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e x p e r i e n c e

Increasing the precision of network
CAPEX

Analysis by Tefficient

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Contents

1 Executive summary

Mobile operators continue to invest in their networks to stay competitive and to keep up with the growing demand for mobile data and customer expectations. Our analysis shows that a mobile operator in a mature market used, on average, **15%** of its mobile service revenue on mobile CAPEX in the first nine months of 2016.

The high level of investment means that CAPEX efficiency obviously is important in our industry. But it doesn't necessarily mean that "less is better". Used right, CAPEX has the potential to grow revenue and to reduce OPEX – and if it does, you don't want to save on it. But to get to that point – where outputs are greater than inputs – you will have to **transform the way you work**.

To understand how, we have interviewed industry thought leaders from **DNA**, **Telenor**, **Tele2** and **Omnitele**. The message is clear: Knowing exactly *where* to invest in the network is a critical starting point. The best performing operators know precisely what levels of quality improvements can be achieved with specific investments and what impact the quality will have on customer behaviour and this in turn on revenues and the bottom line.

Investment	→	Quality	→	Customer behaviour	→	Revenues

Operators who successfully link these four domains operate true "**value-driven networks**" – they can see already today what is around the corner tomorrow and act on it.

Many operators are still struggling to establish these links, though. This means that the **return of investment** within the industry varies a lot. We compared **45 mobile operators** on the long-term effects of CAPEX on both revenue and OPEX – and there are a few which have had much better return of investment than others.

The people we spoke to will give you the keys to **how to do it**.

2   Cut costs – or transform?

For a mobile operator competing in an advanced mature market, the network stands for, on average, 30% of an operator's net OPEX and more than 80% of CAPEX – or, added together, around **45%** of an operator's total annual cost.

With marketing & sales representing on average 35% and customer service 20% of overall costs[1], it is no surprise that operator management often looks at the network department first when cost cuts are on the agenda.

> The network stands for on average 30% of an operator's net OPEX and more than 80% of CAPEX

But here's the dilemma: **The network is the basis for the revenue generation** of an operator – without network coverage, without sufficient capacity and without sufficient quality customers can't use the megabytes, the texts or the minutes they pay for.

2016

NETWORK QUALITY	26%
COST & BILLING	40%
CUSTOMER CARE	24%
SERVICE & DEVICE PORTFOLIO	10%
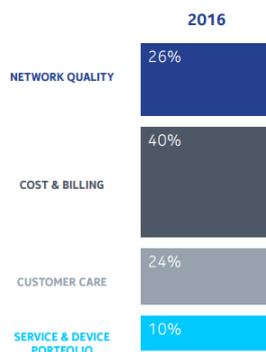
Network quality is, still today, a key driver of customer loyalty. In Nokia's acquisition and retention study of 2016[2] – with 20000 respondents in 14 key markets globally – network quality holds **26% of the retention impact**; see the image to the left.

In the US, it's as high as 34%. Japan has the lowest value in the study, but even there, network quality stands for 16% of the retention impact.

In mature markets, everyone who wants a mobile phone already has one (plus a few additional connected gadgets). This means that, in essence, there are no new customers out there. The key to success for any mobile operator is therefore its ability to keep its customers sufficiently satisfied for them to remain loyal and not to switch to competition.

In this picture, this conclusion in Nokia's study is important:

 "...dissatisfaction with network quality is closely linked with the likelihood to switch"

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[1] In these two cases almost exclusively OPEX

[2] https://pages.nokia.com/rs/677-JYK-041/images/Nokia-AR_Global_Summary_Report.pdf

In an **ultra-competitive network environment** where the quality of service of operators is constantly monitored and reported – by competitors, regulators, consumer organisations, magazines, third party consultants and apps like e.g. Ookla and OpenSignal – traditional cost cutting in network OPEX or CAPEX **risks the fragile perception of network quality**.

To complicate things further for mobile operators, Wi-Fi is today omnipresent in urban environments and approximately 80% of mobile customers carry devices which automatically move the connection to Wi-Fi. This behaviour makes the mobile network less used – and the mobile operator less relevant – for the customer.

At the same time customer expectations are growing while consumers can select services from a wide choice of providers. Constant access to communications is for many **important for the quality of life** – both private and business. Data usage is increasing fast, but the willingness to pay for it isn't.

We have summarised the conflicting drivers in Figure 1.

| ← Price erosion | Usage increasing → |
← Higher acquisition cost	Expectations increasing →
← Higher retention cost	Competition improving →
← Margin pressure	Public QoS benchmarks →
← Cash flow targets	QoS perception game →

Save on network   Spend on network
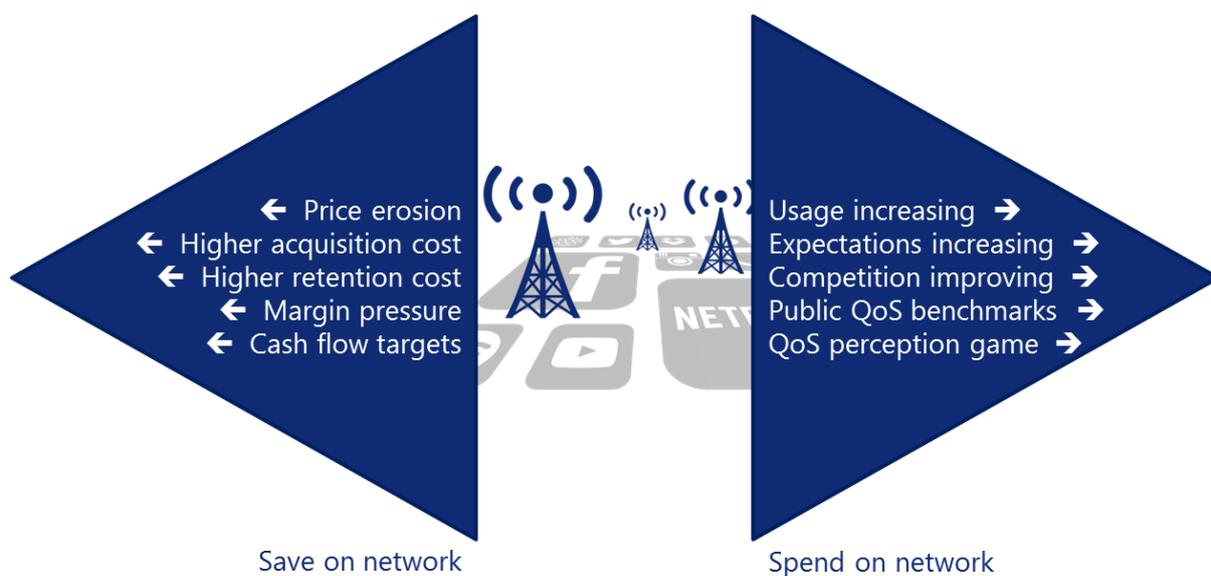
Figure 1. Conflicting drivers risk pulling the network apart

So, if cutting costs in the network isn't feasible, what should be done?

We say: **Transform**.

If you transform the way you work, you can **increase the precision** of your network CAPEX. This means you can meet customer expectations better while improving your return of investment (RoI). CAPEX savings of 20%+ are realistic.

But maybe you shouldn't actually cut the network CAPEX. With an improved RoI, you might actually want to use more, not less, on the network.

Regardless, it all starts with **setting precise QoS targets** – precise with regards to location, but also precise in the targeted performance level of each end-user service.

We will soon come back to the initiatives you need to take, but when you no longer build a best-effort network for an average customer – that doesn't exist anyhow – your **CAPEX precision** becomes much better.

Your customers will reward you for the precise and high quality with **higher service usage**. Reward? Yes, it's an indication of satisfaction with the quality of service you deliver when your customers use your services more.

High-usage customers are also **loyal** – if you don't unnecessarily set limits to their high-usage behaviour. And since a major cost item – typically 15-20% of service revenues – for a mature market operator is customer acquisition and retention, high customer loyalty leads to a **good margin** and your improved CAPEX precision leads to a good RoI.

Which, in turn, provides you with the financial means to define your QoS targets even better.

Let's now talk to three operators that have commenced their transformational journey – DNA, Telenor and Tele2.

3 Operator cases

You will find the full operator cases – with video interviews – published on http://www.omnitele.com during February 2017. Below is a summary of viewpoints about CAPEX precision and predictive analytics from DNA in Finland, Telenor Denmark and Tele2 Sweden.

3.1 DNA – forecasting for unlimited plans

By offering unlimited data with a fixed price, DNA in Finland has overcome a key customer concern about how mobile data is charged. Not only has the operator introduced unlimited data successfully but it has also accurately managed to predict future demand while operating its network efficiently.

When offering unlimited data, it is important to ensure that customers are efficiently using the capacity. Investments have a long-lasting impact. What we see today is the **consequence of the decisions DNA made already in 2010**.

How could DNA foresee this level of demand six years back? Often operators tend to make investments based on a "top down" approach. But DNA also applied a "bottom up" approach to future demand estimates, i.e. clearly identifying services that customers are using most today and are likely to use in future. DNA's focus is on the drivers for growth. The company estimates that in the next five years they will experience a ten-fold growth in data traffic, see Figure 2.
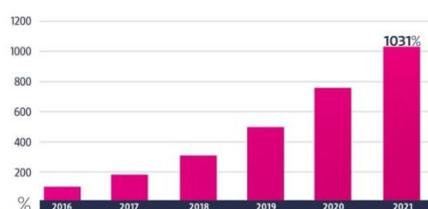
Figure 2. DNA's projection for growth in mobile data traffic until 2021[3]

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[3] http://yle.fi/uutiset/3-9366104

Based on its detailed knowledge of the customer, DNA can today make accurate forecasts on future demand. The company can see how the customer base is reacting and then measure the performance of the network overall and on cell level. Using predictive network analytics and customer experience data, DNA can accurately decide where in the network is best to invest.

If DNA hadn't made the necessary investments back in 2010, the market share and the revenue would not be on the level they are today. "DNA wants to be the best in customer satisfaction and in network planning. A big part of how we implemented our network strategy is by focusing on customer satisfaction", says Tommy Olenius, Senior Vice President, Technology, DNA.

3.2 Telenor – NPS defines network investment

Telenor Denmark has placed particular emphasis and effort into understanding what is needed to keep customers happy. This boils down to an overall NPS target that also breaks down into key segments. By focusing on the customer-driven NPS target, Telenor is also able to **avoid over-investing** in the network.

In 2013, Telenor decided to radically transform[4] its business in Denmark. As part of this transformation, Telenor would – with the help of partners – redesign and replace all business support systems in order to dispose of legacy systems and simplify the setup. A significant reason for this transformation was Telenor's goal to be **loved by the customer**. Telenor did some internal soul searching and evaluated how they should be interacting and doing business with the customers. Another key motivation behind the transformation was the integration of the entire radio network (2G, 3G, 4G) with Telia's – creating one common, shared, radio network. Through the network sharing, the number of accessible sites has roughly doubled for Telenor's customers.

Focusing on NPS has also helped Telenor prioritise network investments correctly. Had the operator followed its old, inside-out thinking to its upcoming rollout in 2017, it would have ended up with a far more distributed rollout than what is actually needed. Instead Telenor

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[4] https://www.telenor.com/media/articles/2014/denmark-in-the-media-spotlight/
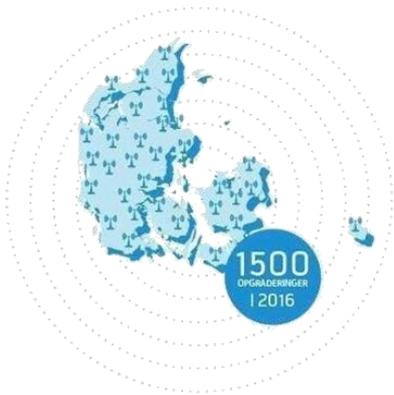
focused on investments into areas where customer feedback was negative and NPS below target. **The network was built for customers – not for the grid**.

A further example of how NPS provides better accuracy in network operations comes from "red flags" in customer feedback about half year ago. Telenor's NPS map over Denmark was quite red even though the technical KPIs were quite acceptable. There were many small problems. The engineering team drew its attention to the NPS and went through every detail to understand what were the root causes of dissatisfaction among customers. Several small issues were identified. These would have been disguised if attention would have been only on network KPIs.

Telenor fixed all of the small issues in the network and are now back to its normal green map. **NPS really helped the operator to stay sharp, identify the real problems and fix them**.

3.3   Tele2 – tops the charts in return on investment

In our CAPEX efficiency analysis (see Figure 7 on page 20), Tele2 Sweden leads the pack with the best return on investment among the 45 operators analysed. The company is a best practice when it comes to turning CAPEX to service revenue. We spoke to Tele2 to better understand what is behind their success and the precision of investing at the right time and in the right places of the network.

There is no doubt that Tele2's **company culture** is the cornerstone for the company's success and healthy return on investment. Tele2 is also one the first companies in the world to set up a **network sharing** joint venture (JV). "When we started rolling out the new 4G network in 2010, we set a clear vision of reaching 99% population coverage in the country while also improving on the voice coverage of 2G – a milestone we reached in early 2013. Our current target is to reach an area coverage of 90%. Our initial focus was primarily on building coverage but also on increasing capacity in areas where it was needed. Building a base area coverage is a necessity, so it makes great sense to have a joint venture where investments are shared", explains Elin Ovesson, Head of Network at Tele2 Sweden.

Tele2 also benefits from "**Shared Operations**" that has been in place for the past year and a half. This is done across the international footprint of the company. This basically enables Tele2 to use the right competences and knowledge across its entire international footprint.

Roshan Saldanha, CFO for Tele2 Sweden, also identifies another key enabler for Tele2's CAPEX efficiency, which is the use of **predictive data models and analysis**. The company has used predictive analytics and related tools for many years. "So when it comes to pointing out *where* we should invest, the decision has been made based on where the demand is. Our use of predictive analytics is another core strength." Elin highlights a recent example: "In 2015, when we launched bigger data buckets we saw a major difference before and after in traffic growth. It is not only old statistics that can point out what is happening tomorrow, you also have to take into consideration commercial activities and the changes to what you are offering to the market."

4 How to increase the precision?

These three cases highlighted some of the actions the operators took to improve the precision of their network investments in order to make their CAPEX go further, offer better quality of service, improve customer satisfaction and ultimately improve the bottom line. Inspired by their thinking, we have in the following section aimed to provide practical guidance on how to get the best out of predictive network analytics.

4.1 The starting point – avoiding the pitfalls

Mobile operators have traditionally excelled in infrastructure projects, i.e. rolling out new networks from 2G to 4G. And very typically their engineering organisation and network has been adjusted and optimised exactly for that process.

Moreover, network transformation objectives are often set unrealistically high and with emphasis on rollout. The operator buys into a "tool" first, but little changes in the way it uses the investment. Rather than thinking about "spend it or lose it", CTOs should think how to make best use of the CAPEX.

Once this initial rollout is completed, operators often face challenges in linking quality and capacity investment decisions to operator business targets and a real understanding of customer needs:

- Which **targets** are most critical for customer satisfaction?
- What improvements in the network would reduce **churn**?
- What are the **business outcomes** we are hoping for?
- **How to** calculate the business outcome vs investment and **prioritise** the investment accordingly?

It is therefore critical to agree on **a common language** for target setting between the CTO's, CMO's and CFO's respective teams. In practice, this means moving away from "best effort" to clearly understanding what is the exact impact of the CAPEX injection and then planning the investments accordingly.

The agreed targets for network investment can be churn related, the need to "harmonise" Quality of Service (e.g. due to heavy use of Netflix HD), a revenue or cost related target, or

derived from customer experience objectives like NPS.

Moreover, we should stop settling for "average quality" – especially when customer experience is the primary target. Operators need to understand **the right distribution**, i.e. which targets (KPIs) have the most impact to customer satisfaction and in which areas of the network. Predictive analytics studies, conducted by Omnitele, show that the appropriate quality range (meaningful for customer satisfaction and customer loyalty) is, in reality, far below the average quality range. Figure 3 shows a network with an average user data rate of 30 Mbit/s. The risk of customers churning is only increasing above the average when the user data rate drops below the 5-10 Mbit/s range.

**Quality impact on churn**
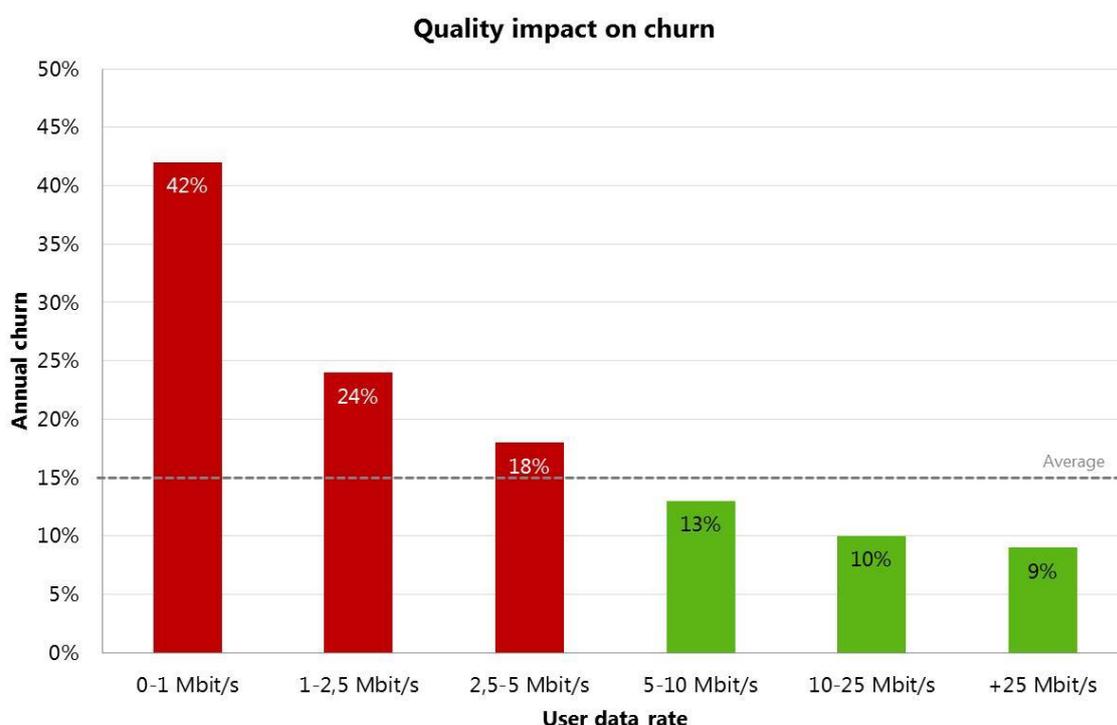
Figure 3. Correlation between user data rate and churn

To achieve consistent quality, the operator should optimise the network and prioritise locations and sites where the customer experience is particularly low. For example, what is the Netflix experience translated to technical KPIs, how churn-prone are customers to specific quality levels and so forth. Avoiding average quality is equally relevant to shunning "over-quality".

Operators often understand and apply analytics in the context of marketing & sales, but are less nimble in using analytics when it comes to network design. Operators spend years in collecting a lot of data from the network and the subscriber, and often without leading into action in network design or capacity optimisation. We want to help customers find the missing link between network analytics and network design.

4.2   Why predictive network analytics?

Before making an investment decision a modern operator should apply predictive analytics to find out what is behind the corner in the next 6 to 12 months' time. To understand what is behind the corner, it needs to set targets that have the most meaningful impact on the bottom line. There's no mystery about target setting – this is normal practice for operators. That's not the problem – but they need to **link to departmental sub-targets**.

To do this we need to first link investment and quality; see picture below. Then link quality improvement and customer behaviour such as usage and churn. When we know the impact on behaviour, we can calculate the financial impact. When links between investment, quality, customer behaviour and revenue have been well defined, operators are investing wisely and with clear foresight into **value-driven networks**.

Investment → Quality → Customer behaviour → Revenues
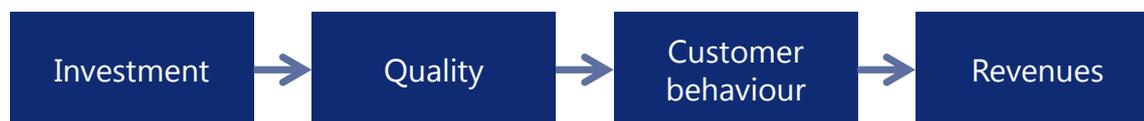
**Esa Vesterinen,
Vice President Sales and
Marketing, Omnitele**

"Operators need to move away from best effort to setting the right targets that can be translated to practical network design. And then start using predictive analytics to choose the best action.

*Think of yourself as the driver in a rally race, someone is sitting beside you and **helping you to see what is around the corner**. Working with Omnitele, you are still firmly behind the steering wheel but we help you identify and analyse the right action, just as the **CoDriver** does alongside the driver in a rally race".*

Many operators make use of forecasts, but traditionally this has meant they make a trend analysis on how technical (traffic based KPIs) evolve. This gives operators a lead time to add capacity prior to the technical KPIs triggers. But technical KPIs measure the network utilisation, not the customer experience.

By using predictive network analytics, operators know ahead of time what they get once the investment is completed – they evaluate the most impactful action before they take it. This will become the norm in network planning in three to four years' time in a similar way as customer experience management is today.

Predictive network analytics leads to impressive results. Based on Omnitele's experience, the typical savings are 20%+ improvement in CAPEX efficiency and 40%+ improvement on return on incremental investment. Operators can decide if they want to save or do more with the money they spend.

> Predictive analytics can improve CAPEX efficiency by 20%+ and RoI by 40%+

4.3   How does it work in practice?

The individual stakeholders within an operator company – e.g. technical, marketing, finance and customer services departments – often have differing targets and sometimes also contradicting expectations when it comes to future investments. Realistically none of these targets can be considered until they can be verified as achievable – within the framework of network CAPEX decisions.

Operators need predictive network analytics in order to truly evaluate and prioritise different targets and their impact to the network, quality of services, customer behaviour and revenue. But how do you put it into practice?

Rauno Huoviala, Principal Consultant at Omnitele, presents how predictive analytics can work in practice, see Figure 4.

4.3.1 Objectives

Stakeholders might have differing targets and expectations. A business manager might consider it is most important that all customers can watch Netflix with HD resolution at all times. While another stakeholder aims to reduce the churn rate considerably, and so forth.

The network is a vital part of customer experience but focusing on network KPIs, on its own, can't deliver everything that is needed to meet the types of targets described above. Let's take a closer look at the targets "reducing total churn rate to 12%" and "offering Netflix HD to all customers". The only way for the CTO to commit to the common target is to provide him/her with answers to the following questions:

- How much of the target is driven by the network quality?
- How much impact can the CTO have on network quality and through this on reducing the churn rate?
- What technical solutions are required to achieve this?
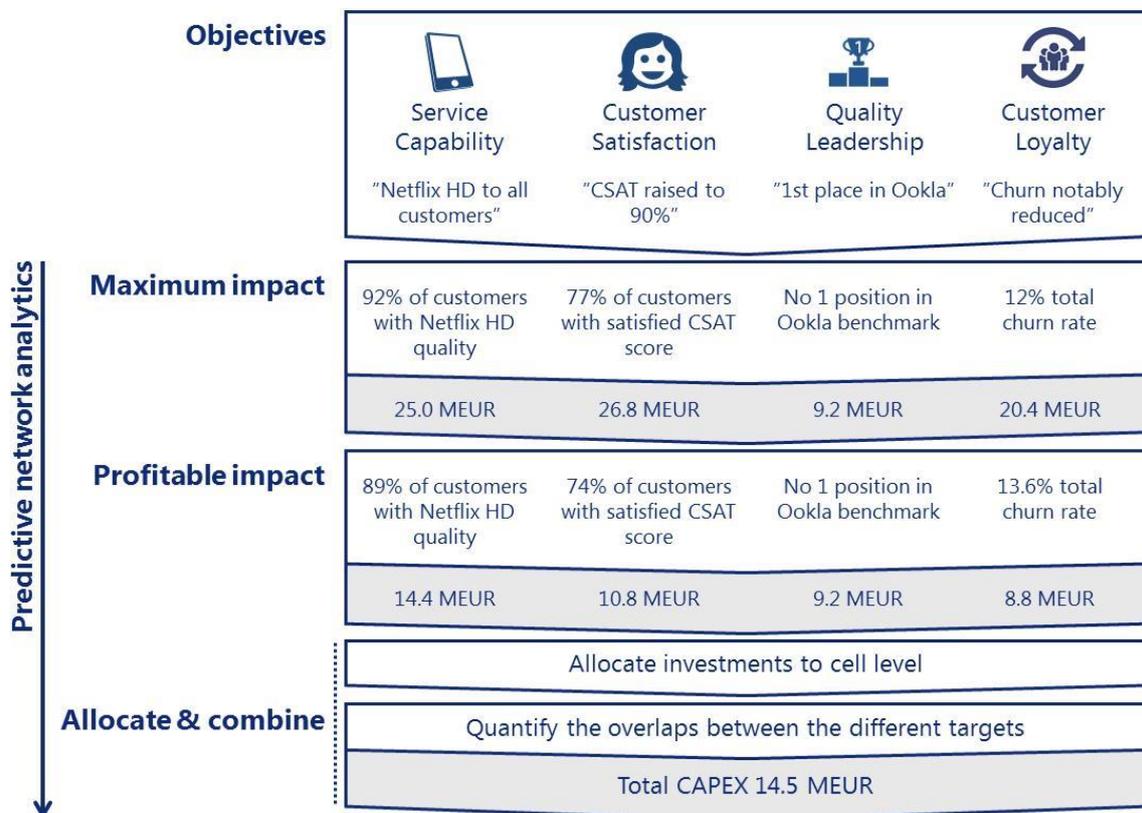
Figure 4. Predictive network analytics in practice – step by step (numbers are examples only)

4.3.2 Maximum impact

Following the logic of predictive network analytics, the first step is to calculate the **maximum impact on the target achieved through network actions**. For the Netflix HD target, this calculation gives a maximum impact of 92% (i.e. not "to all", but not far from) at 25.0 MEUR in CAPEX. For churn, however, the maximum impact is "only" a reduction from current 16% to 12% churn. This means that 75% of the churn is due to other reasons beyond the control of the network. Nevertheless, a four-percentage points reduction to churn would be phenomenal.

4.3.3 Profitable impact

Based on initial calculations, the resulting CAPEX requirement is likely to be too high compared to the impact and the CTO will therefore use predictive analytics to **determine the profitable level i.e. a level where the business benefit is acceptable compared to the required CAPEX**. In our example, the CTO finds out that offering Netflix HD to 89%, instead of the maximum 92%, to customers is more realistic and requires only around half the CAPEX at 14.4 MEUR.

4.3.4 Allocate & combine

Once the realistic target setting is confirmed, the next step is to **determine the required investment of each target on each cell in the network**. It is then necessary to also quantify the overlaps between the different targets. Network actions to improve the experience of Netflix will, for example, at the same time reduce churn. This often results in a reduction of total CAPEX: the total for the four targets separately would be 43.2 MEUR but with the **overlaps calculated and eliminated**, the total CAPEX requirement is 14.5 MEUR. The CTO's team can then define the **precise and combined allocation for network expansion** to meet all the targets.

4.3.5 In summary

Having gone through all the steps in Figure 4, the ***value impact* of the network investment is predicted**, so that the set targets are both realistic and tangible – and also requirements for achieving those targets is known.

All of the steps above can be achieved by using existing operator data and tools. There is no necessity for long and elaborate "big data" projects with often uncertain returns (although it can and should run on top of big data systems, if such exist). Predictive network analytics is not taxing in time – first phase results can be delivered normally within weeks. And the overall capability and methodology can also be integrated into an operator's processes and systems, so that further results can be analysed in a matter of minutes.

5 Return on investment

The best performing operators know precisely what levels of quality improvements can be achieved with specific investments and what impact the quality will have on customer behaviour and this in turn on revenue and profit. The earlier case examples highlighted how the actions the operators took to improve the precision of their network investments made their CAPEX work better for them.

We'd like to conclude by comparing the return on investment (RoI) of mobile operators – using their reported data. This will identify some best practices as well.

5.1 CAPEX to service revenue isn't RoI

While many industry analysts calculate and compare the last quarter's **CAPEX to revenue** ratio of operators, we don't think it's a good indication of return on investment. Since CAPEX doesn't have an immediate – but a longer-term – return we think that this KPI just leads to wrong thinking.

We'll therefore introduce a better way to look at RoI. But first we need to understand the current CAPEX levels better and with this aim we have calculated the "CAPEX to *service*[5] revenue" for 45 mobile operators in mature markets.

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[5] Some operators earn up to 50% of revenue from selling mobile equipment for which no CAPEX is required. By not excluding equipment revenue would give the impression that CAPEX levels are lower than what they are. In this analysis we have therefore not included operators for which equipment revenue can't be excluded.

*) Including small fixed business
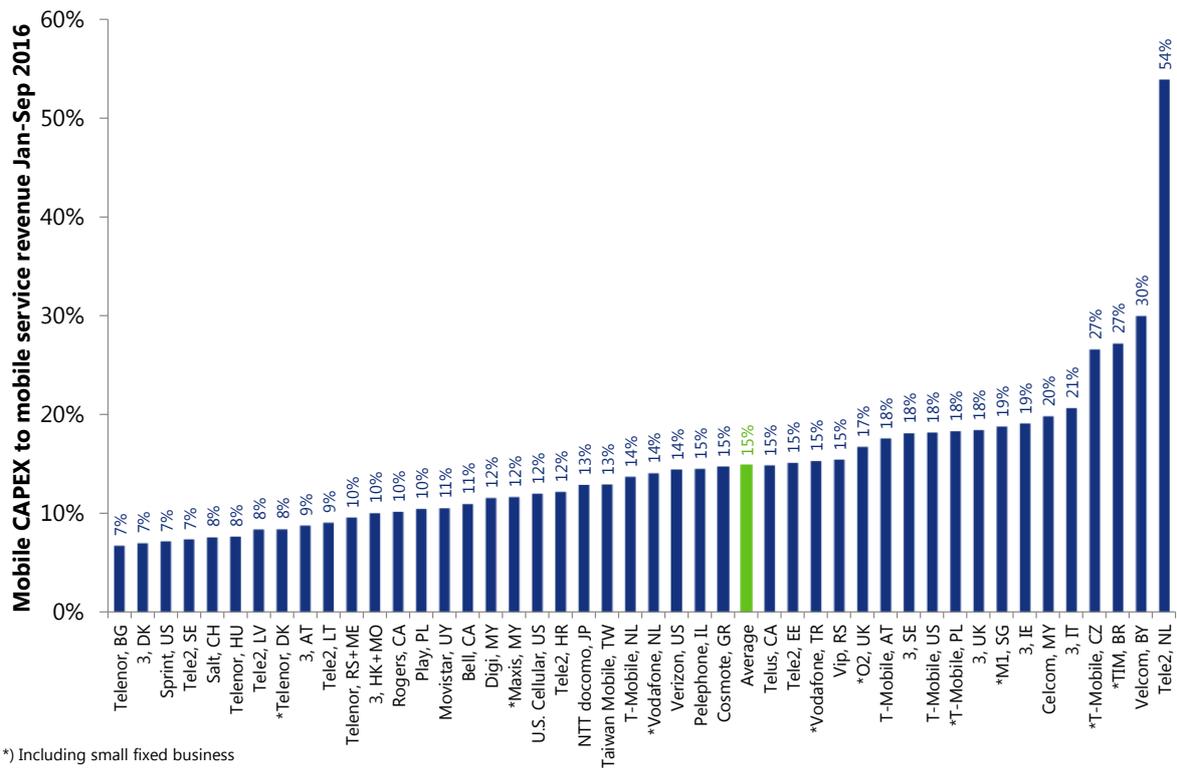
Figure 5. CAPEX to service revenue for 45 mature market operators Jan-Sep 2016[6]

Four operators – Telenor Bulgaria, 3 Denmark, Sprint USA and Tele2 Sweden – all had a very low 7% CAPEX to service revenue ratio in the first nine months of 2016. Tele2 in the Netherlands had the highest ratio, 54%, as the MNO entrant continued to roll out its 4G-only network while gradually increasing customer base and service revenue.

The average operator had a CAPEX to service revenue ratio of **15%** in January-September 2016.

The average operator had a CAPEX to service revenue ratio of 15% in January-September 2016

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[6] Or, if not reported, for the six-month period reported (either Jan-Jun or Apr-Sep)

5.2 The CAPEX efficiency matrix shows RoI

We now know how much the average operator spends on CAPEX – 15% of service revenue. But we don't know what the return on that is. To compare the return on investment, we have to widen our time horizon and look at **the effect of the cumulative CAPEX on the business of today**.

Used right, CAPEX has the long-term potential to **grow revenue**, but also to **reduce OPEX**. The revenue growth could come from growth in customer numbers, but also from monetisation of increased usage. The OPEX reduction could come from a decreased customer churn but also from process transformations such as automation of manual, repetitive, tasks.

Therefore, we have in this analysis chosen to look at return on investment as in Figure 6:
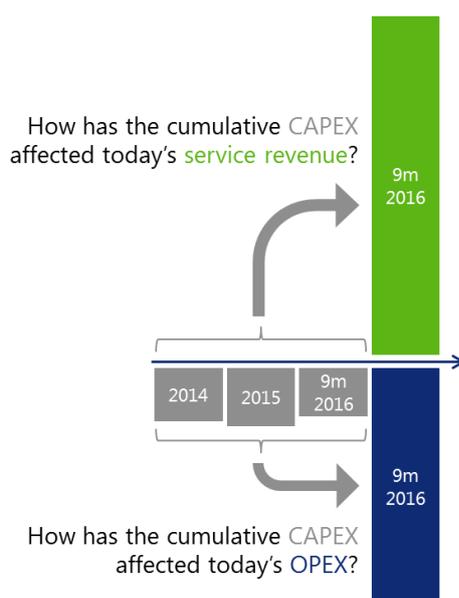
Figure 6. RoI definition used in this analysis

CAPEX – used in the past three years – should ideally have resulted in high service revenue and low OPEX today.

Our selection criteria[7] leave us with 45 operators[8]:
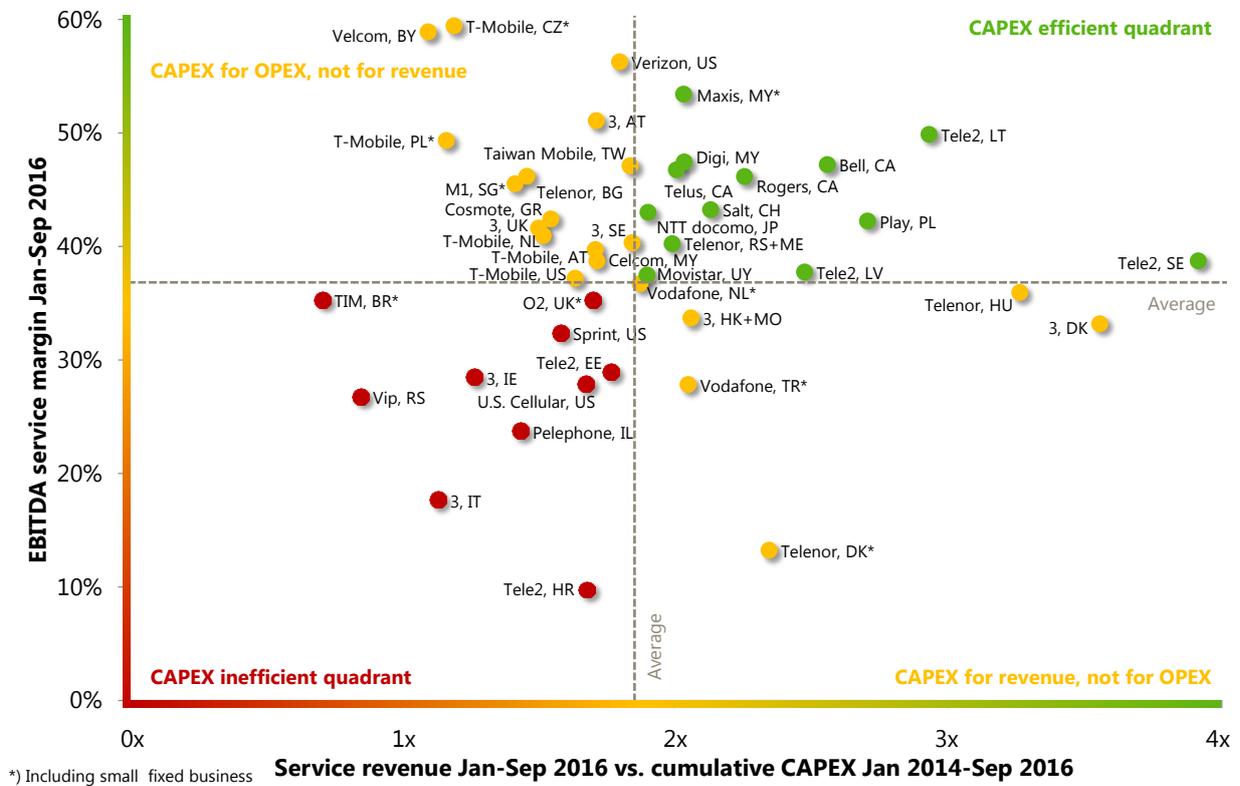
Figure 7. The CAPEX efficiency matrix

The two Average lines give us four quadrants in Figure 7. Let's look closer into the **CAPEX efficient quadrant** since it contains the operators that have higher than average current service revenue in

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comparison to historical CAPEX – and, at the same time, higher than average EBITDA in comparison to service revenue.

Identifying a single reason to why these operators end up in this quadrant proves difficult, though:

	In small country	In multi-national group	In country with 3 MNOs	Market leader	Active network sharing
Tele2, Sweden	✓	✓			✓
Tele2, Lithuania	✓	✓	✓	✓	
Tele2, Latvia	✓	✓	✓		
Bell, Canada			✓[9]		✓
Rogers, Canada			✓[5]	✓[5]	
Telus, Canada			✓[5]		✓
Telenor, Serbia/Montenegro	✓	✓	✓		
Digi, Malaysia		✓[10]		✓[11]	
Maxis, Malaysia					✓
Movistar, Uruguay	✓	✓	✓		
NTT docomo, Japan			✓	✓	
Salt, Switzerland	✓		✓		
Play, Poland					

Table 1. Categorisation of the operators in the CAPEX efficient quadrant

It seems to help to be based in a small country, belong to a multi-national operator group and not have more than two competing MNOs in the same market. Perhaps counter-intuitively, market leadership isn't an obvious key to leading CAPEX efficiency; number 2 MNOs are more often represented in this group.

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[9] The three largest operators Rogers, Telus and Bell are dominating the Canadian market and are almost equally large

[10] 49% Telenor owned

[11] The three largest operators Digi, Maxis and Celcom are very similar in size

Of our 45 operators in Figure 7, Tele2 Sweden is a best practice when it comes to turning CAPEX to service revenue. Also, Telenor Denmark – which is in the process of "radically transforming its business" – has turned CAPEX to service revenue better than the average operator. DNA isn't in Figure 7 since it doesn't report mobile-only figures.

But let's show why it still made perfect sense that we spoke to DNA.

5.3 The Finnish data usage vs. CAPEX paradox

In most markets, mobile data is charged on volume – per gigabyte – and it's perhaps also the explanation to why many operators and analysts believe that network CAPEX also has to increase when data usage increases.

If this was the case, Finnish operators would have been bankrupt. In reality, their business results are stronger than ever before.

Figure 8 is based on Tefficient's latest analysis of mobile data usage[12] and shows that Finland has an **unprecedented usage level** in the world: With 7.2 GB per any SIM[13] and month in the first half of 2016, Finland is almost doubling the usage level of South Korea (ranked second) – one of the mobile powerhouses of the world.

> Finland has an unprecedented usage level in the world: 7.2 GB per any SIM[13] and month in 1H 2016

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[12] http://tefficient.com/unlimited-pushes-data-usage-to-new-heights/

[13] Any SIM, including M2M SIMs
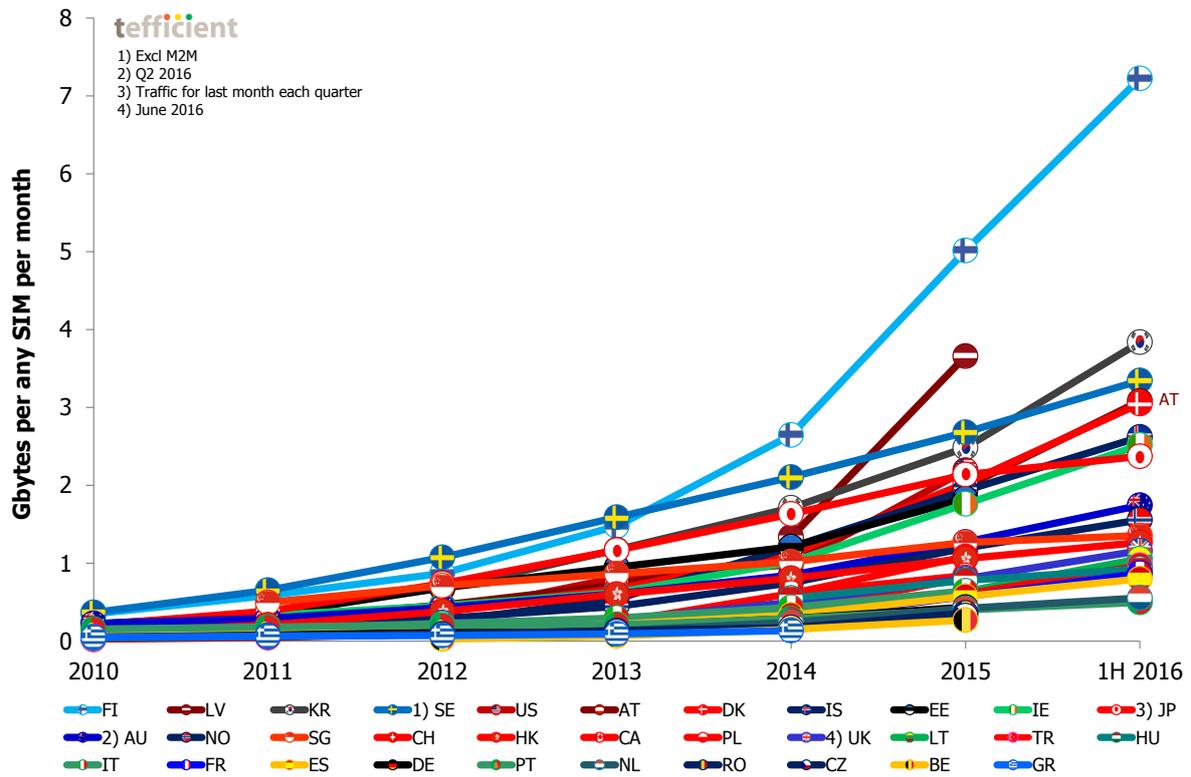
Figure 8. Data usage development 2010 to first half 2016

The usage continues to grow quickly even though the usage is already high: The total traffic in Finland grew 75% between the first half of 2015 and the first half of 2016. This traffic increase had no effect on the Finnish ARPU that remained at a level of 15 EUR.

But if **more for the same** was true for Finnish mobile data users, it was also true for the two Finnish operators that report their CAPEX – Elisa and DNA. Both of them have had more or less constant integrated CAPEX[14] even though they both have acquired and consolidated other companies in the period, see Figure 9.

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[14] Mobile CAPEX isn't reported
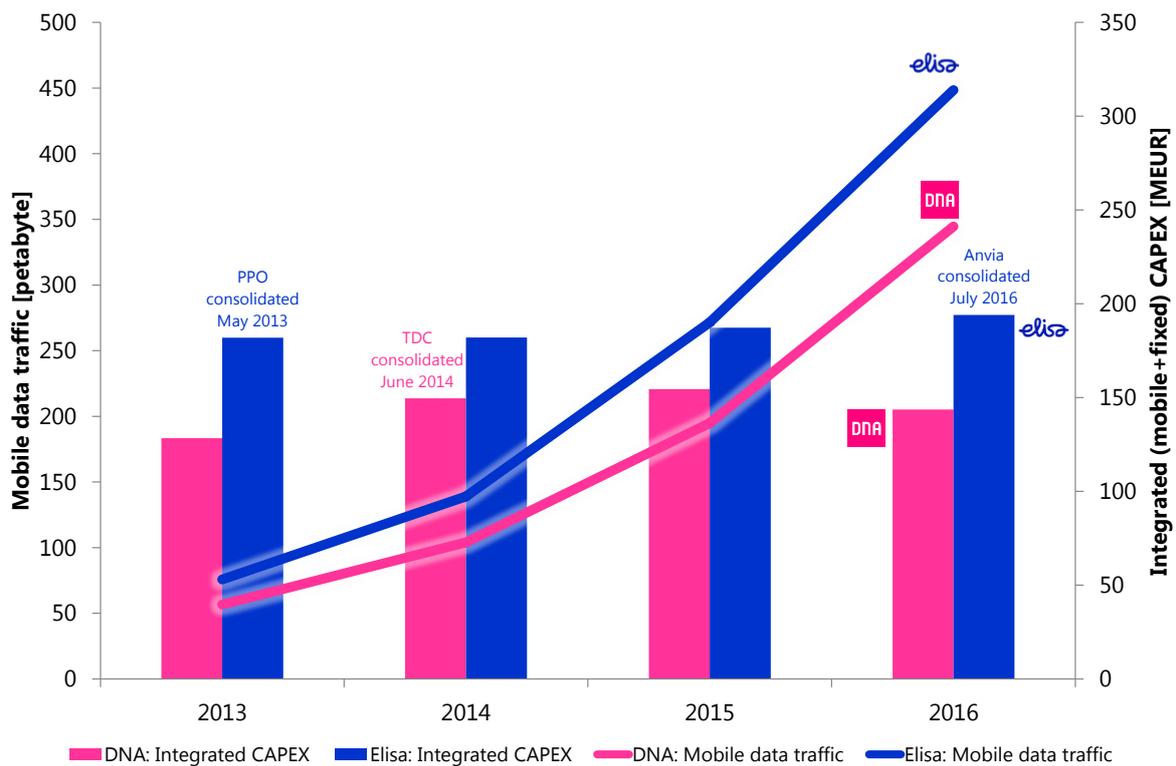
Figure 9. Mobile data traffic (lines) vs. integrated CAPEX (bars) of the two reporting Finnish operators

In stark contrast to the flat CAPEX, the mobile data traffic of both Elisa and DNA was **6 times** higher in 2016 than in 2013. Exponentially growing data usage and flat CAPEX must mean that the CAPEX efficiency has developed very positively.

Is this then a Finnish paradox? Is the rest of the world following another logic?

No. To show that the CAPEX required to deal with additional mobile data traffic indeed is coming down also outside of Finland, we have calculated the **CAPEX per incremental petabyte** for the operators that have reported mobile data traffic and CAPEX on a quarterly basis[15] since 2014, see Figure 10.

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[15] Telenor Denmark doesn't report mobile data traffic, but the Danish regulator does every half year. For each half year we have assumed the distribution between the two quarters.
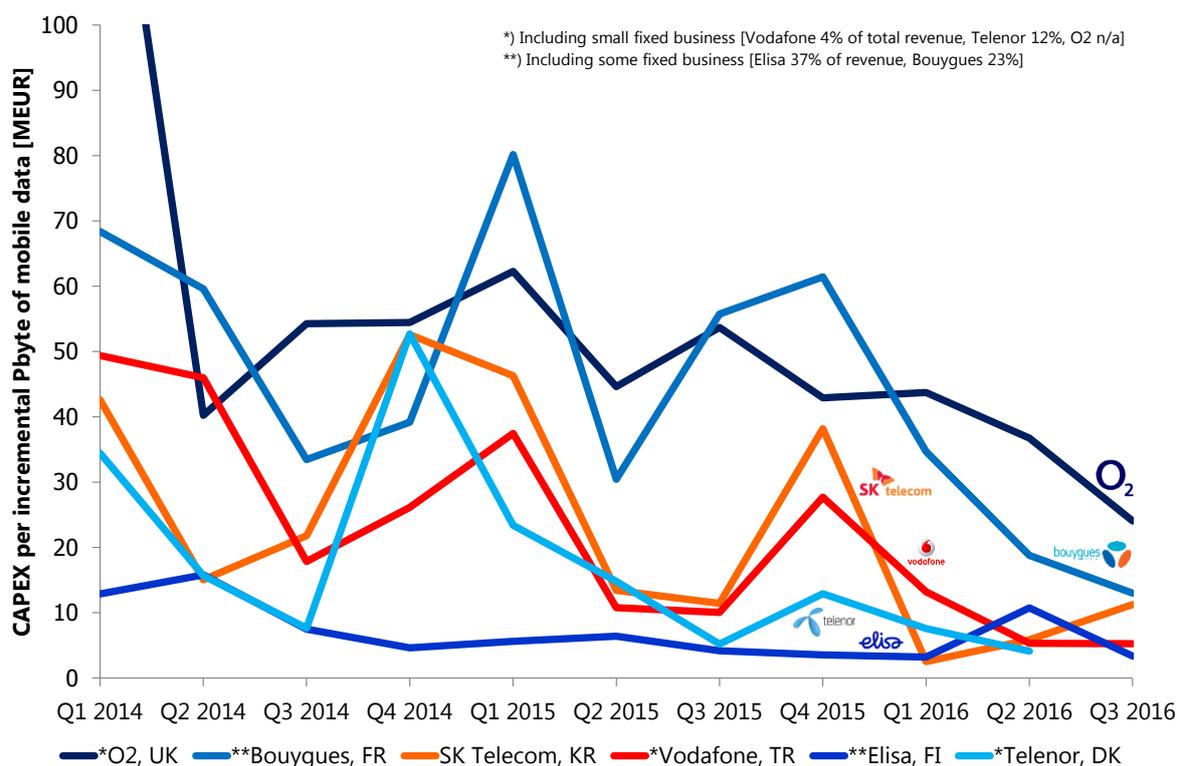
Figure 10. CAPEX per incremental petabyte of mobile data

Among our six operators, Elisa has historically got an additional petabyte for the lowest CAPEX, but it's interesting to see how quickly SK Telecom, Vodafone Turkey and Telenor Denmark have come down to Elisa's level. Also, operators with a historically-high CAPEX per incremental petabyte – O2 UK and Bouygues – seem capable of quickly reducing it.

An additional petabyte of mobile data has never cost operators as little CAPEX as it does today. And since the improvement in CAPEX efficiency seems to continue, the fear that high mobile data usage would put operators at risk is unfounded.

The fear that high mobile data usage would put operators at risk is unfounded

5.4 Increased precision, better RoI

By using operator reported data and visualising it in our CAPEX efficiency matrix we have showed that different mobile operators have very different return on investment. We have also showed that a significant growth in mobile data traffic today is possible without a significant expansion of the CAPEX.

But it doesn't happen by itself. *Precision* is the keyword. It starts with setting precise QoS targets and knowing the link to CAPEX.

When the QoS and CAPEX precision are increased, your customers will use your services more. That's why it's important that the cost for an additional petabyte is developing favourably. If so, higher usage is not a problem, but an opportunity – it's actually an indication of satisfaction. High-usage customers are loyal – if you don't restrain them. And high customer loyalty leads to a good margin. And a good return of investment. Full circle.

6 Conclusions

Our analysis shows that mobile operators continue to invest in their networks in order to remain competitive and meet the increasing demand for mobile data and customer expectation. But it also shows a very significant spread in the outcome: some operators have had better return on their investments than others.

By **transforming the way they work** – embracing an outside-in approach and by setting precise, customer-centric targets which are used in all departments (networks, finance, sales & marketing) – these operators have been able to **increase the precision of their network CAPEX** and obtain better returns. Suddenly high service usage is not a problem but an indication of customer satisfaction and a good prediction of customer loyalty. And with an average 15-20% of service revenues used on customer acquisition and retention, customer loyalty is a key to improve business results.

Big data is still today a promise-ware and many operators have fallen into the trap of gathering rather than using data. But by **linking network analytics and network design** operators can put data into action. As our case examples show, starting small and from one aspect (e.g. customer experience management) provides results faster. When these first results are good, you can widen the use. And when you take the step from backwards-looking to **predictive network analytics**, you can start to see around the corner – like a co-driver in a rally race.

You have now reached a state where you know exactly which quality a certain investment gives. Having established that link, you can calculate how this will affect the customer behaviour. And once you know that, you can calculate the financial impact. You operate true "**value-driven networks**".

| Investment | → | Quality | → | Customer behaviour | → | Revenues |
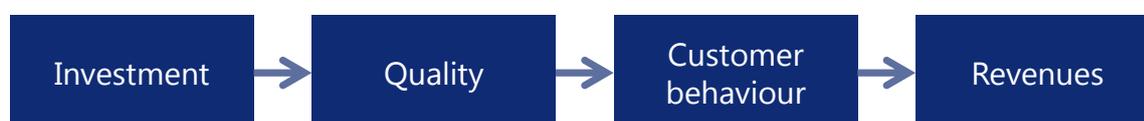
Our interviews with executives and thought leaders in **DNA**, **Telenor**, **Tele2** and **Omnitele** show that it can be done. But rest assured they are not satisfied yet. As Michael Jul Jensen of Telenor puts it:

"We are far from being done."

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experience

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We provide consulting and expert services for telecom operators and regulators in network strategy, design and quality assurance. Our mission is to maximise mobile subscriber quality of experience and minimise operator network expenditures.

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