aforementioned aims could be achieved more easily.

How far away are companies from implementing enterprise-wide IoT platforms?

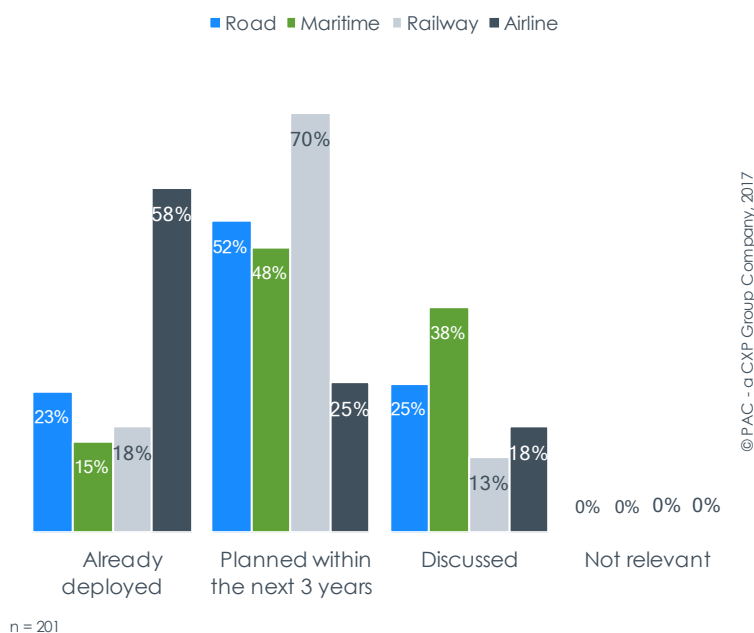


Fig. 12: Have you already deployed a central enterprise-wide IoT platform to manage devices, assets, and process data; Has it been planned for the next 3 years, merely discussed, or is it not relevant?

The results of this study show the airline sector to be a clear leader. Well over 50% of airline companies have already deployed central enterprise-wide IoT platforms. However, this is not something that PAC sees in the market. Moreover, PAC sees most of the companies that are adopting IoT solutions doing so by implementing IoT platforms on a per use case basis. This means that companies are mostly running multiple IoT platforms to support different applications. Still, as IoT evolves in the future, both as a technology and in terms of companies' maturity to support IoT initiatives, we expect to see the consolidation of different IoT solutions into enterprise-wide IoT platforms. It is possible that some survey respondents did not fully grasp the concept of an enterprise-wide IoT platform that integrates multiple applications. In geographical terms, the UK leads the way with 37% of companies having already deployed IoT platforms, followed by France and Germany. This indicates a solid level of maturity when it comes to the strategic approach to IoT, but there is still room for development. This is related to the scale of IoT initiatives. Those companies already investing in large-scale solutions are more likely to have enterprise-wide IoT platforms.

On the other hand, those at an advanced stage of adoption and with a willingness to spend more on IoT are more likely to have a clearly defined IoT strategy and larger scale projects which are more likely to be based on enterprise-wide IoT platforms. For example, more than 60% of airlines are already at a medium or advanced stage of adoption of IoT initiatives, which is another reason why some of them have already deployed central IoT platforms. Moreover, it is worth mentioning that of those companies already using IoT platforms, 74% are using platforms available on the market and are not developing them in house.

The output of IoT solutions is data, and ultimately transport companies need to be able to monetize it. Whether or not they are successful in that depends on many factors, beginning with the aforementioned platforms and their internal analytics capabilities, and also including the supporting infrastructure and business acumen to support processing and understanding the wider business impact of vast amounts of data.

Are companies already using IoT data in business decision-making and where is this data being analyzed?

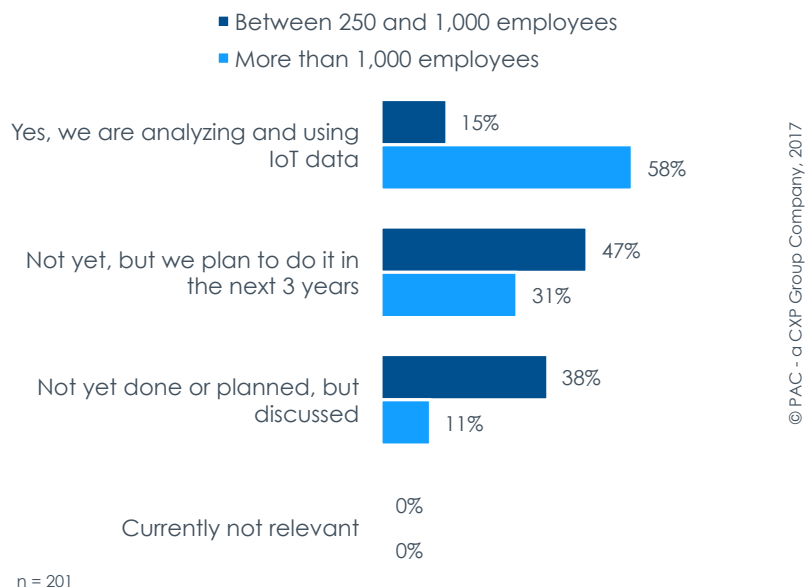


Fig. 13: Are you currently analyzing and using your IoT data in business decision-making? Is it planned within the next three years, or at least discussed, or is it not relevant?

The number of companies currently able to use their IoT data in business decision-making depends much more on the size of the companies and less on where they are located, although France stands out as a leader here. Once again, larger players have a bigger imperative to stay innovative and efficient and therefore almost 60% of them already use IoT data to support business decision-making.

The use of IoT data for business decisions, regardless of whether analytics is done in house or it is outsourced, might also be affected by where it is processed. Therefore, an important question when laying out an IoT strategy is where the IoT data will be analyzed – in the cloud, on-premises, or on edge devices such as gateways?

58% of large transport companies are already using IoT data in business decision-making.

What is the current situation in Europe with regard to where IoT data is being analyzed?

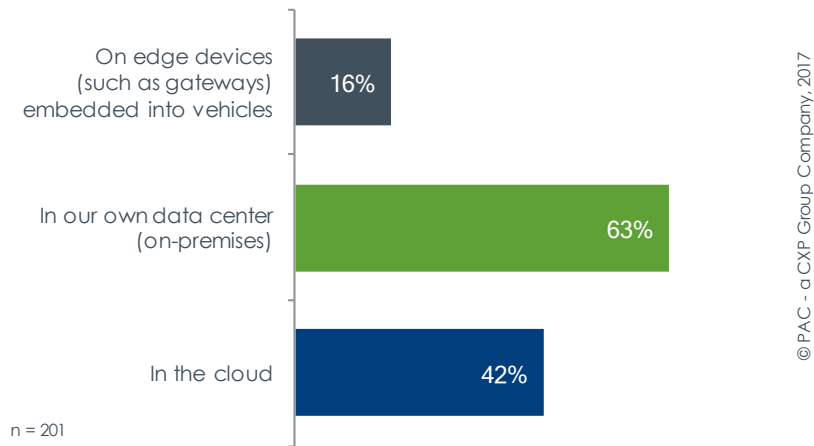


Fig. 14: Based on your IoT strategy, is data analytics performed in the cloud, in your own data center (on-premises) and/or on edge devices (such as gateways)?

There is probably no right answer to this question and much will depend on important factors such as the amount of data that is being analyzed, latency requirements in data analysis and the price of connectivity. Cloud analysis allows the processing of very complex and large data streams as it provides enormous computing power and many pre-built analysis modules in a SaaS or PaaS model. Still, choosing this type of processing for all the data generated by, for example, an entire fleet might be too costly because bringing it to the cloud could incur significant connectivity costs. Also, it could raise concerns about data privacy, especially in more conservative and regulated markets. Furthermore, the processing of data in the cloud would probably not be happening in real time. On the other hand, edge analytics could be performed in near real time but analytics capabilities would be more limited in terms of processing power. On-premises processing could be a more favorable option for those cautious about privacy, but could still be limited in terms of processing and scalability.

The results show that when it comes to cloud, French companies seem the most reluctant, whereas the UK, the Nordics and Germany claim to be more cloud-friendly. Similarly, large players are more open to using the cloud than smaller players, probably due to the cloud's capacity to handle larger amounts of data and offer better scalability, which is certainly a more frequent requirement for large companies.

CONCLUSIONS



Innovation has become an imperative for European transport companies, and larger companies are showing good signs of innovation while smaller businesses are lagging behind. Dealing with high operational costs and a dense competitive landscape is a significant challenge for incumbents, especially in an era when customers have a wide choice of affordable transport options. Therefore, companies are looking to release the pressure by reducing operational costs, which is a major driver of IoT initiatives. Major investments are being poured into telematics, predictive maintenance, IoT security and connected cargo IoT solutions.



Other than improving operational efficiency, some transport players are also investing in IoT applications that touch upon customer experience, such as smart ticketing, connected customer and smart in-vehicle entertainment solutions. Such applications can contribute to better overall efficiency, but more importantly they can provide a better connection with customers and unlock new streams of customer data that can be monetized.



More than half of the companies surveyed are already running some type of IoT solution and around one third have already generated real business impacts. There are no significant differences between the level of IoT maturity in different countries, which is a reflection of the general technology adoption maturity in the sector. Most companies see IoT as a very important factor for their future growth and strategy, and most are willing to increase their IoT budgets.



Software and platform providers are selected more frequently than other third parties for collaboration on IoT initiatives. This reflects the solid internal development capabilities of transport companies, and will bring more value from IoT.



This study reveals that IoT initiatives are mostly being driven from lines of business rather than IT departments. Gaining value from IoT investments in the long term will need to be underpinned by a formalized IoT strategy that requires collaboration between all departments within the enterprise.



A major concern slowing down the adoption of IoT solutions relates to data security and privacy, and is due to the evolving landscape of cyber threats.



Supporting IoT initiatives requires investment not only in IoT solutions but also in the underlying infrastructure, such as IoT and analytics platforms, which need to be integrated into companies' IT systems. Our survey results show that a good number of companies are making steps in this direction.

PAC OPINION

PAC's view of the use of IoT in the transport industry is broadly aligned with the results of our survey, with a few exceptions that are discussed above. Our overall impression is that the maturity of adoption of IoT solutions is stronger than in other industries when the scale of IoT deployments is considered. Also, the industry's clear appetite to spend more on IoT and the fact that companies see IoT solutions as very important for their overall growth and strategy opens up plenty of opportunities for innovation. At the moment, larger companies are expected to invest and focus more on IoT as they have more complex operations and bigger challenges to address, while at the same time they have deeper pockets. The fact that there are no significant differences in adoption between different countries also points to a certain level of IoT maturity in Europe.

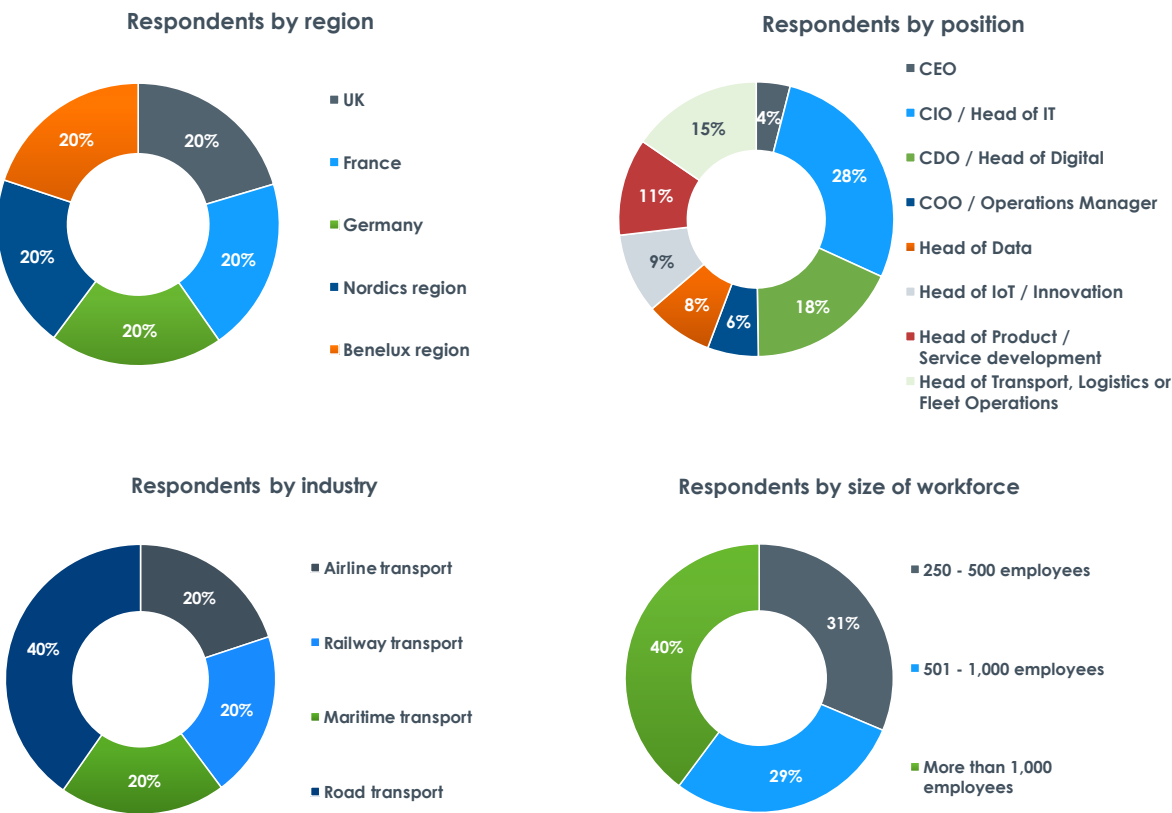
PAC expects that IoT deals in the short term will move beyond simply improving the efficiency of vehicles to enable greater efficiency of the workforce as well. The combined data from connected vehicles, connected employees, connected spaces (e.g. airports and stations) and external data such as weather data will enable transport companies to predict demand and optimize their internal operations accordingly. We also expect to see more innovation both on the sell side and the buy side of the IoT market. There are already some promising examples of innovation picking up, especially in collaboration with startups.

In the medium term, we expect to see the emergence of more customer-focused solutions that facilitate the collection of larger amounts of passenger data and potentially open doors to new types of revenues, either through infotainment-based in-vehicle solutions, or via new pricing models for passengers.

Finally, in the long term, we envisage a more radical transformation of the landscape in which transport companies could become technology providers to other transport players, even their competitors. This has happened before with general IT in the transport industry, but also with IoT applications in other industries. Still, the pace at which these developments take place in the transport sector will largely depend on the strategic vision of boardrooms as well as the ability of the vendor community to offer compelling and revolutionary value proposition. In summary, co-opetition will become a reality in IoT affecting both the buy side and the sell side of the market.

METHODOLOGY

This study is based on interviews with senior business and IT decision-makers with responsibility for driving innovation strategies at 200 medium and large European transport companies from the UK, France, Germany, the Nordics (Sweden, Denmark, Norway and Finland) and Benelux (Belgium and the Netherlands). The study was completed during the third quarter of 2017. Here is a more detailed breakdown of the participants in the study:



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PAC - CXP Group
15 Bowling Green Lane
EC1R 0BD London
United Kingdom

Phone: +44 207 251 2810
Fax: +44 207 490 7335

info-uk@pac-online.com
www.pac-online.com

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