Business Innovation Observatory

Customer Experience

Predictive analytics

Case study 34

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1. Executive summary

Predictive analytics **reviews data patterns** in order extract valuable information and to provide predictive information, such as **forecasts or classifications**. By applying sophisticated analytical techniques to historical and real-time data, predictive analytics converts statistical uncertainty into usable probability for **providing insights into future trends or behaviours**. Ultimately, the approach can be used to offer more timely, targeted products, services and customer support to customers.

Predictive analytics today no longer supports only **banking and financial services**. It is also applied to a range of other sectors, including telecommunications and IT, healthcare, government, transportation and logistics, or consumer goods and retail. In these sectors, predictive analytics fulfils inter alia functions in **marketing** (e.g. predictive advertisement targeting or customer retention with churn modelling) and **risk management** (e.g. credit scoring, fraud detection, insurance and mortgage underwriting, or the development of new pharmaceuticals).

Predictive analytics aims to forecast the future with the help of historical and real-time data

Source: Cover of Eric Siegel's book Predictive Analytics[1]

Predictive analytics enables companies to uncover and exploit patterns in historical data in order to **identify both risks and opportunities** ahead. It allows companies to use data to **sharpen their business performance** by differentiating their offerings, uncovering new opportunities and minimising their risk exposure. Predictive analytics thus has the potential to **reshape** the way marketing is carried

out, as it opens up an entirely new way of interacting and engaging with the customer.

A number of drivers have been facilitating the growth of the trend. For instance, predictive analytics responds to the **increasing demand for tackling big data challenges**. The deployment of cloud solutions by companies, which were initially deterred by high costs, moreover opens new customer segments. Additionally, the growing need for predictive analytics in **emerging economies** is another driver for the trend.

On the other hand, the trend still faces a number of barriers. It faces difficulties in finding **"early adopters"** for its sophisticated predictive analytics technology. Further is it hindered by an insufficient access to finance before the **proof of market** phase, in particular the lack of **"smart money"** (funding including know-how & networking). Further, predictive analytics needs to **strike a balance** between using customer data to anticipate future needs and protecting the privacy rights of customers. The trend also suffers from a **shortage of qualified experts** in the field, made worse by declining research budgets in Europe that encourage a brain drain to the US.

In order to overcome those obstacles, this case study provides a number of policy recommendations. For instance, the EU Commission could **simplify the use of EU funds** by selecting beneficiaries based on strategic considerations and providing them with greater freedom to determine their focus areas. Policy makers could further **reduce the administrative burden** by creating alternative reporting on projects, e.g. by allowing the submission of marketing material or software documentation. Finally, they could **enhance collaboration** by supporting the creation of technology hubs that strengthen the links between SMEs and larger corporation.

2. Predictive analytics

Predictive analytics **converts arrays of variables into statistical or visual models in order to provide predictive information**. Although it may not be able to predict future events with full certainty, the exploitation of online data facilitates the digital profiling of customers by projecting their future behaviour and needs. This enables companies to offer targeted products or services in real-time, along with timely customer support.

Having been applied until the 1990s primarily in controlled laboratory conditions, the use of complex predictive analytics algorithms is since then **increasingly being transferred to the business world**. Apart from application areas in marketing or financial services, predictive analytics can for example also be used for fraud detection in the field of insurance or drug development in the pharmaceutical sector.

Across these sectors, predictive analytics can support a variety of functions, including:

- **Marketing**, e.g. targeted direct marketing, predictive advertisement targeting, customer retention with churn modelling, or political campaigning with voter persuasion modelling;
- **Risk management**, e.g. credit scoring, fraud detection, insurance and mortgage underwriting, clinical decision support systems or the development of new pharmaceuticals; and
- **Personalised services**, e.g. guided studying for targeted learning or movie recommendations.

As businesses are complementing their physical stores with an online presence, they are benefitting from the flexibility the internet provides in targeting customers. This flexibility is facilitated by masses of data generated by customers via their online activity. These data, commonly referred to as **"big data"**, are characterised by their high volume, velocity and variety, which prevents storage, processing and analysis by traditional means.

Companies are becoming increasingly aware of the economic potential resulting from the capture and analysis of big data and are trying to take advantage of this trend by channelling these data into valuable and actionable information. While traditional analytical tools, that comprise basic business intelligence (BI), examine historical data to review "what happened", predictive analytics uses the same data to forecast "what happens next" (Figure 1).

Figure 1: Difference between Business Intelligence and Predictive Analytics
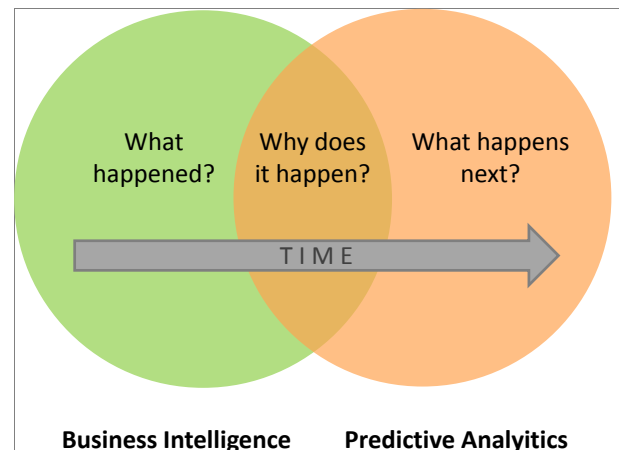

Source: PwC Analysis

Thereby, predictive analytics applies ever increasing processing power and new methods of data analysis, which represents a step forward from traditional business intelligence.

The aim of predictive analytics is to **"profile" individuals** in an accurate, timely and relatively low cost manner. By doing so, predictive analytics can provide companies with the competitive advantage of predicting their behaviour patterns and future needs (Figure 2).

Figure 2: Increasing complexity and added value from predictive analytics
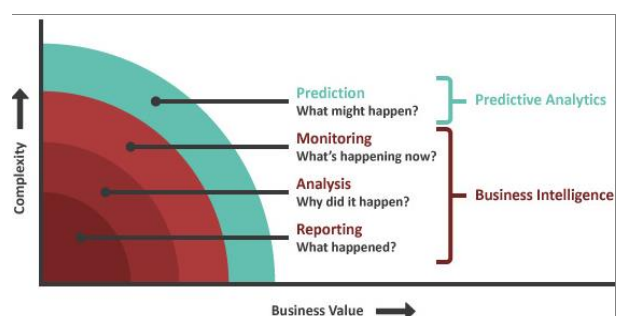
Source: Dunn Solutions Group, Predictive Analytics [2]

Yet in spite of these clear benefits, the **practical application** of predictive analytics took some time to leave the academic ivory tower and enter the business world. This time lag has been attributed to the fact that predictive analytics originally requiring teams of experienced statisticians; however, new, user-friendly tools, combined with data visualisation technologies, have made predictive modelling more accessible to the average business user.

Once integrated into business operations, an application of predictive analytics could take a four-step approach:

1) **Establishing objectives**, developing a hypothesis and identifying the data required;
2) **Collecting good quality data**, e.g. by combining enterprise and social media data, and including other sources, e.g. website comments, emails, tweets, etc.
3) **Understanding behaviour and intent** across different channels and platforms, in conjunction with organisational wisdom; and
4) **Predicting action** to make the right offer at the right time and in the right way, evaluating and adjusting as required.[3]

Key global players have started to heavily invest in the trend. For instance, in 2014, IBM announced an investment of EUR 750 million – equivalent to around 10% of their annual revenues – into the IBM Watson Group for Analytics and Big Data.[4] Similarly, Google Ventures aims to invest EUR 750 million over the next five years into different fields and has highlighted big data and predictive analytics as a target area.[5]

This case study will focus on **European small and medium-sized enterprises** (SMEs) and will investigate which innovative approaches they are developing and how they are tackling the challenges they face during the early phases of their establishment.

3. Socio-Economic Relevance

3.1. The benefits of predictive analytics

Predictive analytics is a rapidly growing field that is quickly expanding both its range of possible applications as well as its customer base. It builds upon the **mega trend of "big data"**, as companies are increasingly embracing the massive growth of data as a fourth factor of production, alongside capital, people and materials (Figure 3).

Figure 3: Worldwide data growth
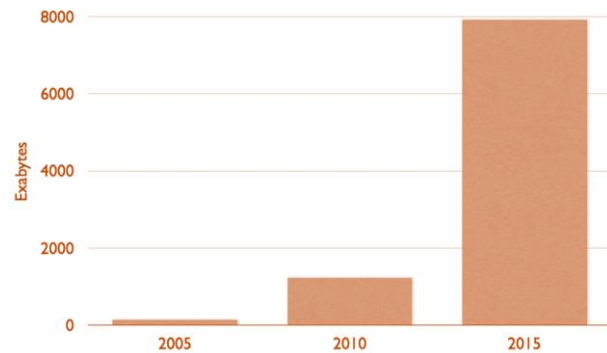
Source: Forbes, How Forrester's Former CMO Is Using Big Data To Build Next Generation CRM [6]

As predictive analytics encompasses a wide array of applications, the enterprises in this case study have

"While Big Data is an IT driven business, predictive analytics remains a consultancy business for extracting data and making predictive models". – Viscovery

developed new and innovative products to support their targeted customers' need. Companies learn to uncover and exploit patterns in historical data in order to identify both risks and opportunities ahead. For instance, pharmaceutical companies are now using predictive models to explore, visualise, understand, predict and correct the actions of drugs in human cells. Similarly, and in order to implement a targeted retention campaign, predictive analytics software is

being used to identify which customers are interested in competitors' products and why.

Other enterprises use predictive analytics to improve their marketing and profile customers to identify those which are of the greatest value. While in the banking sector, the technique opens up new business opportunities for conducting credit rating assessment on a broader and more realistic base of data, instead of relying only on traditional methods of often limited significance.

A recent AgilOne Survey showed that **European retailers** are not using predictive analytics as much as their US counterparts but are significantly more advanced in their application of the technique. Most US-based retailers are only using predictive models for email, whereas around 50% of European companies are also using predictive models for direct mail and call centres. Yet Europe trails the US in its setting up of central customer data warehouses for storing current and historical data; as only a third of European retailers have done this, compared with half of all US retailers.[7]

3.2. The market potential of predictive analytics

The World Economic Forum's Global Agenda Council on Emerging Technologies has identified predictive analytics as **one of the 10 key trends in technological change**.[8] Indeed, the business application of predictive analytics has the potential of reshaping the way of doing marketing, as it opens up an **entire new way of interacting and engaging with the customer**. However, this lucrative market has yet to realise its full potential.

Major factors driving the growth of predictive analytics are the:

- increasing demand for tackling big data challenges;
- deployment of cloud solutions by customers that were initially refraining due to high costs; and
- growing need for predictive analytics in emerging economies.[9]

According to a recent Research and Markets study, the global advanced analytics market – that covers predictive analytics, statistics and descriptive data mining – is expected to grow from EUR 5.2 billion in 2014 to **EUR 21.7 billion in 2019**. This represents a Compound Annual Growth Rate (CAGR) of 33.2% from 2014 to 2019 (Figure 4).[10]

Figure 4: Global advanced analytics market growth (in billion EUR)
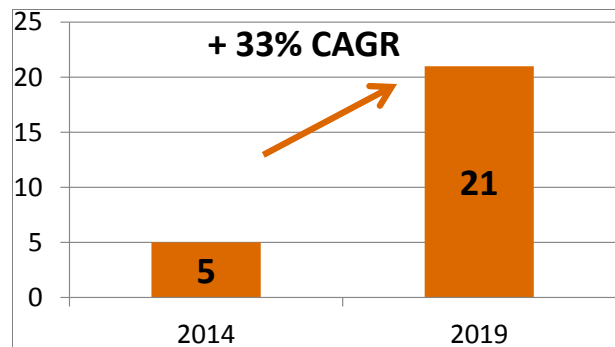
Source: PwC Analysis [11]

3.3. European companies solving predictive analytics challenges

To illustrate the predictive analytics trend in Europe, six companies have been identified and selected for this case study. The companies were identified and selected on the basis of their innovative solutions across different predictive analytics application areas as demonstrated through a range of different success signals (Table 1).

Table 1: Overview of the company cases referred to in this case study

Enterprise	HQ	Business innovation	Signals of success
RapidMiner	DE/US	Predictive analytics platforms, e.g. for customer segmentation, credit ratings, resource planning, and asset maintenance.	In 2014, positioned by Gartner in the Leaders quadrant of Gartner Magic Quadrant for Advanced Analytics Platforms".
Viscovery	AT	Platform for predictive modelling and explorative data mining with focus on visualising predictive models.	In 2008, positioned by Gartner in the "Magic Quadrant for Customer Data-Mining Applications". Acquired in 2007 by Biomax Group.
Big Data Scoring	EE	Credit scoring solutions using data from social media and other big data sources.	Finalists at the CODE_n14 world's largest IT trade show CeBIT 2014. Participants at the Web Summit 2013 as a part of the Alpha Program
FutureLytics	CZ	Analytical platform using predictive analytics to improve marketing campaigns.	Media coverage: Forbes, Financial Times, CNN, TechCrunch. Cooperation with Gartner and Google.
Saberr	UK	Workforce optimisation tool that helps organisations use data to make better decisions about people. It draws on advanced psychometric algorithms to improve business performance.	Received academic grants and raised EUR 750,000 funding from experienced Business Angels and HR leaders. Profile growing fast with articles in Wired, Guardian, Tech- crunch.

Problem 1 – The new data revolution unlocks a large variety of possibilities for entrepreneurs. Nevertheless, the sheer amount of unstructured digital data makes it difficult for entrepreneurs to seize these opportunities.

Innovative solution 1 – Dortmund (DE) based RapidMiner GmbH provides a predictive analytics platform for generating insights and predictive models that can be used in diverse industries, e.g. retail, banking, finance, fashion, media, telecommunications, utilities, pharmaceutical or manufacturing.

For instance, RapidMiner can be used by the manufacturing industry for predicting machine failures to schedule maintenance operations during regular working hours before the machine failures actually happen. This feature has already been successfully used for x-ray equipment in hospitals and drilling machines in the cement industry. In the case of the latter, RapidMiner combined their models with the knowledge of experienced machine drillers in order to develop an application that allows a maximised use of the driller without damaging the drill head.

Services offered by RapidMiner

Source: RapidMiner

Problem 2 – Predictive analytics specialists often struggle to communicate their findings to non-specialists in a quick, effective and comprehensible manner.

Innovative solution 2 – Vienna (AT) based **Viscovery** was one of the first European companies to develop a comprehensive data mining system. Viscovery's patented technology enables the presentation of extremely complex data sets in an intuitive visual way. As a horizontal technology, Viscovery's solutions can be applied to a wide array of sectors such as, telecommunications, finance, insurance, forensics, retail, manufacturing, media, life sciences, medicine, and social sciences.

As an example, Viscovery has been used to model clinical and patient data to better understand the disease of Chronic obstructive pulmonary disease (COPD). In pharmaceutical research, the clustering of genetic data can help to identify drug effects and, in turn, limit the risks and allow for a personalized medical treatment.

Screenshot from the Viscovery suite displaying mobile usage behaviour
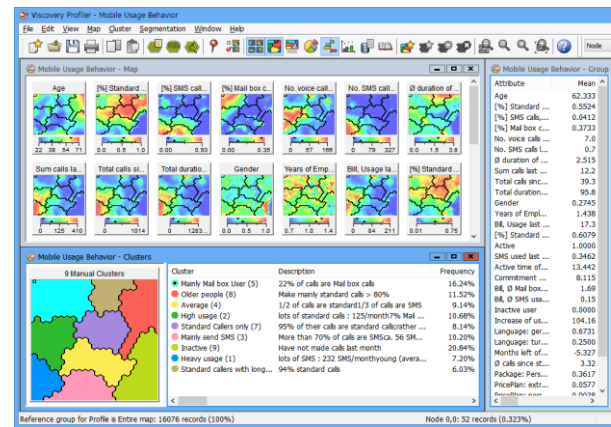
Source: Viscovery

Problem 3 – Most banks rely on outdated credit scoring methods and often exclude potential customers with non-standard backgrounds. Furthermore, banks do not make use of new technologies and all available client data.

Innovative solution 3 – Tallinn (EE) based **Big Data Scoring** is a provider of innovative credit scoring solutions that use social media data. Collecting on average 7,000 data points from social networks such as Facebook or Twitter, Big Data Scoring aims to predict client credit behaviour and reduce credit losses.

Big Data Scoring's model is of particular help for financial institutions when only limited information on a potential borrower is available, for example, when a person has only recently moved to another country or in emerging countries where traditional credit scoring tools are limited.

Facebook as a source for credit scoring

Source: The Economist[12]

Problem 4 – Customers provide massive information during their online activity. Most e-commerce companies, however, lack the appropriate tools to leverage on this information.

Innovative solution 4 – Ostrava (CZ) based **Futurelytics** is a Google cloud-based retention analytics platform providing tools that use big data to predict what customers will do next and react accordingly. By analysing purchase orders on their clients' systems, Futurelytics identifies behaviour patterns of clients and clusters them accordingly.

Through the delivery of "prescriptive analytics", Futurelytics' data mining models go a step further than predictive analytics by not only forecasting of what might happen, but offering concrete advice on which actions would be recommended to improve the likelihood of making another sale, increasing average spending or retaining customers at risk ("**actionable predictive analytics**").

Up to 60% of Futurelytics' revenue increase has been achieved in the sectors where its data mining technique is most effective, such as e-commerce for food, fashion or books.

Futurelytics business architecture
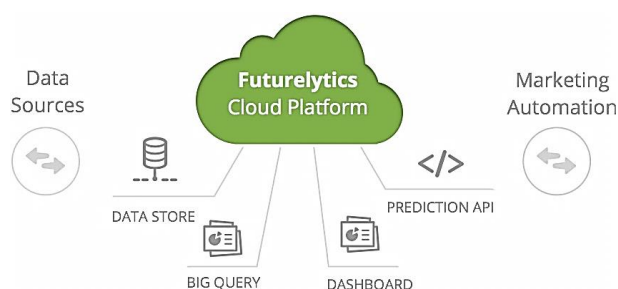
Source: Futurelytics

Problem 5 – According to academic research, 83% of start-ups fail and in two thirds of all cases failures are linked to a suboptimal team composition.[13]

Innovative solution 5 – London (UK) based Saberr uses predictive analytics to help organisations optimise their workforce by designing internal teams or by recruiting candidates who are more likely to fit well into an existing team structure. The psychometric algorithms developed by Saberr to predict the general success of teams and other team related issues draws inspiration from key metrics applied online dating websites,

Saberr's method has the potential to reshape perspectives on recruitment of workforce and by highlighting the importance of value alignment, Saberr could redefine the way human resources design internal teams or employ candidates who will fit with the rest of the team.

Proof of Saberr's concept has been demonstrated by its >95% accuracy in predicting the outcomes of accelerator programmes and the judges' ranking of teams in more than 15 short term start-up competitions.

Screenshot of Saberr's team rating
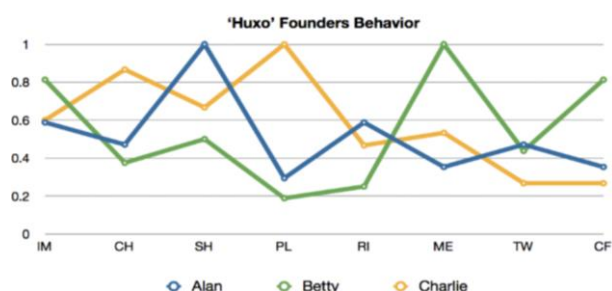
Source: saberr.com

3.4. The creation of new markets and jobs

Due to its digital nature, predictive analytics has no borders. Consequently, most predictive analytics enterprises aim for **global market reach**. Predictive analytics is being applied to a broad range of industries that are applying its advanced forecasting techniques to a variety of business functions (Table 2).

Table 2: Target sectors and markets of interviewed enterprises

Enterprise	Client sector
RapidMiner	Manufacturing, retail, banking, finance, transportation, telecommunications, pharmaceutical, fashion, media, travel, oil/gas.
Viscovery	Life sciences, medical research, insurance, forensics, banking, telecommunications, media, social sciences, retail, manufacturing.
Big Data Scoring	Banking, any company working with credit fees.
FutureLytics	Smaller and medium e-commerce businesses, supply chains using loyalty cards, but also companies using CRM system.
Saberr	Large human resources consultancies, as well as several smaller start-ups.

The global reach of predictive analytics providers is demonstrated by RapidMiner, which serves customers in more than 50 countries in the world, including the US, where around 50% of its new service requests originate. Equally, Viscovery's software has been licensed to more than 600 customers worldwide, including a large number of research institutions and universities. Big Data Scoring is also looking beyond Europe's borders for business opportunities, as the firm expects its social media based credit scoring to be particularly attractive to emerging markets in Asia, Africa and Latin America. In these markets banks are typically not well-equipped for assigning proper credit scores.

All interviewed enterprises have undergone **rapid employment growth** (Table 3). Employment and sales growth is likely to continue in view of the increased uptake of predictive analytics in more sectors and geographies.

Table 3: Jobs created by interviewed enterprises

Enterprise	Jobs when founded	Jobs today
RapidMiner	2 (2002)	65
Viscovery	3 (1994)	15*
Big Data Scoring	2 (2011)	10
FutureLytics	2 (2012)	9
Saberr	2 (2012)	6

The demand for skilled labour, most notably data scientists, is an underlying trend in the field of predictive analytics, as predictive analytics companies are experiencing higher growth rates. As more businesses are integrating predictive analytics as part of their strategy, the demand for skilled employees able to effectively draw insight from predictive analytics platforms further increases.

Generally speaking, interviewed companies do not limit themselves to Europe when recruiting qualified staff as, in many cases, the continent's workforce lacks appropriately skilled labour. However, this issue is mirrored in the US where there is also shortage of data scientists and, as a result, many businesses are competing globally (often against European businesses) for top analytical talent.

3.5. Client perspectives and challenges related to the uptake of the trend

In an ever more data producing world, companies need to consider how they can improve their business by leveraging the economic potential resulting from the capture and analysis of these data. Few companies, however, are fully exploiting the promising potential of predictive analytics so far. Most businesses lack the awareness and a solid understanding of the business functions that predictive analytics could support and which "big data" approaches are of the greatest relevance to them.[14]

Thus, companies must first be open-minded enough to explore and commit resources to assessing the business opportunities offered by predictive analytics. Having done so, companies need to ensure that they have access to accurate and timely data concerning their business processes, customers, markets and competitors. And following this, they should target predictive analytics tools that would have a positive impact on the value of their business.

This will likely require the creation of new IT positions, such as dedicated **data scientist** roles. In addition, company IT departments will increasingly collaborate with their business management colleagues to build tailor-made predictive capabilities by identifying what information will be needed, before delivering the analytical tools and applications required to generate forecasts and improve business outcomes. And over time, this will change the way companies think, work and make decisions.[15]

4. Drivers and obstacles

The uptake of the predictive analytics' market in Europe is fostered by several drivers but also faces a number of barriers. These drivers and obstacles generate significant consequences on both enterprises developing solutions and companies interested in exploring them for their businesses.

4.1. Market entry barriers

Despite the increased awareness regarding the economic potential stemming from the adoption of predictive analytics,

"The most biggest challenge for a tech company is entering the market" – Viscovery

a critical obstacle for the uptake of the technology is still the limited response to data-driven business innovations. **It is often difficult for European start-ups in the field of predictive analytics to find "early adopters"** willing to buy their innovative technologies.

As a result, the road for entrepreneurs setting up predictive analytics start-ups in Europe is long and often requires

several costly pilot projects with little to no profit. In contrast, the US's start-up environment is far more receptive to new innovations and provides young, innovative companies with a better market in which they can secure their first client.

Enterprises such as Big Data Scoring overcame this barrier by dedicating resources to "educating the market" by well-explaining the potential of predictive analytics in unlocking business value. Furthermore, predictive analytics enterprises invested efforts in improving the usability of their solutions, to allow also less IT savvy clients to use their predictive analytics tools intuitively.

Access to finance is one of the most critical challenges faced by European start-ups. Hence it was unsurprising that all enterprises interviewed for this case study expressed the difficulties they encountered in securing funding for their activities. And as such, most interviewed entrepreneurs were forced to rely on their own funds and forego the receipt of a steady income.

In accessing finance, Big Data Scoring emphasised that it is only interested in "smart" money. In other words, they do not only want a grant from a bank or an investment from a return on investment driven business angel, but an engaged investor willing to also share his know-how and network with the entrepreneurs. Most private financiers, however, are often only looking for quick return on investment and hardly attracted by companies before their "proof of market". Therefore, the enterprise experienced a gap between their seed and early stage.

RapidMiner noted that US venture capitalists usually offer more money, but are not necessary the "philosophical fit". While venture capital typically likes to "invest in IP", RapidMiner's open source strategy did not fit the standard categories of typical venture capital investors. Still, other investors were interested in investing into open source technology, especially those who already invested into open source technology before, e.g. Germany based investor EarlyBird or Finland based Open Ocean, that already backed the founder of MySQL, vendor of the worldwide most widely used open source database.

The requirements to benefit from funding through the **EU's Framework Programme for Research and Innovation** include the drafting of large reports to explain the rationale for the use of the funds and how they will be allocated. The formats of these reports often exceed the capacities of the interviewed predictive analytics enterprises which lack the time, skills or administrative know-how to draft such long reports.

RapidMiner shared insights into its approach to EU funds, which usually entails a strong partnership with universities that take the lead on documentation and administrative tasks; thereby allowing enterprises to fully focus on the business aspects of the project (Table 4).

Table 4: Source of funding for interviewed enterprises

Enterprise	Source of funding
RapidMiner	Self-funded, later research grants from EU and DE government and EUR 3.7 million from 2 European venture capitalists.
Viscovery	At very beginning beneficiary of EU funding. Later mix of venture capital, business angels and AT government (the latter alone EUR 2-3 million. Sold to Biomax Group in 2007.
Big Data Scoring	Self-funded. Plans to apply for Horizon 2020 funding.
FutureLytics	Self-funded, later seed money from accelerator and from venture capitalist.
Saberr	University of Southampton Equity investment, then funding from Seedcamp and EUR 750,000 from angel investors.

It is generally accepted that **US venture capitalists offer more and quicker money compared to their European counterparts**. Therefore, most successful European enterprises consider engaging US venture capitalists. As a consequence of this, European enterprises often relocate their headquarters to the US, as they prefer to work and invest in the environment more conducive to their financing needs and growth aspirations.

*"In the US, it's easier to get money. In Europe the funding policies are more risk oriented" – **Viscovery***

The need of adjusting websites and hiring new sales and customer support teams speaking the local languages of new target markets, **language barriers** emerge as a considerable hurdle for SMEs during their internationalisation activities. In consequence, enterprises like Saberr limit themselves to English speaking countries only. Similarly, FutureLytics emphasised that they could grow much quicker if they translated their website and services into other languages.

4.2. Data protection as a barrier and driver

Big Data is increasingly considered as the "new oil of the century" but the exponential growth of unstructured digital data – combined with the improvement of analytical techniques – is casting a new light on data protection issues. By providing an insight into customer needs, predictive analytics must strike an appropriate balance between helping companies to use their customer data to anticipate future needs, as well as protecting the privacy rights of customers.

On one hand, interviewed SMEs considered the European **data protection as a barrier** for their business. The wider adoption of predictive analytics comes with new risks for customers' privacy rights. As a result, enterprises like Big Data Scoring tend to avoid markets that are more sensitive to data protection (e.g. France, Spain, or Germany) in favour of Scandinavian and Eastern European countries, where they find a better acceptance for their business model.

The rather cautious perspective of some European countries towards privacy rights has driven the European Commission to provide stronger policies towards data protection, manifested for example in the 2012 reform of the EU legal framework on the protection of personal data. The EU legislation aims to prevent data from being used against the will of customers or for discriminatory purposes against groups of customers. However, such European legislation is also discouraging predictive analytics firms from basing themselves in Europe, as they face less stringent data protection regulations elsewhere.

On the other hand, interviewed enterprises considered strong **legislation on data protection in Europe also as a competitive advantage** as it guarantees security for companies interested in integrating predictive analytics into

their business strategy. Indeed, customers in general and certain industries (e.g. mechanical engineering or the health sector) are becoming increasingly concerned about the use of their (personal) data and want to ensure that they fully control their data in order to ensure that it is not misused.

This led to interviewed CEO's suggesting that a strengthened European legislation on data protection might attract non EU-companies willing to assure data protection to their clients. In this regard, European legislation over data protection could act as a driver for the development of the market of predictive analytics in Europe.

Finally, Big Data Scoring highlighted that the issue relating to European data protection rights does not lie in fulfilling the strict data protection laws but rather in explaining the regulation to clients. Hence, given the sensitivity of their credit scoring business model, Big Data Scoring is facing a serious barrier to realising the potential of its business.

4.3. Intellectual property concerns and security risks

A clear **Intellectual Property (IP) legislation** was considered by the interviewed entrepreneurs as a critical success factor for the uptake of predictive analytics. Competition in predictive analytics is currently being played on the field of international patents, which is increasingly leading to legal battles between companies trying to reap the economic rewards of the business innovation.

However, registering IP internationally is a long process that small companies cannot always afford. Moreover, the necessary but complex process of complying with IP legislation in foreign countries often prevents the international expansion of small companies.

Increasing use of digital data has led to higher levels of **cyber security requirements**. Companies in the field of predictive analytics have to provide security guarantees to ensure the safety of their customers' data. Therefore, predictive analytics enterprises have to make sure their platforms are at the cutting edge of security requirements technology; which is a costly requirement that can act as a market entry barrier for small start-ups.

4.4. Skilled labour force shortage

The entrepreneurs in this case study all emphasised the importance of attracting highly skilled employees for the development of their technologies. Predictive analytics require particularly advanced skills such as the ability to develop complex software or to analyse large datasets, combined with a consultancy mind-set. It is also critical for analysts to acquire profound knowledge of the core principles of marketing and customer relationship management in order to present results correctly to a non-technical business audience.

Europe is facing a shortage of skilled labour and despite the awareness of the issue the gap appears to be increasing. In relation to this, interviewed entrepreneurs heavily criticised the declining research budgets at European universities. The

"Establishing a talented workforce has always been an issue" – Viscovery

impact of previous cuts has already been felt on the availability of an appropriately skilled workforce and has contributed to the acceleration of the brain drain of European predictive analytics experts to the US where more research funds are available. Therefore, the training and the retention of predictive analytics experts is becoming an increasingly important factor in the uptake of the predictive analytics trend in Europe.

5. Policy recommendations

5.1. Improving legal frameworks

The increasing use of predictive analytics is generating greater risks for the privacy rights of customers. Therefore, a solid European framework on data protection is critical to ensure a sustainable further development of the market of predictive analytics.

The EU has established concerted legislation on data protection, which protects customers from abuses related to the use of their data. However, many small companies cannot afford the legal support needed to help them understand all the requirements of the legislation. As a result, many entrepreneurs perceive the EU legislation as "unreadable".

Similar to the European Union Agency for Fundamental Rights' (FRA) "Handbook on European data protection law" [16], the EU could provide an even **shorter version of the legislation regarding data protection in the form of an information booklet**; making it more accessible for a wider audience, especially companies that are interested in using services that fall within the legislation's scope.

5.2. Encourage collaboration

Predictive analytics companies need to leverage on the skills of IT professionals. However, Europe is facing an impeding dearth of data scientists hindering the further development of the market of predictive analytics.

The companies interviewed in this case study stressed that they are struggling to find adequate data scientists, such as quantitative analysts, systems architects, software engineers, visualisation designers, or business analysts. Policy makers should ensure that European universities **train more data scientists** but also enable businesses to empower their staff with technical skills in order to develop a data-driven workforce.

Technology hubs enable high-tech enterprises to leverage on the experience of other innovative companies and access their network. Moreover, European hubs serve to enhance the cooperation between European enterprises. Interviewed enterprises believe that improved networking would enable innovative SMEs to have greater access to decision makers at big corporations.

"With more qualified developers, the company could have developed faster and better" – Viscovery

More **industry-university interactions** would facilitate the provision of better information on the range of activities covered by a career as a predictive analytics data scientist. This would attract more students to the field of predictive analytics which, in turn, would contribute to resolving the data scientist shortage in Europe. Further to this, increased interaction between industry and universities would enable academia to better assess the industry needs in the field of predictive analytics, for designing more efficient platforms.

Educational institutions train future data scientists but it is also important for schools and universities to engage in industrial partnerships when developing relevant, high-tech skillsets. In this regard, public institutions could create **plans for continuous training that is co-financed by local authorities and companies**.

To ensure that the supply of data scientists meets the market demand for them, it will be essential for public institutions and academic institutions to **launch public campaigns that inform students of Europe's need for data scientists**.

The policy makerss could provide **funds for research related to the creation of predictive analytics software with intuitive user interfaces and a shorter learning curve**, in order to allow any average computer user to work with predictive analytics software even without any expertise in fields of data mining or statistical analysis.

The benefits of such "democratisation" of predictive analytics would be two-fold: first, it would empower semi-technical staff to develop new approaches to predictive analytics on their own without the need for being educated as a professional data scientist. Second, with more easily usable platforms, companies willing to implement predictive analytics solutions could better understand the benefits of predictive analytics. In this regard, the democratisation of predictive analytics could raise more awareness on the market and consequently lead to a wider adoption of predictive analytics solutions.

5.3. Develop a supportive investment culture

Access to finance is a challenge of the utmost importance for SMEs throughout Europe. The difficulties in accessing finance expressed by the interviewed companies of this case study reflect the urgency of the issue and the pressing need to address it.

Improving SMEs' access to finance will be critical in establishing a more supportive environment for the further development of the market of predictive analytics. While tech start-ups need funding at every step of the development of their enterprises, the lack of funding appears to be particularly intense at the early stage. In Europe, the risk-aversion culture of European banks, public institutions, and policy makers is preventing highly innovative companies from developing their new ideas.

Public institutions have a role to play in the facilitation of young innovative enterprises' access to finance. For instance, policy makers could **incentivise private investment in innovative enterprises** by offering tax relief. This would enable SMEs to benefit from private capital, which is typically more flexible and open to innovations than capital provided by banks or public institutions.

The **level of R&D funds** is a critical success factor for the uptake of the trend of predictive analytics in the European market. Yet, universities are cutting their research funds preventing new innovations from being further developed. European policy makers need to provide more research funds to enhance the competitiveness of European firms in the field of predictive analytics. Moreover, funds could be linked to projects involving several companies instead of only single enterprises or small consortiums in order to facilitate the allocation of funds to SMEs.

Better **communication on all information regarding EU funds**, e.g. on their goals, their eligibility criteria or reporting standards would better equip enterprises in accessing and using existing EU funds.

Interviewed enterprises would appreciate the **public sector's support in internationalising their business**. Interviewees suggested for example that national or European chambers of commerce could better assist SMEs in identifying partners in foreign markets. In order to not oblige enterprises to locate their headquarters in the same areas as their investors, policy makers should further **improve international investment** law by establishing standardised rules that would allow enterprises to build mixed international models to be partially owned e.g. by EU and US funds.

This view was supported by interviewed enterprises that believe the EU should better acknowledge the reality of globally competing companies. After all, the EU environment should be an attractive destination for foreign investments rather than an exclusive one, as it is today.

5.4. Reducing administrative burden

Administrative burdens have always been criticised by hands-on entrepreneurs. However, some countries – especially Northern European ones like Finland or the UK –

have implemented solutions in recent years to reduce them. Their pragmatic and quick solutions that allow entrepreneurs for example to do all the "paper work" through lean online forms or that minimise the need to provide documents for opening a bank account, could inspire changes in other European countries.

Policy makers should facilitate the set-up of new start-ups by **reducing the bureaucratic overhead** entrepreneurs face during the establishment of their start-ups. Some interviewed start-ups noted the administrative burden of setting up and registering their enterprises; however, Big Data Scoring praised Estonia's administrative efficiency, as the company's set-up "took only 10 minutes".

One-stop-shops providing free legal support and additional help to **understand the eligibility criteria to benefit from EU funds** could boost the uptake of such funds by SMEs. Such one-stop-shops could further provide free legal support for start-ups facing issues with the comprehension of the legislation regarding data protection and IP registration in Europe. Further, the policy makers could also shorten the time and the requirements for IP registration.

Viscovery enterprise suggested that EU funds should be less linked to well-defined projects for which enterprises or consortiums would need to file long and costly applications and reports. Instead, the EU Commission could select companies that qualify for a strategic field of interest. Those shortlisted companies would only need to prove that the money they received was invested in RDI but would have greater freedom in determining the area of RDI.

Another enterprise acknowledged the importance of proper project documentation but suggested adapting formatting requirements, e.g. by also accepting software documentation or marketing material instead of the standardised formats of reports.

Predictive analytics could be beneficial for various public institutions that could on the other hand support the uptake of involved enterprises by becoming early adopters. Some local authorities are already engaging in contracts with predictive analytics enterprises in order to use their technologies in various departments. In this regard, policy makers could act as "early adopters" of innovative products. Therefore, policy makers could foster administrative simplification and reduce red-tape for SMEs seeking to work with the public sector.

RapidMiner also suggested that the EU could change their approach to funding by using the innovations of European start-ups rather than simply funding research and development; thereby providing innovative SMEs with financial support and a strong reference within their client portfolio.

6. Appendix

6.1. Interviews

Enterprise	Interviewee	Position
RapidMiner	Ralf Klinkenberg	Founder, CEO
Viscovery	Gerhard Kranner	Founder, CEO
Big Data Scoring	Erki Kert	Founder, CEO
Futurelytics	Daniel Hastik Mirek Cerny	Founder, CEO Founder, CTO
Saberr	Alistair Shepherd Tom Marsden	Founder, CEO CFO

6.2. Websites

RapidMiner	www.rapidminer.com
Viscovery	www.viscovery.net
Big Data Scoring	www.bigdatascoring.com
Futurelytics	www.futurelytics.com
Saberr	www.saberr.com

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