HP DO

DEMONSTRATE DATA-DRIVEN BUSINESS BEHAVIOUR

A Dutch research study on data and analytics maturity and business effectiveness

TABLE OF CONTENTS

PREFACE

Rob Beijleveld

CEO ICT Media BV &
Publisher CIO Magazine

This is yet the second publication on a topic that has had my interest for a long time, the high-performance digital organisation. When I started this company 15+ years ago, some pioneers were already working on the concept of 'high-performance information' as the foundation of a thriving business. An organisation that is not just existing in some vacuum, but operates as a wholesome part of the economy and is actively involved in society.

High-performance digital organisations are built around data. It shouldn't come as a surprise that their CIOs and CDOs have an important role here. They are the nexus between data, i.e., rich, high-prised information, the boardroom, and the supervisory board. These tech leaders are outward-looking and understand their stakeholders: end-users in the business, B2B customers, business parters and consumers.

For this report we asked the help of some of these leaders: Hylke Sprangers (Talpa Network), Richard Raats (Rijksover-heid), Alex Hurkmans (Garantibank), Kees Jans (Wehkamp), Audrey Coutinho (Elsevier), Erik Janse (Manpower Group), Roeland Allewijn (Rijkswaterstaat), Marcel van de Lustgraaf (VIVAT), and Svend Lassen (Tata Steel).

These digital leaders show us how they put technology and data to use on their journey to becoming a truly data-driven, high-performance digital organisation.

For this publication we combined the power of Tata Consultancy Services and TIAS Business School to shed light on the state of data maturity in the Netherlands. I hope you'll find inspiration and guidance in this report.

EXECUTIVE SUMMARY

Data driven business behavior is a pre-requisite to thrive. To better understand this, Tilburg University / TIAS School for business and society and ICT- Media in conjunction with Tata Consultancy Services (TCS) as its knowledge partner, conducted a survey in the Netherlands. Many of the Dutch surveyed organisations have a very low analytics cloud computing score. Missing out on this requisite for demonstrating data-driven business behavior will stifle data driven results – analytics needs cloud computing! Also, many of these organisations don't have the basics at level. Poor data management, low analytics automation, limited use of open and external unmanaged data combined with limited use of active data warehouses and data lakes requires immediate management attention.

However, what we learned from comparing this Dutch survey with the global TCS DATOM™ assessments, conducted by TCS, is that data and analytics maturity in the Netherlands is slightly higher than the global results. Yet the Dutch maturity is still low to medium. At this point, most Dutch surveyed organisations have a limited ability to improve business performance with data and analytics. Just over 15% are increasing their business effectiveness by leveraging data and analytics.

Those that are data-driven high-performance digital organisations (HPDOs) have anchored the topic in the board of management and implemented a data driven mindset and culture. Furthermore, they provide budgets to invest in data analytics, not only in tooling, but also in data literacy, processes and governance. This focus is paying off, they are able to monetize data insights.

Josu Devasia
Managing Director & Head
Tata Consultancy Services Netherlands B.V.

Dinanath Kholkar
VP and Global Head, Analytics & Insights
Tata Consultancy Services

With an abundance of data available at various levels in an organisation, it is extremely important to have a holistic view of your data and analytics landscape to stay competitive. Successful organisations in this digital era have embarked on a journey of "Data & AI Democratisation" combined with Data Literacy. This has helped them to simplify their data estate, navigate the business ecosystem with ease, and enable products and services at scale.

Many large European organisations have partnered with TCS to help them exploit the opportunities of the digital economy with the Business 4.0™ thought leadership framework. Over the last two decades, TCS in the Netherlands has supported large national and multinational organisations in their digital transformation journeys, enabling them to innovate and stay relevant.

A key challenge we see across sectors and industries are disrupting forces, often driven by digital-first companies, that are changing markets and business like never before. For established businesses, to compete and remain ready for the future, a shift in mind-set is needed - from searching for scarce resources, to harnessing an abundance of data, to driving business performance. To get a better perspective on how 'data mature' Dutch organisations are, we partnered with Tilburg University /TIAS Business School and ICT Media in commissioning a research. The key objective was to better understand and explain the correlation between business effectiveness with enterprise data and analytics maturity and this report is the manifestation of that effort.

Our study evaluates and analyses the potential of an organisation's digital intelligence based on their analytics program and initiatives as compared to industry leaders.

Key takeaways from the study are that it is imperative for an organisation to build information management capabilities, break data silos, validate data solutions, modernise data estates, and enable broad based access to data in order to exploit the full potential of digital transformation. As enterprises are at varied levels of data maturity, this study can help them assess and benchmark themselves in their industry. It also covers strategies for moving forward, with the end objective to gain and retain the competitive edge in business.

We hope you find this study useful and valuable in your current business context, as well as in your endeavor to be a data driven enterprise.

Happy reading.

INTRODUCTION

The volume of data available and technology advancements creates unlimited business opportunities for any organisation. In the previous high-performance digital organisation (HPDO) study (www.hpdo.nl), the focus was on understanding how to implement a digital transformation successfully. In this study, we build on these insights for business effectiveness and performance and focus on the value of data and analytics, on data-driven decision making and operations. This Dutch research project demonstrates that data-driven business behaviour is a prerequisite to thrive.

Sixty-two leading Dutch organisations[1] and ten C-level information technology leaders (e.g. chief information officers, chief digital officers and chief data officers) ("Dutch surveyed organisations") have contributed to this study[2], which defines a clear call for action. How can data and analytics improve business effectiveness, disrupt and avoid being disrupted?

This report details the challenges that the Dutch surveyed organisations face in leveraging data and analytics. The basics are missing. They lack proper data management and have a low degree of analytics automation and cloud adoption. Furthermore, they are predominantly using only managed data, which are predominantly structured data, and, to a limited degree, data lakes and active data warehouses. This limits their ability to fully extract insights from their enterprise data.

We then take a deep dive into data and analytics maturity and its correlation to business effectiveness. This includes an analysis of the Dutch market indicating a low to medium data and analytics maturity driving business effectiveness and the inhibitors in play.

Next, we provide guidance on how to improve data and analytics maturity. This includes improvement actions

RESEARCH APPROACH

This second high-performance digital organisation research project of Tilburg University / TIAS School for Business and Society and ICT-Media, conducted by prof. dr. Erik Beulen, is embedded in Tata Consultancy Services' (TCS') global Research & Development program. TCS has been focusing for many decades on data and analytics. Based on a structured questionnaire, TCS has been performing DATOM™ data and analytics maturity assessments for many years. The current TCS DATOM™ data set includes 240 assessments. In this study, we used 103 global enterprise level assessments. The data and data maturity of organisations operating in the Dutch market is investigated and benchmarked with the global enterprise level assessments. Sixty-two Dutch organisations participated in a data and analytics survey and ten interviews were conducted with C-level information technology leaders (e.g. chief information officers and chief data officers) supplemented with three interactive workshops.

clustered around four topics:
1) anchoring by the board of management;
2) implementing a data-driven mindset and culture;
3) investments in data and analytics; and
4) monetisation of data insights.

Finally, we wrap up with our conclusions. In short, Dutch organisations are increasingly leveraging data, but they are not utilising it to its fullest potential. They will need to focus, invest, and commit resources to improve their data and analytics maturity.

---

[1] The Dutch organisations include all sectors and range in size up to +1.000m Euro revenue/budget. See for profile the appendix for profiles.

[2] Wherever these Dutch results are combined with previous studies, including global TCS DATOM™ (103 global enterprise level assessments) ("global enterprise level assessments"), see https://www.tcs.com/data-analytics-target-operating-model, and TCS Global Business 4.0 (1,231 global enterprises) ("TCS Business 4.0™"), it will be noted. The Dutch survey includes organisations of different sizes and operating in different industries.

HYLKE SPRANGERS:
DATA FUELS ARTIFICIAL INTELLIGENCE

Looking at the technology landscape, there are seven tech trends. First of all, the evergreen tech trends: big data and cloud computing. The other tech trends are artificial intelligence, extended reality (e.g. virtual and augmented reality), Internet of Things, blockchain across the value chain to create trust and to enable smart contracts and, still in the research and development stage, quantum computing. Hylke Sprangers, Chief Technology Officer and CIO of the Year 2018: "*Cloud computing is pivotal for analytics. Although very mature, cloud computing is still innovating, think serverless, containerisation and edge computing. Technology and innovation should be at the heart of any organisation.*" Therefore, they must be managed properly within a clear tech strategy. Seamless collaboration with the business drives value and growth.

At Talpa Networks, as their Chief Technology Officer, Hylke Sprangers has put a lot of effort into centralising and standardising one big data platform across all units and products. "*This enabled product innovation and improved our client interaction.*" Investing in artificial intelligence increased the value of data, resulting in completely new business platforms such as FootballTV for automatic live streaming of amateur football matches. Hylke Sprangers: "*Data fuels artificial intelligence. Also, proper governance and a long-term focused delivery model have to be in place and maintained to safeguard future value creation.*"
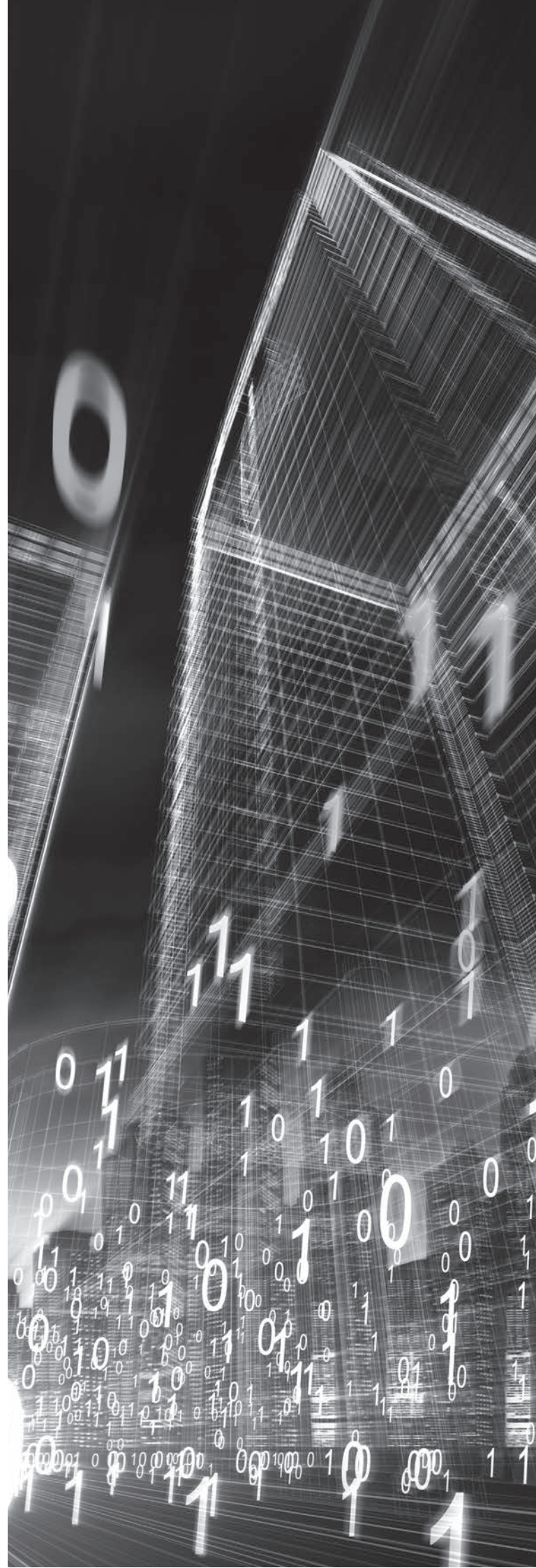
CHALLENGES

These days the competition is all-out, and market actors are no longer taking sector boundaries into account. Digitalisation enables organisations to be nimble, capturing markets whenever they are ready. The TCS Business 4.0™ ³ framework provides endless opportunities for those organisations which outperform in driving mass customisation, creation of new business models, leveraging ecosystems and embracing risk. Digital is transforming our way of doing business. In high-performance digital organisations, information technology is becoming an integral part of the strategy as well as of products and services. Strengthening the data foundation and technology adoption is required for maturing data and analytics. All this has set new requirements for organisations, their governance and architectures. Digital transformations are an integral part of doing business, are fully endorsed by the Board of Management, and implemented by digital leaders.

Being a high-performance digital organisation is necessary to disrupt and avoid being disrupted by others. Organisations need to adjust their strategies, collaborate with partners in value chains , and of utmost importance take advantage of insights coming from analytics to pursue growth ambitions.

In this second high-performance digital organisation research project, performed by Tilburg University / TIAS Business School, in association with ICT Media and Tata Consultancy Services (TCS) as knowledge partner, we address the data and analytics maturity challenges focusing on the Dutch market. The path to such maturity is laden with a variety of challenges, in the section below we look at some of these pitfalls and hindrances in the Netherlands.

ASSESSING DATA AND ANALYTICS BASICS - OVERVIEW

Understanding adoption levels in data management, analytics automation, types of data, types of analytics platforms used, and cloud adoption, helps us better understand the challenges that organisations are facing. This is the foundation for analysing the data and analytics maturity of the Dutch surveyed organisations. No Dutch surveyed organisations can be qualified as best in class on all five aspects. There are eight organisations that qualify as laggards on all five aspects, which are in the following sectors: Government and Public Services (2), Life Sciences and Healthcare (2), Consumer Goods and Distribution, Insurance, Manufacturing and Other (agriculture). The remaining organisations have large diversity in data and analytics basics. Let us take a closer look at these organisations for data and analytics basics, as this foundation contributes to data and analytics maturity.

RICHARD RAATS:
ADVANCING SERVICE TO THE PUBLIC AND SOCIETY WITH DATA

Of course, the Dutch government is not allowed to commercially monetise data, but more than ever data is centric in serving the public and society. Richard Raats, senior program manager with a track record at the central government: "*Think about the pre-populated tax assessment of inland revenue. This reduces the time and effort required to complete the tax return and improves the accuracy significantly.*" Furthermore, data and analytics is widely used to detect fraud, in many cases this is highly automated. Also there is a need for government wide data governance and adherence to data quality standards like ISO 8000 and FAIR principles. The information technology systems include the thresholds set in accordance with the thresholds in the law, which is possible these days with legal engineering. The outcome of using analytics is augmenting with human fraud detection. Richard Raats: "*In any cases, it is opportune to introduce the concept of transparency.*"

Due to the nature of governmental organisations, ownership is sensitive and not straight forward. The citizens own their personal information, however are obligated to provide specific data to the government. Also, civil servants can enrich this data, think notes and analyses related to a file. Richard Raats: "*This is making ownership of data for governmental organisations complicated. What about the privacy rights of citizens versus privacy rights of civil servants?*" In any case, the governmental organisation is responsible for the file, and for any data captured in that file. Richard Raats: "*Awareness at any level of this responsibility requires attention. The Dutch government is focusing on implementing processes and tooling combined with awareness programs.*" This will support the data and analytics value creation of governmental organisations.

---

³ Business 4.0™ is the next wave of change breaking over organisations across the world.
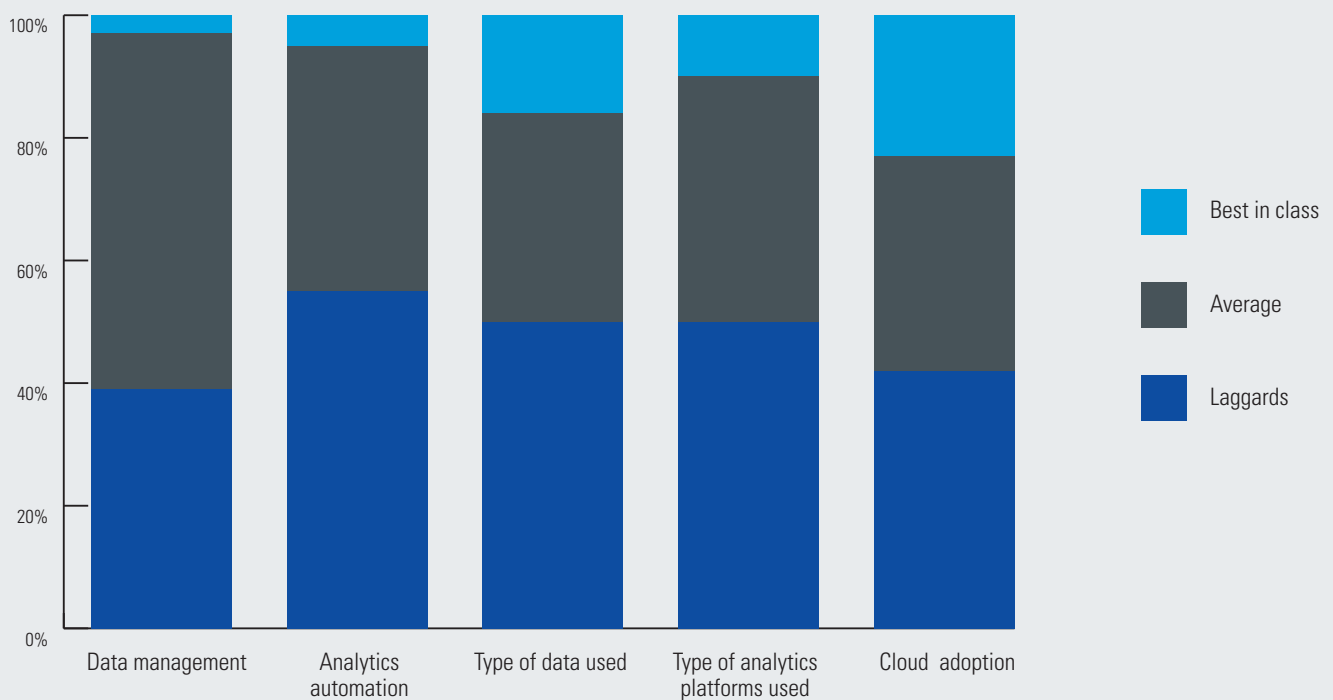
Figure 1: Data and analytics adoption aspects: data management, analytics automation, types of data used, types of analytics platforms used, and cloud adoption; by level: laggard, average and best in class (N=62).

ASSESSING DATA AND ANALYTICS BASICS – ADOPTION LEVELS DETAILS

By analysing the adoption levels of the five aspects of the Dutch surveyed organisations, we continue to distinguish between laggard, average and best in class per aspect.

Data management. From the Dutch surveyed organisations we conclude that the adoption of data management is low – a score of 2 or below on a 0 – 7 Likert scale (N=24): laggard. This is impacting the ability to derive insights from data gathered from process and transactions across these organisations. Most of these organisations are smaller, with revenue below 1,000M euro (N=19). There are no Dutch surveyed organisations using entirely digitised data management

– a score of 7 on a 0 to 7 Likert scale, only two organisations in Manufacturing and Energy Resources and Utilities reported a 6 score. Organisations need to focus on data governance including master data management to be able to improve the data and analytics maturity.

Analytics automation. Reducing the need for human intervention is the objective. Unfortunately, the adoption of analytics automation is also low, as over 50% of the Dutch surveyed organisations report analytics automation under 25% (N=34): laggard, with a limited difference in the size of the companies. As expected, the Dutch surveyed organisations in Banking and Financial Services reported higher degrees of analytics automation adoption.

ALEX HURKMANS:
OUR INVESTMENT IN DATA QUALITY AND ANALYTICS CREATE TREMENDOUS VALUE

Garanti Bank International (GBI) is a mid-sized European bank established in Amsterdam, serving retail, corporate and institutional clients. GBI is a wholly-owned subsidiary of Turkiye Garanti Bankasi A.S. and has presence in Germany and Turkey. GBI is under the supervision of the European Central Bank (ECB), De Nederlandsche Bank (DNB) and Dutch Authority for the Financial Markets (AFM).

Alex Hurkmans, Chief Digital Officer at GBI: "*In addition to regulatory reporting obligations, facilitating data driven decision making is a priority. We are investing heavily in improving data governance quality and analytics.*" As result, GBI is, for example, able to regulate the speed and accuracy of adjusting risk profiles in their portfolio. Also, manual effort required for compliance with the Know Your Customer legislation which shortens the lead time to onboard a customer and open their new account. The current level of analytics automation is low and the analytics platforms used are not distinctive yet. Alex Hurkmans: "*Going forward GBI will use data at different SAAS and PAAS providers centralised in Azure Cloud.*"

Furthermore, Alex Hurkmans is introducing a data driven mindset and culture to GBI: "*Employees already realise that their efforts matter in respect to data governance and data quality and that they all are so-called data stewards. We are currently implementing workflow to increase digital possibilities, data sharing (input once at the source by the source etc).*" The objective is to go to a customer and data centric organisation.

Type of data used. For the type of data used in analytics we concluded that the adoption was medium, half of the Dutch surveyed organisations derive insights from open data and/or external unmanaged data (N=31): average and best in class. This includes eight out of the ten Energy Resources and Utilities organisations. The most widely used type of data by the Dutch surveyed organisations is as expected: internal managed data. Adding external data and open data will expand the ability of organisations to derive insights.

Type of analytics platforms used. Most of the Dutch surveyed organisations use transitional platforms, like enterprise data warehouses (N=42) or department data marts (N=15). Only a few organisations leverage traditional management information systems to perform ad hoc analyses – makeshift MIS (N=11), the Energy Resources and Utilities organisations are well represented - four out of the ten. The advanced organisations (70% of the large organisations) use active data warehouses and/or data lakes (N=31): average and best in class.

Therefore, the ability to derive insights from advanced analytics platforms across all Dutch surveyed organisations is classified as medium. Investing in the implementation of more advanced analytics platforms, such as active data warehouses and data lakes, will enable improvements to data and analytics maturity. In order to optimise platform usage, some participants have set up a data and analytics center of excellence.

Cloud adoption. In this day and age cloud computing is largely used in analytics by many organisations. In this research, one-third of the Dutch surveyed organisations have a low analytics cloud computing score (0, 1 or 2 on a Likert scale of 0-7 – N=26). Surprisingly, the data and analytics maturity of these organisations is no different from the maturity of the remaining two-thirds of the sixty-two Dutch surveyed organisations.

In conclusion, most Dutch surveyed organisations have to take immediate action to bring their house in order. They have to improve the effectiveness of their business by leveraging data and data analytics – and, to disrupt and avoid being disrupted. Organisations have to focus on ensuring alignment of their data and analytics capabilities within their business value chain. Increased focus on data literacy, analytics automation, and modern data governance techniques can help bring around the required data-driven result.

HISTORIC PERSPECTIVE

Marking the start of Artificial Intelligence is difficult. Let us mark Alan Turing's paper in 1950, Computing Machinery and Intelligence as the Artificial Intelligence start. Five years after the first Artificial Intelligence programme followed: Logic Theorist. The beginning included lots of pioneering, but also significant investments. This resulted in a large number of expert systems. Amongst others, these innovation efforts resulted in the discovery and use of multilayers and opened a new path in neural network research in the 1960s, and in the 80s it led to the invention of backpropagation, which is used by computers to learn from their mistakes and get better at doing a specific thing. After the so-called 'Artificial Intelligence Winter' started in the late 80s and early 90s, IBM's Deep Blue defeated chess player Garry Kasparov in 1997, and Google's Alpha Go beat in 2016 Chinese Go champion Ke Jie.

The term machine learning originates in the same period as artificial intelligence. It was introduced by Hebb and picked up by Samual in 1952. However, machine learning took its time, as the initial machine learning focus was on neural networks that were used to train artificial intelligence researchers. Only from the late 1970s and in the early 80s, machine learning started to get used for solving practical problems in terms of providing services including boosting algorithms e.g. the AnyBoost framework. Its focus shifted from the approaches inherited from artificial intelligent research to methods and tactics used in probability theory and statistics. In the late 90s, machine learning started to introduce deep learning in, for example, speech recognition – the Long Short-Term Memory of Schmidhuber and Hochreiter, followed in 2015 by the Google speech recognition program and (experiments with) face recognition, including DeepFace from Facebook in 2014. Machine learning is currently predominantly used in analysing data, real-time personalisation, including product recommendations and dynamic pricing, fraud detection, decision making and natural language processing.

Increasing knowledge and experience, growing availability and increasing affordability of computer processing power and storage, enable organisations to perform analytics on massive data sets, including external data and open data.

DATA-DRIVEN HIGH-PERFORMANCE DIGITAL ORGANISATIONS

Doing business is fueled by data. To understand data-driven high-performance digital organisation better we are taking a deep dive into data and analytics maturity and its correlation to business effectiveness. The ability to use data has become a core competency for any organisation. This requires, in addition to having the basics in place, a continuous focus on foundational data capabilities such as data quality, master data management and meta data. Data and analytics maturity improve business effectiveness and performance, and disrupts and avoids being disrupted. Let us take, after

the assessment of the data and analytics basics, a deep dive to better understand data-driven high-performance digital organisations.

DATA AND ANALYTICS MATURITY – THE NETHERLANDS VERSUS GLOBAL MATURITY

In this research, the data and analytics model, TCS DATOM™, is used to assess maturity. This model contains five maturity stages, 1) Siloed; 2) Simplified; 3) Scaled; 4) Synergised; and 5) Self-optimised.
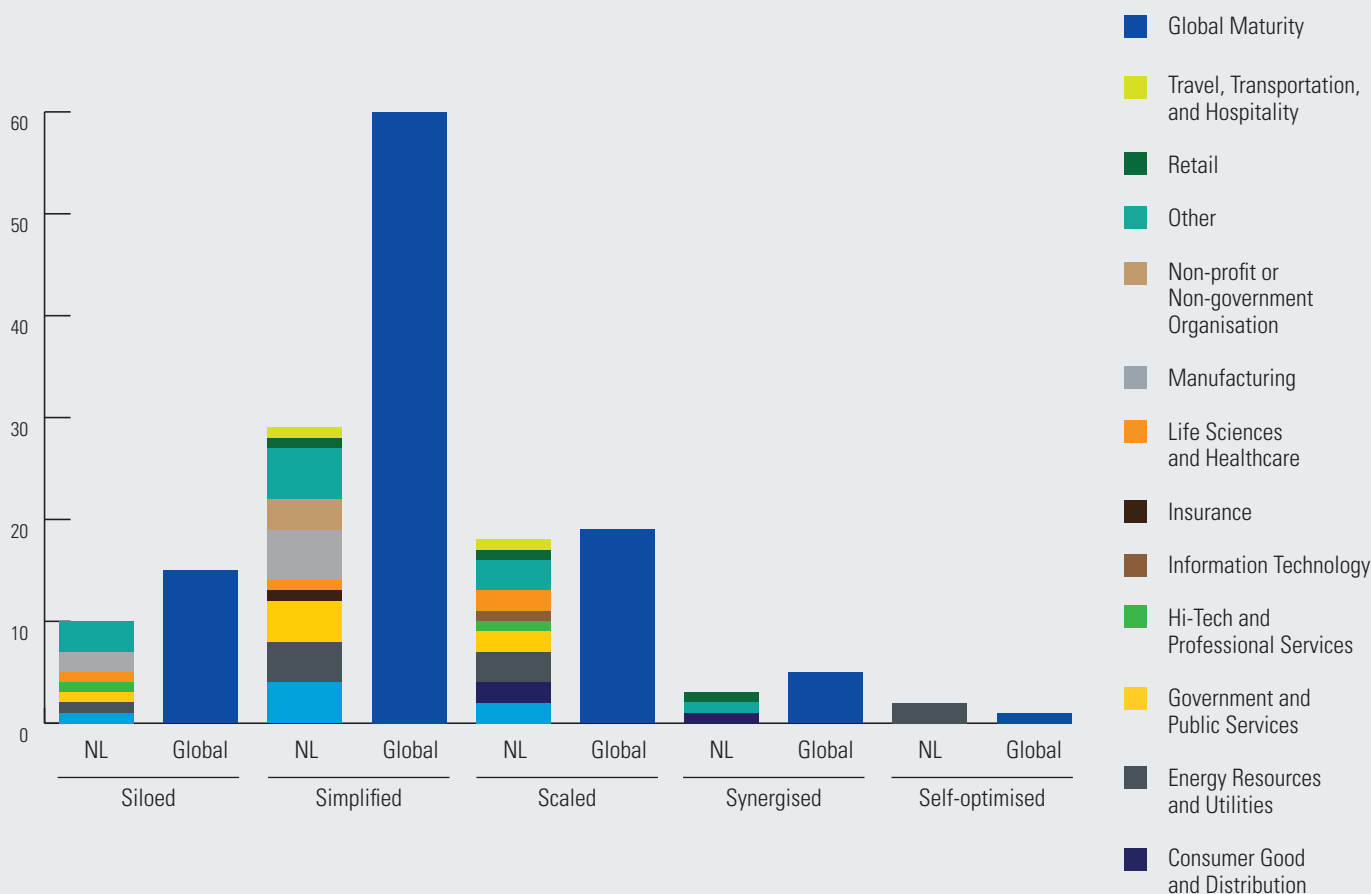

Figure 2: Data and analytics maturity levels in the Netherlands – TCS DATOM™ five maturity stages from Siloed (least mature level) to Self-Optimised (most mature level) by sector (N=62) compared with the global Data and analytics maturity levels (N=103)

The data and analytics maturity of the Dutch surveyed organisations is detailed in Figure 2.

In the first maturity level – Siloed – the seven out of twelve sectors are represented. Nearly 50% of the Dutch surveyed organisations have the second maturity level – Simplified – meaning some data are shared across the organisation. About one-third have the third maturity level – Scaled.

Only three organisations (less than 5%) participating in this research project have the fourth maturity level – Synergised. Only two organisations (3%) have the highest maturity level – Self-optimised. The two organisations at the highest maturity level both surprisingly belong to the Energy Resources and Utilities sector with a revenue over 1,000M euro.

By contrast, in the global enterprise assessments (N=103), the highest maturity level in the Utility sector is Scaled. Only a single retail company operated at the Self-optimised maturity level.

The average data and analytics maturity of the Dutch surveyed organisations is different from the globally surveyed organisations, indicated by a higher average maturity score of 1.82 for the Dutch surveyed organisations (N=62) vs. 1.67 for the globally surveyed organisations (N=103)[4]. Also, in Figure 2, the differences between the Dutch surveyed organisations and the global enterprise level assessment are detailed. The majority of global organisations are simplified, where the Dutch surveyed organisations outpace global at the scaled maturity level.

BUSINESS EFFECTIVENESS – IN THE NETHERLANDS

High-performance digital organisations are constantly looking for digital avenues of success, to increase their business effectiveness. A global TCS research study[5] – based on a survey of 1,231 senior executives across industries – shows that adopting four specific business behaviours will increase business performance and increase revenue. Therefore we are focusing in this study on the four business behaviours: 1) driving mass customisation; 2) creating exponential value; 3) leveraging ecosystems; and 4) embracing risk. These four business behaviors also for the basis of TCS Business 4.0™. This last business behavior, embracing risk, requires some context. Organisations need to move beyond rigid planning and operational barriers with an agile, strategic approach. This requires a lot of change in their operations, their culture and their business model. Data and analytics can be instrumental in making the change happen.

DATA MATURITY

There are five data maturity levels, starting with "Siloed" up to "Self-optimised".

- Siloed: Independent Tactical capability within Business Units;
- Simplified: Standardized Capabilities across Business providing strategic visibility for the Enterprise;
- Scaled: Operational Excellence for real time decisions at enterprise level;
- Synergised: Established Digital ecosystem enabling Complex Event processing across Enterprise and its Affiliates;
- Self-optimised: Intelligent Automation driven balance between human centric and machine centric decision-making using ecosystem and PESTLE data.

These data maturity levels are based on TCS' Data and Analytics Target Operating Model (TCS DATOM™).

Organisations are leveraging data and analytics across all four of these business behaviours. The combination of these four business behaviours and the ability to leverage analytics on them indicates the business effectiveness: Business Performance Score.

Improving data and analytics maturity is also important, which ranges from Siloed to Self-optimised in the TCS DATOM™ model. As data maturity is sector specific, we use the Sector Data and Analytics Maturity Comparison Score, which compares the data and analytics maturity score of an individual organisation against the average data and analytics maturity score of their sector from the global enterprise level assessments (N=103).

In this part of the study, we consider organisations with a higher than average score on the Business Performance Score, combined with a higher than average sector score on the Sector Data and Analytics Maturity Comparison Score, as Data-driven high-performance digital organisation (top right quadrant). The bottom left quadrant is labelled as Emerging data-driven organisation, where the bottom right quadrant is labeled as Data-analytics driven organisation. The top left quartile is labelled as Business-performance driven organisation. The data and analytics maturity vs. business effectiveness of the Dutch surveyed organisations is detailed in Figure 3.

---

4 The rigor of the globally surveyed organisations exceeds the Dutch surveyed organisations. The globally surveyed organisations were assessed by independent TCS assessors, while the maturity of the Dutch surveyed organisations is self-declared.
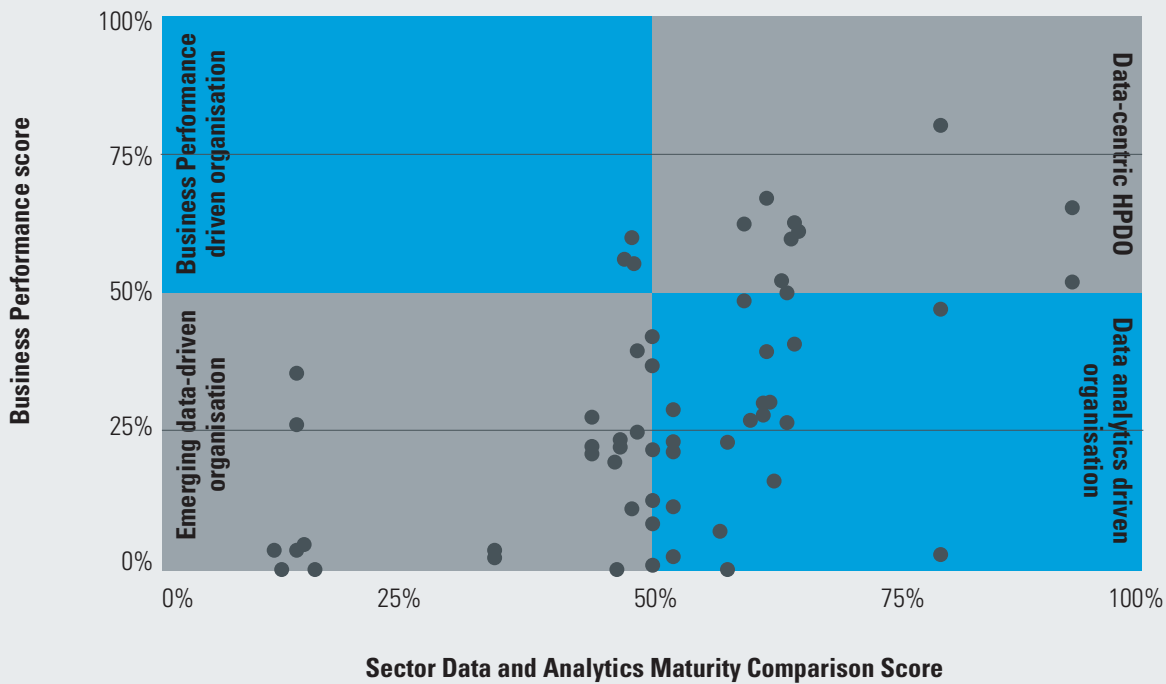5 Winning in a business 4.0 world – a TCS study tracking business 4.0™ adoption and impact.

Figure 3: Data and analytics maturity drive business effectiveness – the Netherlands (N=57). The Business Performance Score is a combination of Business 4.0™ business behaviours and the ability to leverage analytics on these business behaviours, where the Sector Data and Analytics Maturity Comparison Score is comparing the data maturity score of an individual organisation with the average data maturity score of their sector.

BUSINESS 4.0T™ BUSINESS BEHAVIOURS

- Driving mass personalisation – personalizing products and services to a market of one customer, often even of one transaction, and at scale;
- Creating exponential value – adopting business models that leverage value from transactions at multiple levels and address new markets;
- Leveraging ecosystems – collaborating with partners inside and outside the supply chain to create new products and services;
- Embracing risk – moving beyond rigid planning and operational barriers with an agile strategic approach.

These business behaviours are based on TCS' thought leadership framework Business 4.0™.

DATA AND ANALYTICS BASICS ADOPTION – IN THE NETHERLANDS

With regard to data and analytics basics adoption, over 70% of the Dutch surveyed organisations have an adoption that is proportional to their business effectiveness (N=57). There are fifteen respondents that don't match – they are in different sectors and their revenues range from very small to six organisations that generate more than 1,000M euro.

There are eight respondents that qualify as highly business effective that report a lower than expected basics adoption, where there are seven respondents with a low business effectiveness and a higher than expected basics adoption. This research indicated that analytics basics adoption contributes to business effectiveness.
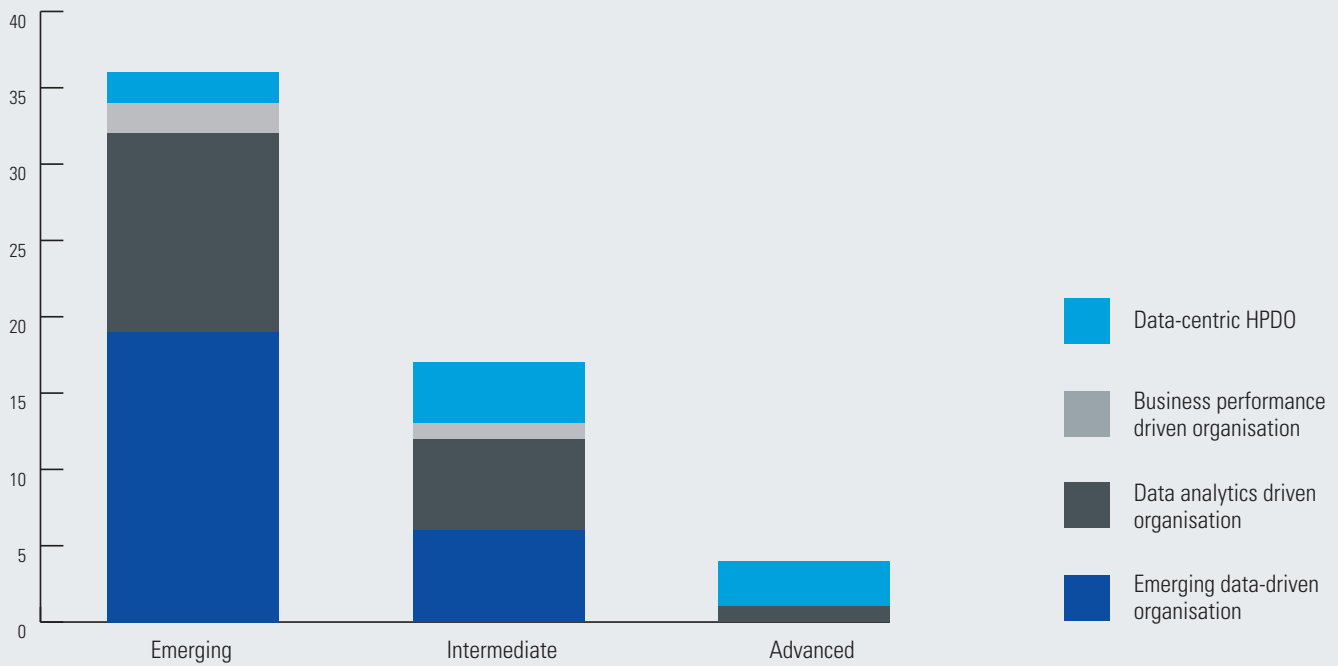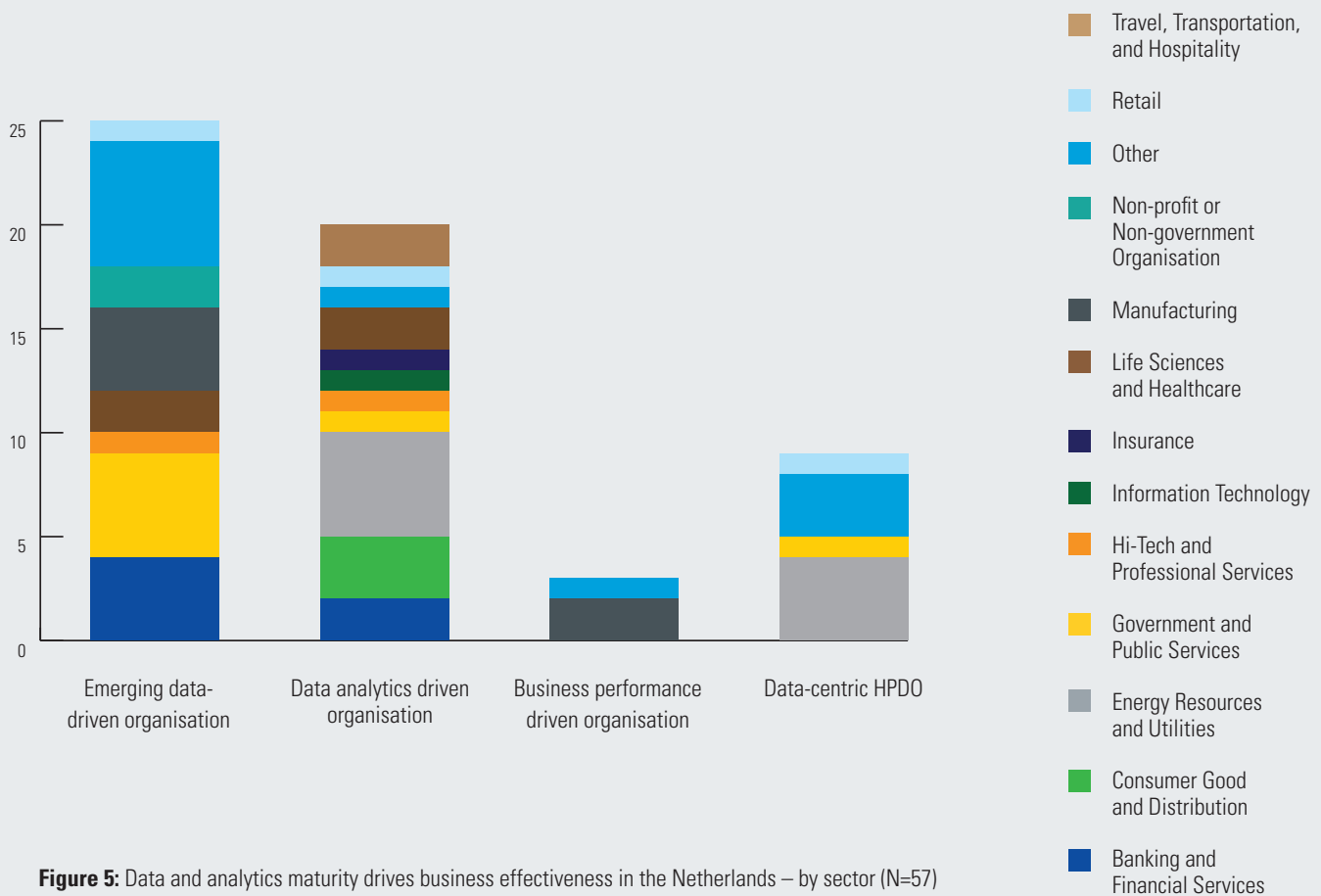
Figure 4: Data and analytics basics, aspects include five adoption levels: data management, analytics automation, type of data used, type of analytics platforms used and cloud adoption; by adoption of business effectiveness type of organisation (N=57). Respondents that have reported the adoption of none or one aspect as best in class are categorised as Emerging, respondents that have reported the adoption of one or two aspects as best in class are categorised as Intermediate, and respondents that have reported three or more aspects as best in class are categorised as Advanced.

DATA-CENTRIC HPDO PROFILE – SURVEY EXAMPLE

A large (+1.000m Euro annual revenue) energy resources and utilities organisation from the Dutch surveyed organisations is classified as data-centric HPDO organisation. Obviously, they have a high data and analytics maturity: self-optimised. They have a +10% of their annual revenue/budget spend on information technology and digital and have outsourced their analytics to a minimal degree (<10%). Additionally, they leverage any data type, including external unmanaged data and open data and invested in analytics automation, as between 50 and 75% of all their analytics is fully automized and their analytics is entirely on the cloud. Furthermore, they have set up enterprise-wide data literacy programs and embraced agile working for every process in their organisation. All this effort resulted in achieving the top-quadrant quartile: data-centric HPDO.

The Energy Resources and Utilities, Government and Public Services and Retail sectors have a high data and analytics driven business effectiveness in the Netherlands – they are Data-driven high-performance digital organisations. The latter two sectors also have Dutch surveyed organisations categorised as Emerging data-driven organisations – low business effectiveness. In addition, this also includes the following sectors: Banking and Financial Services, Hi-Tech and Professional Services, Life Sciences and Healthcare, Manufacturing, and Non-profit or Non-Governmental Organisations. Figure 5 details the data and analytics driven business effectiveness by sector for the Dutch surveyed organisations.

Figure 5: Data and analytics maturity drives business effectiveness in the Netherlands – by sector (N=57)

Legend:
- Travel, Transportation, and Hospitality
- Retail
- Other
- Non-profit or Non-government Organisation
- Manufacturing
- Life Sciences and Healthcare
- Insurance
- Information Technology
- Hi-Tech and Professional Services
- Government and Public Services
- Energy Resources and Utilities
- Consumer Good and Distribution
- Banking and Financial Services

For the Dutch surveyed organisations it is clear that size matters, to a moderate degree the largest organisations (+1,000M euro annual revenue)[6] and to a full degree organisations with an annual revenue up to 25M euro[7] show higher data and analytics drives business effectiveness – as detailed in Figure 6.

In conclusion, with 84% of the organisations outside of the data-centric HPDOs bracket, Dutch organisations have to step up and improve their data and analytics maturity to improve business effectiveness, and to disrupt and avoid being disrupted. Understanding which of the aforementioned improvement topics and measures are required, and putting them into action, is pivotal.

6 In the Dutch survey organisations, +30% of large organisations (N=5) are in the combined business effectiveness categories: business performance driven organisations and data-centric HPDO, compared to 21% based on an even proportion over the four business effectiveness categories.

7 In the Dutch survey organisations, 40% of the small organisations, less than 25m Euro annual revenue (N=2), are in the combined business effectiveness categories: business performance driven organisations and data-centric HPDO, compared to 21% based on an even proportion over the four business effectiveness categories.
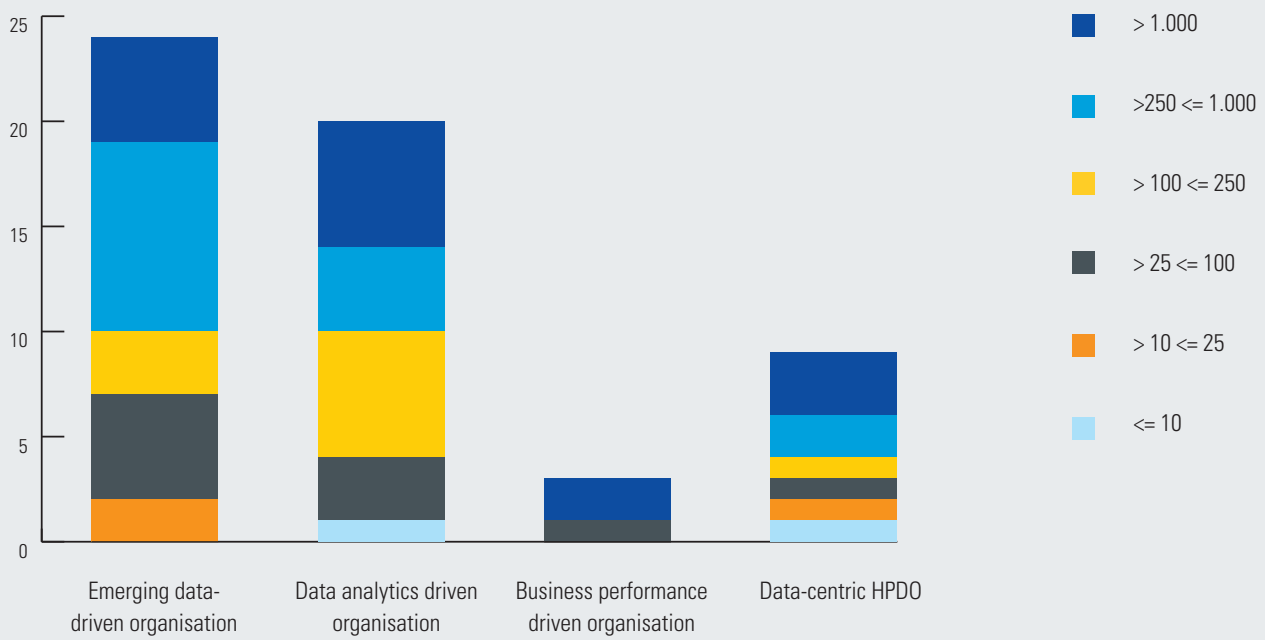
Figure 6: Data and analytics maturity drives business effectiveness in the Netherlands – by revenue category in M euro (N=56)

REQUIRED ACTION

It's important to understand what is hindering organisations from embedding analytics in their business value chain. In the workshops and interviews, four topics were identified and aligned to survey participant's lists of data and analytics improvement measures: 1) anchoring by the board of management; 2) implementing a data-driven mindset and culture; 3) investments in data and analytics; and 4) monetisation of data insights. Obviously, the fourth topic is the ultimate goal for maturing and leveraging data and analytics.

Most action is required in implementing a data-driven mindset and culture as well as developing a comprehensive data and analytics (DA) strategy and roadmap, which provides a foundation for setting investment priorities and monetisation of data insights. This is not surprising, given the emerging data and analytics maturity of the Dutch surveyed organisations.

There are also differences between the types of organisations. Emerging data-driven organisations have less of a focus on driving innovations and transformations, as these types of organisations concentrate on the data and analytics basics first. Data-centric HPDOs have more successfully put data and analytics on the agenda of their boards and better understand that their performance can be improved by focusing on internal communication, change management capabilities and data literacy. Data-centric HPDOs also focus more on addressing ethical concerns and understand the need to properly manage ecosystems to a greater degree than the other types of organisations.

Responses are grouped by the four improvement topics and corresponding improvement measures (ability to select one or more), clustered by business effectiveness type of organisation – as detailed in Figure 7. Now let us understand these four topics better.
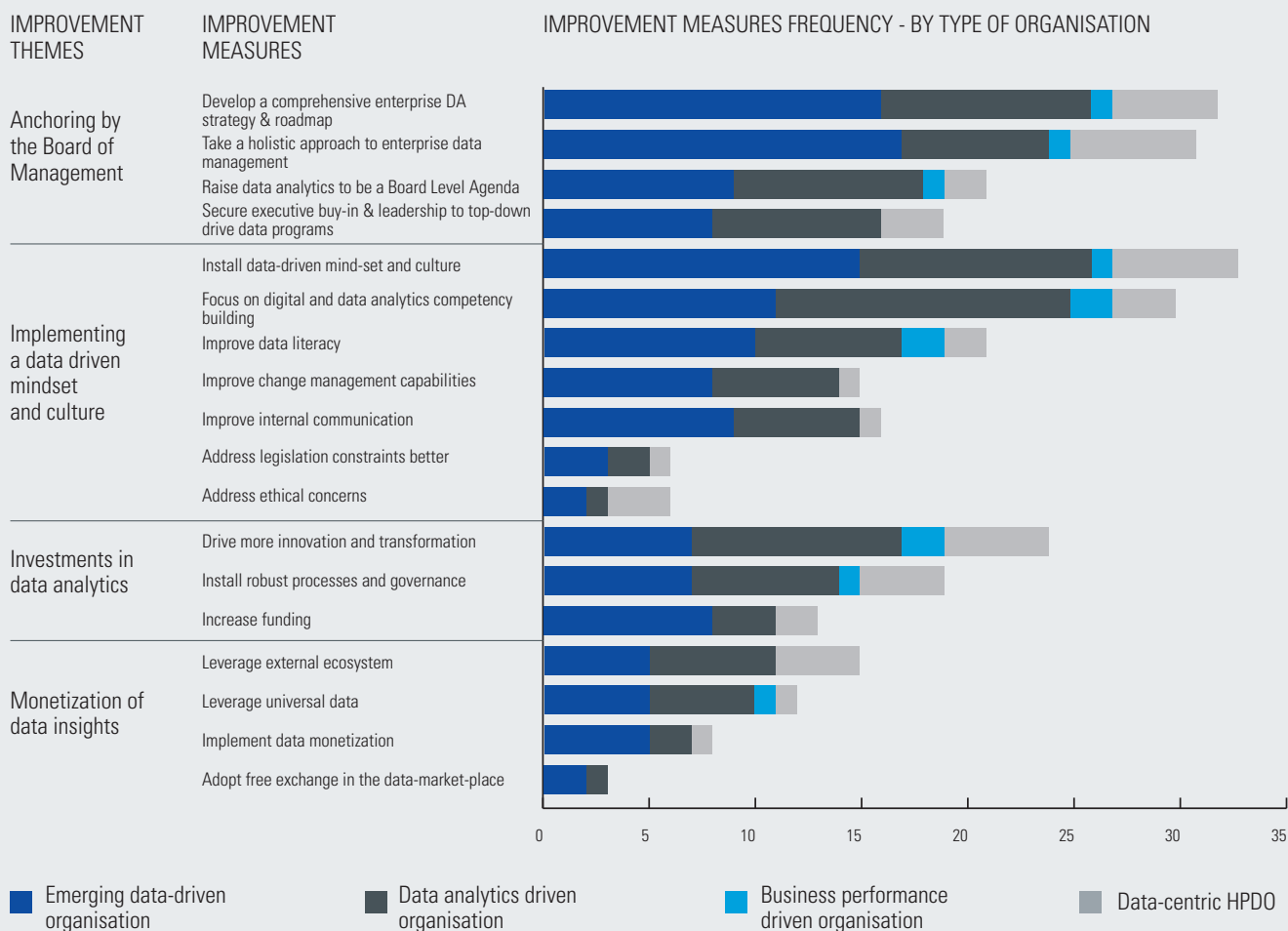
IMPROVEMENT THEMES — **IMPROVEMENT MEASURES** — IMPROVEMENT MEASURES FREQUENCY - BY TYPE OF ORGANISATION

Figure 7: Data and analytics improvement topics and measures detailed by the type of organisation – multiple answers are allowed (N=52)

BOARD OF MANAGEMENT – ANCHORING DATA AND ANALYTICS

Vision, involvement and support for data and analytics from the board of management is critical to becoming a data-driven high-performance digital organisation and, to disrupt and avoid being disrupted. The board of management must set an example for the organisation and board-level decisions and analyses must be data-driven – well beyond insightful business intelligence (BI) reports. Board members need to change their attitude from intuition to data-driven, and their decisions need to be driven by data as well. Furthermore, they need to consider investing in the automation of core practices using intelligent solutions.

By no means are board members themselves expected to conduct data analyses for their strategic explorations and decision making, but the board should set the agenda for the appointment of data and data analytics organisational structures and policies to support their decisions with proven data. Appointing a chief data officer (or chief analytics officer) is instrumental for larger organisations, since embedding accountability at the board level for data and continuous reporting and tracking of data maturity, is a necessity for any organisation. Boards remain a critical point of vigilance and should keep an eye on how their organisation's data and analytics maturity is improving with investments.

In anchoring data and analytics, board members communicate priorities and empower employees. Data and analytics need to be led from the top, combined with embedding a data-driven mindset and culture. Board members should not presume that employees understand the value of data. Remember, organisations will have many competing initiatives. Board members need to illustrate the value of data and obviously secure funding for investments.

Enterprise data management

Furthermore, enterprise data management (EDM) requires attention from the board of management. Organisations need to discuss, establish, monitor and report on data and analytics key performance indicators. Remarkably, in the Dutch surveyed organisations there is no difference between the response of smaller and larger organisations regarding their focus on EDM.

Implementing master data management (MDM), in addition to meta data, data quality, security and data policies, is key

KEES JANS:
DATA DEMOCRATISATION AND ANALYTICS REQUIRE SUPPORT OF ALL BOARD MEMBERS.

Although most boards of management recognise the value of data and analytics, in Wehkamp, an online Dutch retailer, data was at the heart of their digital transformation. That's why the skills and competencies to use data and analytics to improve processes and decision making, needed to be spread across the organisation. Kees Jans: "*Data literacy and data democratisation are important.*" The risk of a centralised group of data specialists becoming a bottleneck for the transformation was just too high. That's why the board decided to make all data, in a controlled way, available for the whole organisation and to train business process specialists to use data and tooling (e.g. analytics, Machine Learning and Artificial Intelligence) to improve their processes. Kees Jans: "*This approach fits perfectly in our Agile Way of Working where we strive for autonomous teams that are able to use data and tooling to improve forecasting, fraud detection & prevention and many other processes.*" Support is available for the teams from colleagues (peer to peer) and specialists from the supplier of the tooling.

Kees Jans, is currently non-executive IT director at Wehkamp Group. In his previous role as CTO, he was part of the Digital Transformation Team that consist of all C-Level executives.

in enterprise data management. Different from the data analytics strategy, which is generally implemented centrally by most organisations, MDM can be implemented locally for decentralised organisations. Proper enterprise data management will ensure coherence by providing guidelines, policies and tooling. These measures will reduce risks, including non-compliance, e.g. GDPR. Also, these investments need to be secured by the board of management.

Enterprise data analytics strategy

Finally, it is pivotal to endorse a comprehensive enterprise data analytics strategy, including a detailed roadmap that cuts across data driven business capabilities, foundational data & analytics capabilities and technology needs to support business expectations of data & analytics. This requires mature change management capabilities. The strategy needs to be updated from time to time and maturity assessments provide valuable input for these strategy updates. The board of management needs to ensure that proper risk management is in place.

The roadmap enables the steering committee, including board members, to set priorities and, if required, make local adjustments by the business function and/or geography, while still driving top-down data programmes. Important in the strategy, is the recognition of the ability to demonstrate successful scaling up of pilot projects.

DATA-DRIVEN MINDSET AND CULTURE – ASSESS YOUR CURRENT STATE

First of all, it is important that organisations have a clear understanding of their current data and analytics capabilities. Modern data and analytics portfolios are a complex mash up of data driven business capabilities, data cores spread across numerous information systems, a wide array of technology and skills and a data governance structure to control it all. An enterprise assessment of the reality of these capabilities becomes the first step and baseline on which to build further. Over 50% of the Dutch surveyed organisations (N=33) have never conducted an assessment, this includes three organisations that are planning an assessment in the next six months (N=3). The Dutch surveyed organisations in both the Banking and Financial Services (N=1 out of 7) and the Energy Resources and Utilities (N=3 out of 10) sectors are underrepresented in this 50%. Remarkable is the difference in the category data driven organisations, seven out of the nine organisations in this highest maturity category have conducted an assessment.
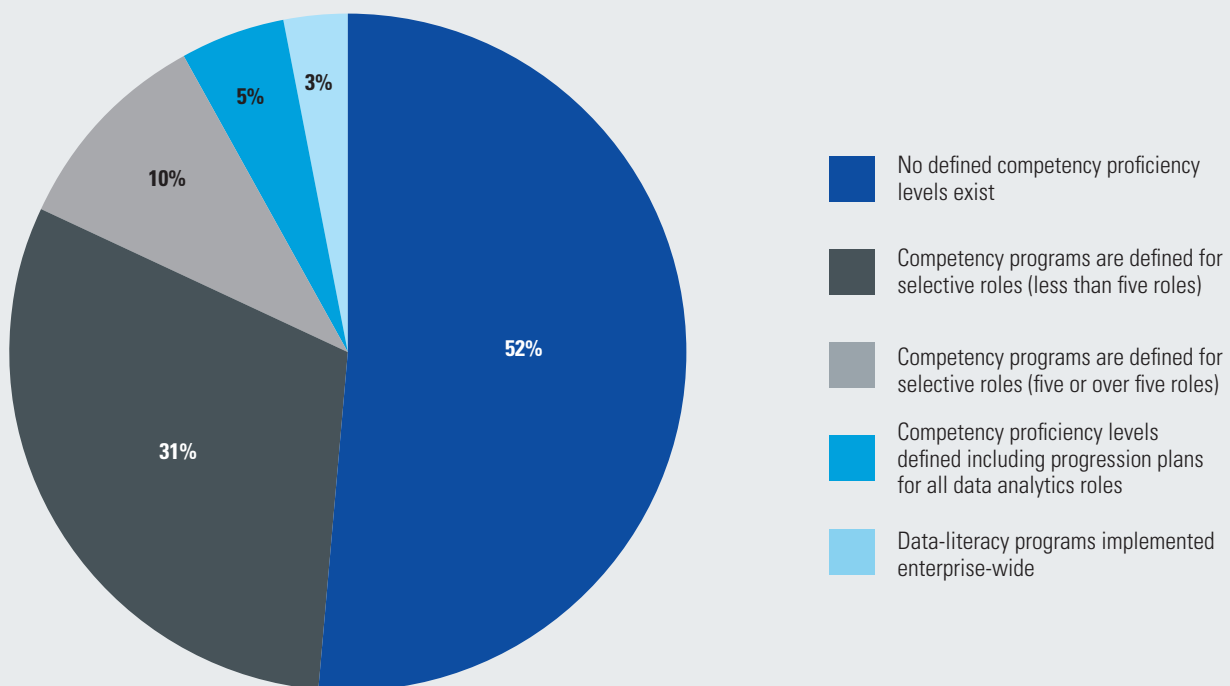

Figure 8: Defined competency-proficiency levels for data analytics (N=62)

None of the Dutch surveyed organisations in the Life Sciences and Healthcare and Retail sectors, and five out of the seven Dutch surveyed organisations in Manufacturing, conducted an enterprise assessment. These organisations are predominantly smaller, only five generate a revenue of more than 1,000M euro, where we were expecting nine organisations, based on the distribution of the full data set.

Less than 25% conducted an enterprise assessment (N=14), among which were only two organisations with a revenue of +1,000M euro. Most of these large organisations have only conducted assessments for specific businesses or functions, which is a perfect initial step towards gaining a better understanding of an organisation's overall data and analytics maturity. Performing an enterprise assessment provides input for setting priorities, building a roadmap, and tracking progress to improve data and analytics maturity.

Deriving insights

A good indicator for data-driven mindset and culture is the ability of organisations to derive insights through data gathered from processes and transactions across the business. This ability in the Dutch surveyed organisations is medium, 44% has a score of 3 or lower on a 0-7 Likert scale. All Dutch surveyed organisations in the sectors Hi-Tech and Professional Service (N=2), Information Technology (N=1), Life Sciences and Healthcare (N=4), Non-profit or Non-Governmental Organisations (N=3), Retail (N=3), and Travel, Transportation, and Hospitality (N=2) have a score of 4 or higher on a 0-7 Likert scale.

Digital and data analytics competency building

In order to derive insights, organisations need to focus on digital and data analytics competency building, also known as data literacy, including awareness, training and defined proficiency levels. This is mentioned as an improvement measure by 30 organisations, predominantly organisations with revenue under 1,000M euro (N=20). In competency building, it is important to build not only competencies at board level and in the IT function, but digital and data analytics competency building is also important in the business itself.

Most of the Dutch surveyed organisations are not very advanced in defining their competency proficiency levels. In over half of the organisations, no defined competency proficiency levels exist (N=32), and only three organisations have defined competency proficiency levels for all data analytics roles, including progression plans. There is definitely room for improvement.

Agile ways of working

It is also important to introduce agile ways of working as an embedded part of digital and data analytics competency building. The agile maturity of the Dutch surveyed organisations is low, nine of the Dutch surveyed organisations have not yet adopted agile, where 23 organisations use agile techniques only for IT projects, such as software development.

A handful of the Dutch surveyed organisations characterised themselves as organisations where agile underpins every process in their organisation (N=6). These are the only organisations setting themselves up for a successful implementation of a data-driven mindset and culture. Interestingly, these include an equal number of small as well as large organisations, where large organisations will have a greater challenge to implement agile across all processes.
In the organisations which have adopted agile in some parts of the organisation, the larger organisations are equally represented (N=9 of the 23 Dutch surveyed organisations in this category). This may indicate that the size of the organisation is not blocking the adoption of agile.

Data and analytics management and ownership

Finally, data management is important in digital and data analytics competency building, which is a pre-requisite to structurally improve data quality. The rating of data management, which includes data quality management, data governance, master data management, information lifecycle management is relatively low, nearly two-thirds score a 3 or lower on a Likert scale of 0 to 7. Senior leadership needs to set the example with data-driven decisions and operational management.

Furthermore, it is important to embed the analytics function in the business organisations, as part of Enterprise Data Management. Historically, data and data management have been owned by IT departments. However, the reality is that IT owns the architecture and support of the container, whether it is cloud, data lake, data warehouse, etc. Business organisations should be the true owners of the data inside the container, as they are best suited to understand the data and data relationships in order to ask the right questions to uncover analytical insights, given the right tools and skills training.

In 32 of the Dutch surveyed organisations, the analytics function is partly owned by the business, this includes five of the six organisations in Banking and Financial Services, 50% of the Energy Resources and Utilities organisations and 40% of the organisations in Government and Public Services. Two-thirds of these organisations are data-centric HPDOs (N=6).
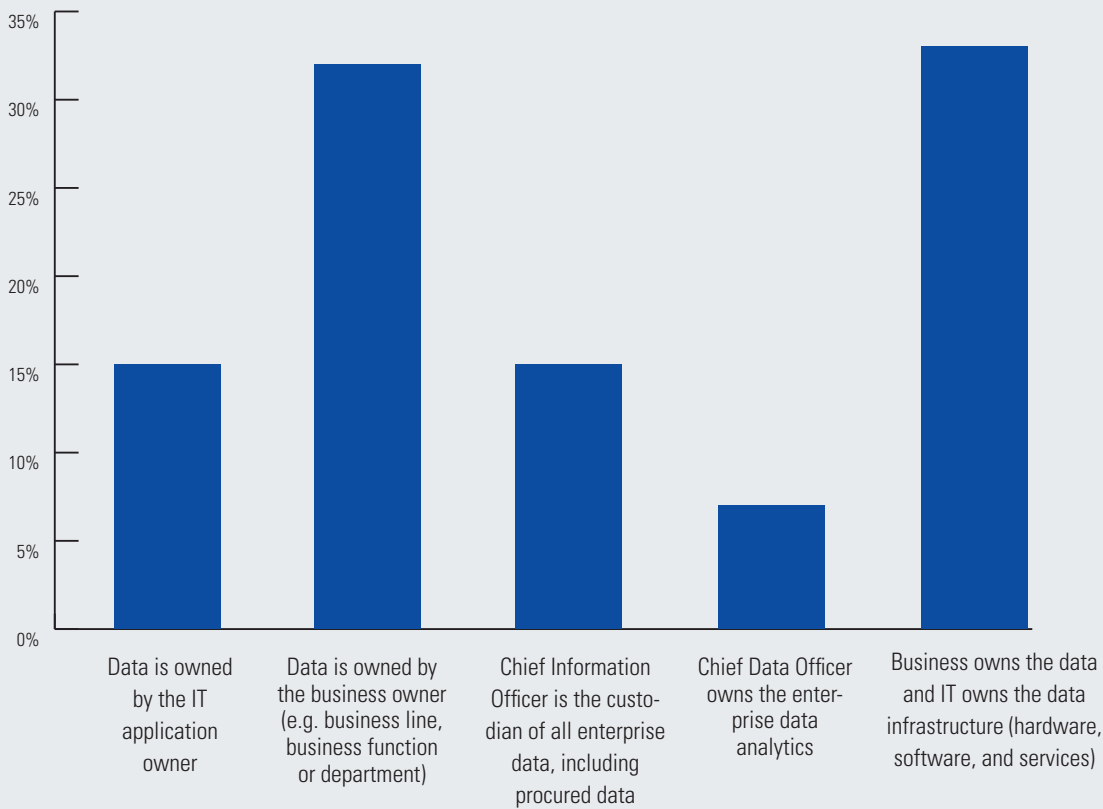
Figure 9: Data analytics function and data ownership classes in the Netherlands, multiple answers allowed (N=62)

Change management

Embedding data and analytics in an organisation requires a continuous change management effort. In the Dutch survey, 15 respondents (N=62) indicated change management as an improvement area. These were predominantly smaller organisations with a revenue of less than 250m Euro.

In the survey, two measures mentioned by the participants to support change management include 1) Improve internal communication, and 2) Improve data literacy. Understandably, larger organisations have reported significantly more need for improved internal communication (11 respondents out of 17). Their size is impacting this need. Remarkably the large organisations report significantly more need for improved data literacy as well, two-third of the responses are from organisations with a revenue over 250m Euro (14 respondents out of 22).

Furthermore, the importance of governance for change management is acknowledged by the participants of this study. This includes the implementation of governance processes as an embedded part of the change.

Finally, the participants of this study identified constructive feedback as important in change management. This includes the implementation of feedback loops and having processes in place to process the feedback.

Compliance and ethical constraints

Ethical concerns and legislation constraints are related to data ownership. Surprisingly, only six organisations reported a need for both improvement measures. Ethical concerns were predominantly mentioned by Data-centric HPDOs (N=3), where legislation constraints were mostly raised by Emerging data-driven organisations (N=3). In general, data ethics continues to develop as a growing concern, especially as organisations seek to increase monetisation of data. Concerns about ethical use of artificial intelligence and the vast amounts of personal data produced from Internet of Things, facial recognition, and continuous emerging technologies, call into question how data privacy protections will be integrated and managed. Since only six out of 62 Dutch surveyed organisations included addressing ethical concerns and legislation constraints in their responses, it can be concluded that there is much more to be done in this space.

FINANCIAL INSTITUTIONS FOCUS ON DATA QUALITY IN ORDER TO REDUCE THEIR CAPITAL CHARGES WHILST BEING COMPLIANT

Financial institutions are highly regulated organisations. Their capital charges are continuously monitored. By building a consistent data set over a 12-year period (full economic cycle), financial institutions can build their own statistical models to calculate capital. Business Intelligence manager: "*We are currently retrospectively building a 12-year data set. This not straight forward due to all the legacy applications that had historic information. This data set allows us to reduce our capital charges, which creates enormous value for the bank.*" The investments in creating this data set are substantial, but have a very short payback period.

Data governance is set at the corporate level. The bank has a data quality board, which has implemented a governance framework following the applicable regulations. Business Intelligence manager: "*The degrees of freedom in the framework are limited.*" Compliance also dictates what information has to be made available to the regulatory bodies and governmental organisations. Business Intelligence manager: "*We are working hard to align all the information and associated data to ensure we can provide all requested information automatically. This is reducing our efforts and improving the accuracy of the information to be provided significantly.*"

That leave us with the question: are financial institutions allowed to sell aggregated and anonymous their data? Obviously, this has to be done in compliance with GDPR. However, this is also an ethical question: what is the position of a bank in our society? Business Intelligence manager: "*Trust is at the core of a bank. For that reason, our data focus is on optimising internal processes and improving the customer interaction.*" The financial institution will continue to advance in these later to areas.

DATA AND ANALYTICS INVESTMENTS – SET YOUR PRIORITIES

The survey and the interviews didn't provide an unambiguous picture. Furthermore, participants and interviews had difficulties in demarcating their data and analytics investments. More importantly, they were very hesitant to share their current and future investment plans.

From the survey we learned that the respondents on average spend 18% of their budget on hardware, 33% on software and 49% on services. In the future, if adoption of cloud computing increases, then the percentage spend on hardware will be reduced as well. Organisations will benefit from performing maturity assessments in setting their data and analytics investment priorities.

We also learned that over 60% of the Dutch surveyed organisations have less than 25% external data and analytics spend. The organisation-specific knowledge required for analytics is hindering the ability of most organisations to consider full analytics outsourcing. Furthermore, internal staff are more capable of establishing connections to internal stakeholders. Organisations that invest in data literacy – bring their own staff at level. The seven organisations with an outsourcing percentage over 75% are smaller companies with less than 250m Euro revenue. These companies might lack scale to implement and maintain analytics efficiently and/or effectively. Regardless what analytics outsourcing percentage suit an organisation best, the workshop participants agreed that analytics outsourcing should be a deliberate decision.

Drive innovation and transformation

Many organisations perceive their inability to drive innovation and manage transitions as their most important inhibitor for investing in data value creation – just under 50% of the Dutch surveyed organisations. From the survey we conclude that neither size nor industry matters, except for the Energy Resources and Utilities sector (7 out of the 10 responses), for this measure. The current focus of most organisations is on improving data quality and optimising current business processes. There is consensus that data quality is a prerequisite for considering more innovative investments in data and analytics, which is indicated as a separate improvement measure by over one-third of the Dutch surveyed organisations. In order to improve data quality, many organisations focus on improving their data governance including policies and processes. True innovation in data and analytics is still aspirational for many companies.

AUDREY COUTINHO:
DATA LITERACY AND MORE DATA LITERACY

In 2018, Audrey Coutinho, Chief Data Officer of Elsevier initiated the discussion around the importance of data literacy to build a data culture and improve the success of data programs. This led to the set-up of the Data Literacy Forum consisting of about 20 senior leaders representing all parts of the business who were introduced to the concept of data literacy and how it could benefit the people and organisation.

Subsequently, a pilot assessment was designed consisting of 20 questions covering core competencies of data literacy to test existing levels and appetite for the subject. An organisation wide communication was sent out introducing the concept of data literacy and seeking volunteers to participate in the pilot. "*We were pleasantly surprised to receive over 250 respondents to the communication representing management and staff as well as a good spread of participants from across the business functions and geographies.*" The pilot was very well received and provided many insights and these participants have become true ambassadors of the data literacy program.

Currently, Elsevier is in the midst of finalising an initial learning and assessment module based on the competency framework which will be rolled out to the entire organisation. The initial module will provide links to associated training/learning to develop the learner's competencies based on their individual personas. Employees have an intrinsic motivation to participate in the assessments and are signing up for these trainings. This will support the development of a data-driven mindset and foster a data culture.

Audrey Coutinho: "*We are well advanced on our journey to address master data which is core to the organisation. Through this program we are also raising awareness of the importance of data governance, quality and accessibility to advance analytics.*" Many of our people are acutely aware of the challenges, pain and difficulty of working with fragmented data with varying levels of quality, so bringing them onboard has not been a difficult sell. However, what is important is for the wider organisation to understand the impact and benefits of good data quality and governance and this is where data literacy will play a critical role in the success of democratising data and monetizable data programs.

From the participants we also learned that, similar to digital transformations, fail fast and acceptance of failure are also important in data and analytics transformations. Life cycle management sets investment priorities and supports these transformations.

Increasing funding
Quite remarkable was the low number of organisations that reported funding as a measure to increase the value from data and analytics – less than 25% of the respondents, where neither size nor sector mattered.

Building a business case is required at all times. Some business cases are built on increased legislation, such as GDPR, where investing in data and analytics is simply needed to remain compliant.

However, setting investment priorities for data and analytics remains important. We learned that more mature organisations are currently able to create more value with flat budgets, consolidation of tooling and optimised outsourcing. However, data and analytics investments also require a strategic point of view to ensure organisations achieve their objectives. Data and analytics strategies are set investment priorities, and potentially open up opportunities to increase budget, if there is a positive business case aligned with the strategy.

MONETISATION OF DATA INSIGHTS – THRIVING IN THE DATA ECONOMY
Monetisation of data is the ultimate goal of investing in the maturity of data and analytics. The focus of monetising is to support the business model. Once the data and analytics investments have been made, the data insights gained will be the guide towards monetisation. Monetising goes beyond "selling" data. There are three different types of monetisation: 1) improving internal business processes & decisions; and/or 2) wrapping information around products & services; and/or 3) selling information offerings to new & existing markets, a.k.a. commercialisation.

There were only eight organisations that reported the implementation of data monetisation as an improvement area,

were we would expect a much higher response given the low monetisation maturity of the Dutch surveyed organisations – see below. These are all smaller organisations – none with a revenue of more than 1,000M euro. The eight organisations included two in the Banking and Financial Services and two in Energy Resources and Utilities sectors.

Monetisation maturity
Survey data on monetisation maturity contradicts the above-mentioned low response on monetisation as an improvement area. The Dutch surveyed organisations did not rate their ability to monetise very high, over 50% had a score of 2 or lower, of which over one third ranked 0 on a Likert scale of 0 to 7.

In general, more mature organisations are better able to monetise data insights. Interestingly, a cluster of eight orga-nisations had a high data and analytics maturity (Scaled and Synergised) and a low score on monetisation of data insights (0 or 1 on a Likert scale 0-7). This cluster consists of five organisations with a revenue over 250M euro, including one organisation with +1,000M euro and covers a large variety of sectors, including Hi-Tech and Professional Services, Retail, Banking and Financial Services, Consumer Goods and Distri-bution, Information Technology, Life Sciences and Healthcare and Energy Resources and Utilities.

On the other hand, there are five organisations which have a relative low data and analytics maturity (Simplified and Scaled) but a HIGH score on monetisation of data insights (5 or 6 on a Likert scale 0-7). This cluster consists of three Manufacturing organisations, three large organisations with a revenue of +1,000M euro, and two small organisations with a revenue between 25M and 100M euro. This outcome of the survey challenges that data and analytics maturity is positive-ly related to monetisation (N=5+3).

It is also important to realise that monetisation requires chan-ge, and change potentially increases the risk profile. There-fore, the participants of this study concluded that change takes courage. Nevertheless, the importance of monetisation is undisputed.

ERIK JANSE:
POWERING OFFERINGS WITH DATA IS THE NORM

The labour market is in motion, demographics have their impact and as well the demand for increased flexibility. The offerings of temp agencies are heavily investing in data and analytics to enable their workforce solutions. This was initiated one year ago with the endorsement of their central data strategy. Erik Janse, Chief Information Officer Manpower Group Netherlands: "*Our offerings will include advisory services. These services are data driven and are expected to generate significantly higher margins than our traditional temporary work services.*" Also, in the matching process, data is pivotal. Further-more, Manpower will invest in artificial intelligence.

The GDPR legislation sets requirements for the moneti-sation of data. A strict governance programme is being been implemented. Erik Janse: "*We will launch the implementation of governance in the Netherlands. The objective is to ensure we create a single source of truth to maximise our ability to monetise our data.*" A key success factor is the personal involvement of the board of management and senior management – this commit-ment and dedication makes the difference.

Ecosystems

Only 15 organisations indicated the leveraging of external ecosystems as an improvement measure, of which 13 organisations have a low score on the ability to monetise – a score of 3 or lower on a 0-7 Likert scale. These organisations include 50% of the Dutch surveyed Energy Resources and Utilities sector (N=5).

We observed a similar trend for the measures: adoption of a free exchange in the data-market-place (N=3) and leveraging universal data (N=12). The organisations, which reported these two measures, have a low score on ability to monetise. For the measure: adoption of a free exchange in the data-market-place, all three organisations have an ability to monetise score of 2 or lower on a 0-7 Likert scale. Where for leverage universal data, all twelve organisations have a low monetise score, except for one Retail organisation with a revenue of +1,000M euro, which had a monetisation score of 3.

Focusing on implementing external ecosystems, the adoption of a free exchange in the data-market-place and leverage universal data will improve the data insight monetisation capabilities of organisations.
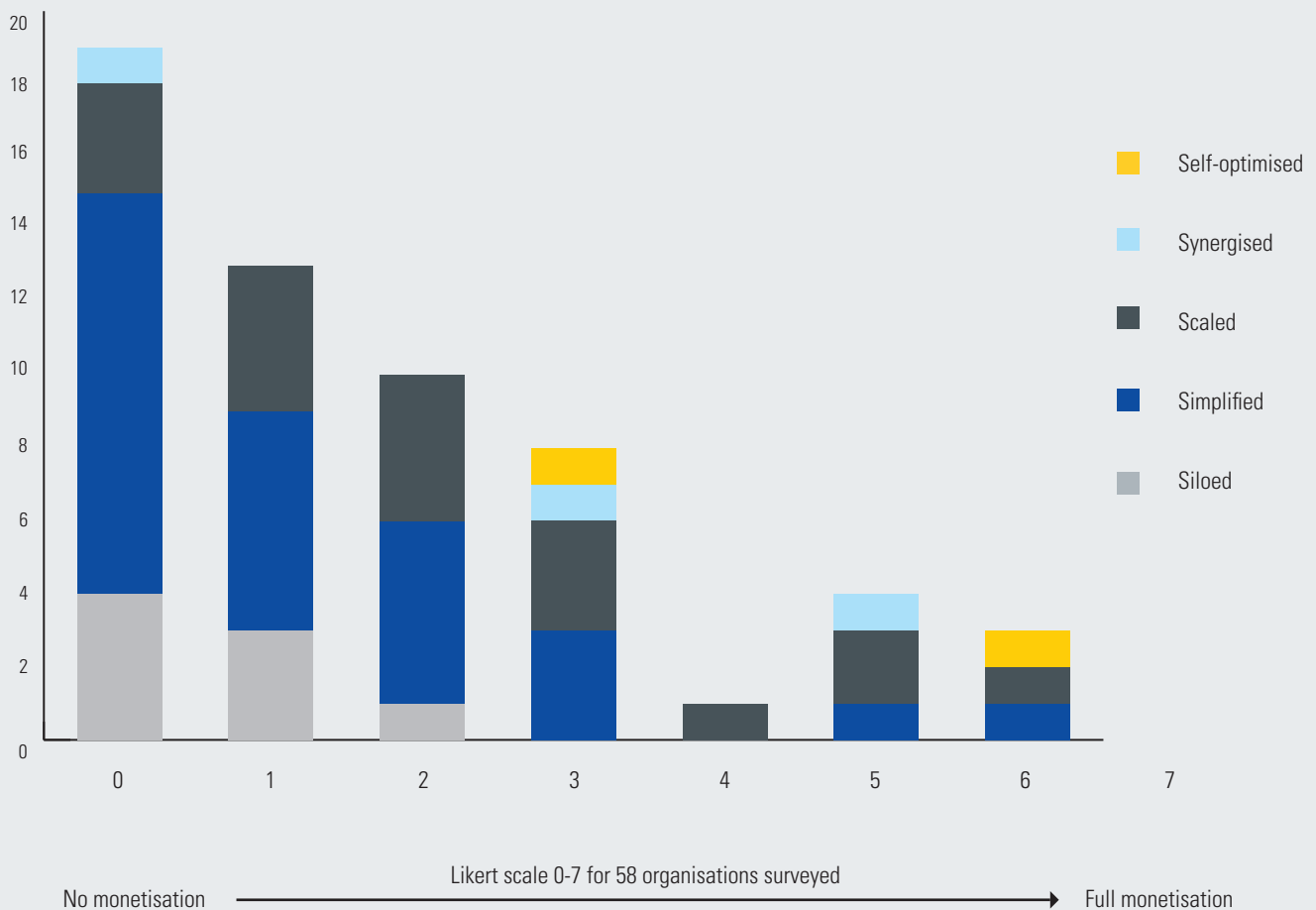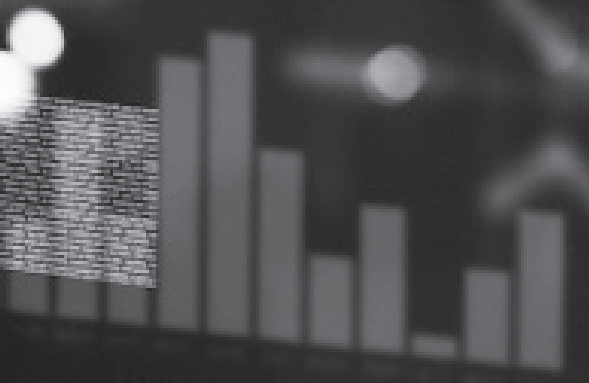

Figure 10: Monetisation of Dutch organisations on a Likert scale 0-7 grouped by data and analytics maturity – Siloed, Simplified, Scaled, Synergised and Self-optimised (N=58)

CONCLUSION

Data and analytics correlate to business effectiveness and performance. Furthermore, the analytics basics adoption is a good indicator for this correlation. The data and analytics maturity in the Netherlands is low to medium, but emerging and more mature than the average global maturity. In the Netherlands, not only are investments planned, but of equal importance, the board of management of many companies has taken ownership and developed a vision and endorsed a strategy. Also, senior leaders are more often making data-driven decisions and managing their operations by insights gained from data and analytics. Furthermore, many organisations have initiated programs to implement a data driven mindset and culture. This is changing business processes and models, and these changes should not be underestimated. Employees need to have different capabilities. Successful organisations put a significant effort into data literacy and regularly assess their data and analytics maturity to set the right priorities at all times.

All of this will enable monetisation of data insights. Initially, the focus is on optimising internal processes. Some organisations have initiated and actively participated in emerging data eco systems. Organisation which have fully embraced data eco systems take the full benefit.

A lot of companies have initiated pilots to wrap information around products and services. In all fairness, most organisations are not fully benefiting from these pilots, they are also struggling with upscaling these initiatives. Selling information offerings to new and existing markets is neither feasible now nor in the near future for most organisations. But undoubtedly over time, the monetisation will increase, amplifying business effectiveness and performance. This demonstrates that data-driven business behavior pays off.

CASE STUDY RIJKSWATERSTAAT[8]:
ANALYTICS SERVING THE PUBLIC GOOD
Data is at the core of Rijkswaterstaat (RWS). They designated "Data and IT" as one of six focus areas and continuously focus on improving data quality and accessibility both within RWS, as well as to the general public and businesses. Roeland Allewijn, Chief Data Officer (CDO): "*We are working to make the Netherlands safe, secure, attractive and accessible for all. Achieving these objectives is impossible without this focus.*" RWS is facing four data and analytics developments: 1) Increased complexity and interconnectedness of tasks; 2) Increased data volumes; 3) Increased need/ desire to provide public access to data and changing government roles; and 4) Increased data driven decision making. In view of these developments, data maturity is pivotal.

RWS is well on its way towards data literacy and invested in familiarising the directors and head of departments. Data literacy is cascaded to the teams via information and discussion sessions, as well as training programs. RWS has established a Datalab the number of data scientists and data engineers is currently about 20 and still counting. However, onboarding talent remains a challenge. The RWS data strategy entails a focus on unambiguous data conventions and standards, IT architecture rigor and optimisation of data management processes, and recognises the need for qualified staff. Roeland Allewijn: "*In my role as CDO I'm connecting the dots. We are currently working on further improving data quality of the 10 most critical data sets.*" A good measure for the success of their approach is the participation of departments.

Although initially not straight forward, the departments have embraced data. The role of the CIO-office was important to get buy-in from departments, in addition to top management support via the overall i-Strategy of RWS. They both fully supported the evangelist approach of the CDO.

Chief Data Officer

In his role as CDO, Roeland Allewijn focuses on four topics. First, business intelligence to enable data exchange and insights within RWS and with partners. In order to improve business intelligence, he and his team are working on further improving data management – the second topic. Fostering innovation and supporting implementations is the third topic. Roeland Allewijn: "*Scaling up innovation is key for me. Let me share an example. We initiate a pilot project to track traffic and anticipate on road accidents. We developed prediction models by analysing data. The arrival time at accidents for our high way inspectors was reduced significantly. This improved road safety and avoids congestion and delays. Today a lot of roads in the Netherlands benefit from the insights presented by our analytics models.*" Finally, the CDO is managing data alliances with external partners. This facilitates exchange of data, enables current and future innovations and unlocks data pilots.

Sharing data

Currently RWS is running the AIRBIM program (Areaal Informatievoorziening Rijkswaterstaat / Bouw Informatie Management). The program focuses on improving information management and exchange related to RWS objects, such as roads, dykes, bridges and tunnels. The program integrates a large number of central and regional systems and enables the exchange of data within RWS and its partners, such as builders. The Object Type Library (OTL), based on central data definitions, is key to this program. Also, enterprise and IT architecture provide good guidance and context for this program. Roeland Allewijn: "*Programs of this size and impact are not easy and straightforward but essential. We are getting there; this program will significantly improve our ability to engage with our partners.*"

RWS also shares much of their data and is a main contributor of open data, such as AHN (Actueel Hoogtebestand Nederland), national key registrations (BGT, BRO) and traffic information, including status of bridges (open or closed). Internet of Things has an important role in sharing this data. Roeland Allewijn: "*Obviously the open data we share is GDPR compliant. We never share personal and individual data. The data we share is aggregated data.*" Sharing open data is an import part of RWS' public role.

Sharing insights

One of the most important pain points in RWS is siloed data, which is partly addressed by the AIRBIM program. Roeland Allewijn: "*We have over 200 years of experience and data. The data has been collected and managed by departments. We are enabling data consumption across departments as there is value, but also a need. Legislation enforced us, for example the Environment and Planning Act (Omgevingswet). With this law the Dutch government wants to combine and simplify the regulations for spatial projects. For RWS, this requires combined input from multiple directorates and their departments, such as "Traffic and Water Management", and "Water, Transport and Environment", and the regional organisation units.*"

RWS benefits from improved accessibility. The required data collection and verification effort have been reduced significantly. RWS is currently also aligning data and analytics budgeting: a central budget versus directorates and department budgets. Pivotal to enable sharing of data, is the RWS Data and Information Management council. This council sets the tone from the top, as the managing directors of the directorates. Chief Information Officer, Perry van der Weijden, from the Central Information Technology directorate, is the chairman of this council.

Next level

RWS is enhancing their data strategy with a focus on data governance and attracting talent. Improved data governance will elevate data quality, increase the ability to exchange data, and provide data driven insights. Data governance will enable RWS to further increase the value of data and analytics and enable RWS to serve the public better.

---

8   Rijkswaterstaat is part of the Dutch Ministry of Infrastructure and Water Management and responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands.

CASE STUDY VIVAT: SELF-ORGANISED SUCCESS

For nearly a decade VIVAT, an insurance and asset management company, has focused on data and analytics. Data is one of four pillars of their corporate strategy and instrumental for the other three pillars: innovation, customer intimacy and digitalisation. Marcel van de Lustgraaf, general manager @ VIVAT: "*This focus was pivotal for us, to meet our compliance obligations, but of equal importance in value creation.*" Marcel's dedication and determinisation was essential for this journey.

VIVAT is the holding company of the brands Zwitserleven, Reaal, nowGo (three insurance labels) and ACTIAM (asset management), employing about 2.200 employees. This includes +300 IT professionals including 30+ data specialists. The industry has to deal with a significant level of compliance obligations, from regulatory bodies such as the Dutch National Bank, e.g. IFRS 17 and Solvency II, on top of general compliance regulations such as GDPR. This is increasing the need for data and analytics maturity.

Journey

In 2011/2012, the introduction of agile ways of working was the start of VIVAT's realisation that data was the new gold. Marcel empowered his organisation to form scrum teams. Initially the executive board was hesitant, but his employees were enthusiastic from the start of the journey. Marcel van de Lustgraaf: "*I quite well remember the kick off session, which was initiated and organised by one of my employees.*" Over 150 employees joined, a resounding self-organised success!

VIVAT also stimulated the development of the data community and freed up training budgets. Furthermore, VIVAT is partnering with universities such as The Jheronimus Academy of Data Science, founded by Tilburg University and Eindhoven University of Technology. Today over 35% of employees are active Power BI users. Data driven decision making is the norm, however data awareness remains important. VIVAT empowers their employees and works with external consultancy companies to ensure they are on the right track. This is not limited to measuring data and analytics maturity, but also their information technology costs are frequently benchmarked. Furthermore, VIVAT has a small external pool of technical resources to meet temporary demands.

The heart of data management is VIVAT's data governance. They have appointed a data governor, a.k.a Chief Data Officer, which reports into the Chief Technology Officer. The data governor engages with the data owners for the three

domains: operations, finance and commercials. These data owners have application owners, which will be transformed into delegated owners for sub domains of the data to improve data value creation opportunities.

The efforts on data management have paid off, the data quality is at level. Data is published on dashboards, including mobile access, which increased the adoption rate significantly. The current focus is on process optimisation. VIVAT is heavily using big data for fraud protection, document handling/ classification and separating medical data from general data. They are experimenting with speech to text. Marcel Lustgraaf: "*The next level is using data for improving customer value.*"

Agile way of working
Over the years, VIVAT introduced an agile way of working as a gradual transformation, now fully adopted. The business and IT are working seamlessly together. The benefits are obvious. The teams are self-organised and managed by team managers. VIVAT removed the head of department roles. Marcel Lustgraaf: "*The HR department is focusing on developing the workforce, as good teams don't need line management.*" The SAFe framework is instrumental in setting project priorities. There are quarterly Program Increment Planning events which are also linked to the budgeting process to enable a continuous alignment of priorities in these portfolio meetings. An important success factor is the product owner capabilities, no comprise. VIVAT only appoints product owners which are up for the job. A core responsibility for product owners is setting priorities, they are not the project manager. Furthermore, measuring progress is essential, this is not limited to agile team performance. Marcel van de Lustgraaf: "*We measured, amongst others, the effectiveness of our cycle time and concluded that a reduced cycle time will improve our efficiency and effectiveness.*" Continuous optimisation is an embedded part of VIVAT's culture.

Challenges
Despite the rigor, digital pipeline and governance, VIVAT needs to stop projects more proactively. This will free up resources and budget, and further optimise the agile way of working. The real challenge is in aligning the strategy and setting the priorities across the agile teams. Over the years, VIVAT has reduced their application landscape significantly, resulting in shared and very cost-effective IT operations. However, this is also causing challenges, applications are used by multiple domains such as pensions, life or non-life. To set priorities across Agile Release Trains is, despite using

the SAFe framework, not straight forward. VIVAT's architecture and limited scale is hindering cross-domain priority setting. It is important that the agile team focuses on delivering the functionality instead of fighting cross-domain battles. Cross-domain priorities need to be set during the quarterly Program Increment Planning meetings. However, a very high level of technical detail is required in the quarterly meetings to make informed decisions. Currently, VIVAT is revisiting their architecture and the availability of IT resources per application. Also, improvements in the quarterly Program Increment Planning events are explored to overcome these challenges.

Outlook
VIVAT is about to implement future teams to facilitate the platforms. Standardisation of the infrastructure will increase time-to-market and enable security by design. This will enable the agile teams to fully focus on the implementation of solutions, reduce technical resource constraints and simplify cross domain priority setting.

Finally, after closure of the intended acquisition by Nationale Nederlanden and Athora, the business strategy will be reassessed. We will learn shortly if data will remain an important element of their business strategies – for sure it will be.

CASE STUDY TATA STEEL EUROPE: WORLD ECONOMIC FORUM RECOGNITION

Over about four years, Tata Steel in Europe has been driving data and analytics, which was recognised by the Word Economic Forum (WEF) in 2018 by inducting the Dutch operation into their prestigious global community of Industry 4.0 lighthouses. Svend Lassen, Head of Reporting and Data Analytics in Commercial, and his team are creating value in Sales & Marketing, Supply Chain and Logistics. Next steps for Tata Steel in Europe are expanding data usage in decision making, installing cross-functional data governance, and consolidating data and analytics tooling.

Tata Steel in Europe (TSE) has operations in 26 countries running more than 100 production lines. They serve several hundred large customers and many smaller customers utilising hundreds of partners in their vendor landscape, from raw materials suppliers to logistic partners. TSE is focused on levers to make their supply chain more robust and to ensure smoother fulfilment of plans – also enabling faster interventions on supply chain issues. Optimising the product mix and making better sales choices, e.g. allocating volumes and bringing differentiated products to clients, are equally important. Data and analytics can create a lot value. Svend Lassen: "*Data and insights increase our profitability and margin, they reduce capital employed and improve the cashflow, as well as elevate customer satisfaction through a higher delivery performance. These are all very necessary improvements given the current market conditions.*"

Strategy

The Executive Board understands the importance of data. Senior leaders are more frequently asking for data to make decisions and are thereby setting an example. Business functions, such as Manufacturing and Commercial, are in the lead for applying data and analytics for business value. The Commercial data strategy thereby includes three key elements: 1) improve customer experience by better understanding the markets and customer needs; 2) create value chain excellence by integrating decisions across sites and functions, optimising the product portfolio and driving delivery performance; as well as 3) acting responsibly by minimising resource usage, linked to the Corporate Social Responsibility agenda. These set the priorities for the Commercial Reporting and Analytics team.

Use cases

Let us take a closer look at TSE's use cases. Svend Lassen: "*We have a comprehensive and interconnected ecosystem of*

use cases." One of the earlier use cases is Demand Forecasting, which allows TSE to predict the customer demand better and in more detail, than even their customers do. It builds on an optimum blend of nine generic forecasting models. The forecasting improves the internal planning process and helps optimise the product mix, resulting in improved margins and customer satisfaction. It also provides input for making strategic choices related to the product and client portfolio. In the future, TSE is considering sharing forecasts confidentially with customers and logistics partners.

Better forecasting also drives the second use case of production prognosis for logistics planning – targeting a two-week horizon. There are a lot of dependencies in production, as well as a re-prioritisation due to urgent customer orders and production irregularities. Currently, the planned completion date in the systems is only a 35% valid predictor for the actual production completion of steel products. Other factors are now considered in a machine learning model as well. A more accurate production date improves the allocation of more cost-effective transportation and increases the utilisation of transport over water instead of rail or roads. Svend Lassen: "*We have increased the forecasting accuracy to 80-90%. We thereby avoid a lot of rush transports and associated costs and hassle for our customers.*"

Most recently, TSE has implemented a digital twin of their supply chain in Ijmuiden, the Netherlands, called Virtual Mill. It includes all the assets, storage and transport capacities as well as the possible material routes. Any volatility in order volumes as well as capacities can be simulated. The digital twin has automatic data feeds, as for instance the maintenance plans and capacity forecasts for each production line. Svend Lassen: "*We are showing the simulation results as well as supply chain opportunities and risks in an interactive dashboard – the Supply Chain Control Tower – to ensure ease of use for the business functions.*"

Analytics maturity

The current data maturity has improved significantly over this journey. TSE has standardised capabilities across business functions and is able to provide real-time data for decision making. The focus is currently on the Manufacturing and Commercial functions. Svend Lassen: "*We performed the TCS DATOM™ assessment a couple of years ago. We had the lowest score – Siloed. In a more recent assessment, we improved our maturity significantly. We are currently at the second maturity level – Simplified and are entering into the third level – Scaled.*" As a next step, TSE is exploring the expansion of data governance across the company and all functions including Finance and Procurement. Master Data Management is pivotal – thinking of consolidated and consistent views on customers or products on TSE level. To facilitate cross-functional data management, TSE has appointed a central data officer as a new data governance role.

TSE is managing their data on a new cloud-based data and analytics platform. The security challenges are tackled by TSE's IT function in conjunction with external (cloud) service providers. They manage the development and maintenance of the platform and take care of identity and access management, including encryption. Data sets are shared upon demand with selected users that are allowed to have access. Svend Lassen: "*Making qualitative data and meta data available, while ensuring confidentiality, requires active data stewards in the business functions.*"

TSE are currently facing significant margin and cost pressure, which means that any development must have a business case and a payback time of 12 months. Budgets are scrutinised, which is not any different for data and analytics. Tooling rationalisation contributes to the cost reduction targets: reduced licence and maintenance costs, as well as replacing external with internal staff. Svend Lassen: "*Despite the strict business case requirements and reduced budgets, we are able to increase the value. We are leveraging our learnings of the last years.*" These are not limited to Europe because of an exchange of know-how within the Tata Steel Group, also the Indian sites. Svend Lassen: "*Transferring algorithms and code is not always possible, but sharing value levers and approaches is a good practise, which increases speed and reduces risks and costs significantly.*"

End game

The end game vision is a fully digitised business model – as if operating TSE through an App on a phone with very limited human intervention. Think algorithms to set the product price – all underlying processes can be fully automated. What is left are focus on decision making, personal relationships in the steel ecosystem, driving change and integration as well as developing and consulting on the best products for customer applications. Svend Lassen: "*We will have a fully digital business model and, at this time, we must be CO2 neutral. The two are not fully related, but both require a lot of focus. Ultimately, we will get there.*"
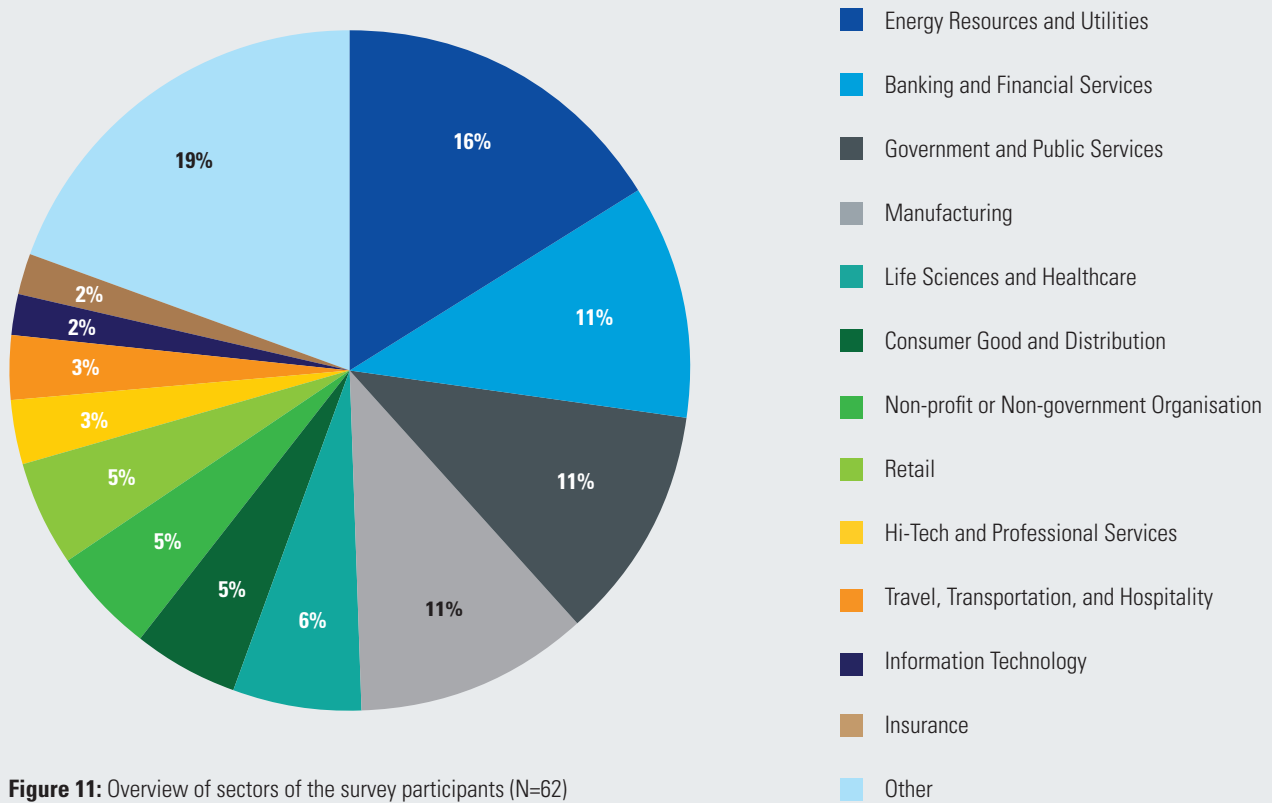
APPENDICES

SURVEY PARTICIPANT DATA

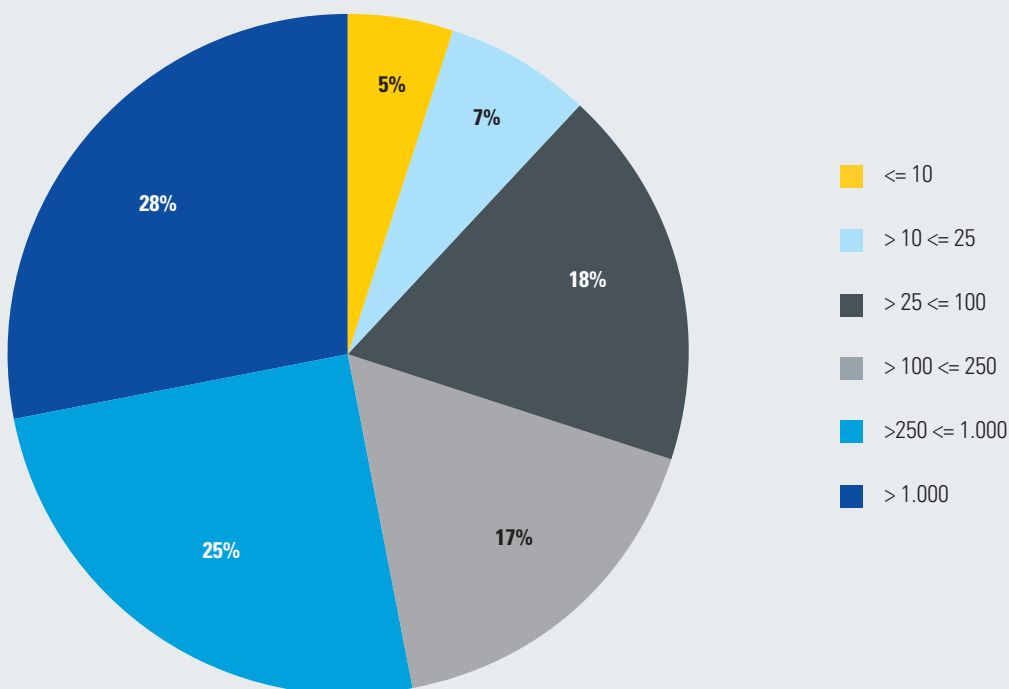**Figure 11:** Overview of sectors of the survey participants (N=62)

Legend:
- Energy Resources and Utilities
- Banking and Financial Services
- Government and Public Services
- Manufacturing
- Life Sciences and Healthcare
- Consumer Good and Distribution
- Non-profit or Non-government Organisation
- Retail
- Hi-Tech and Professional Services
- Travel, Transportation, and Hospitality
- Information Technology
- Insurance
- Other

Figure 12: Overview of revenue in M euros of the organisations of the survey participants (N=60)

Legend:
- <= 10
- > 10 <= 25
- > 25 <= 100
- > 100 <= 250
- >250 <= 1.000
- > 1.000
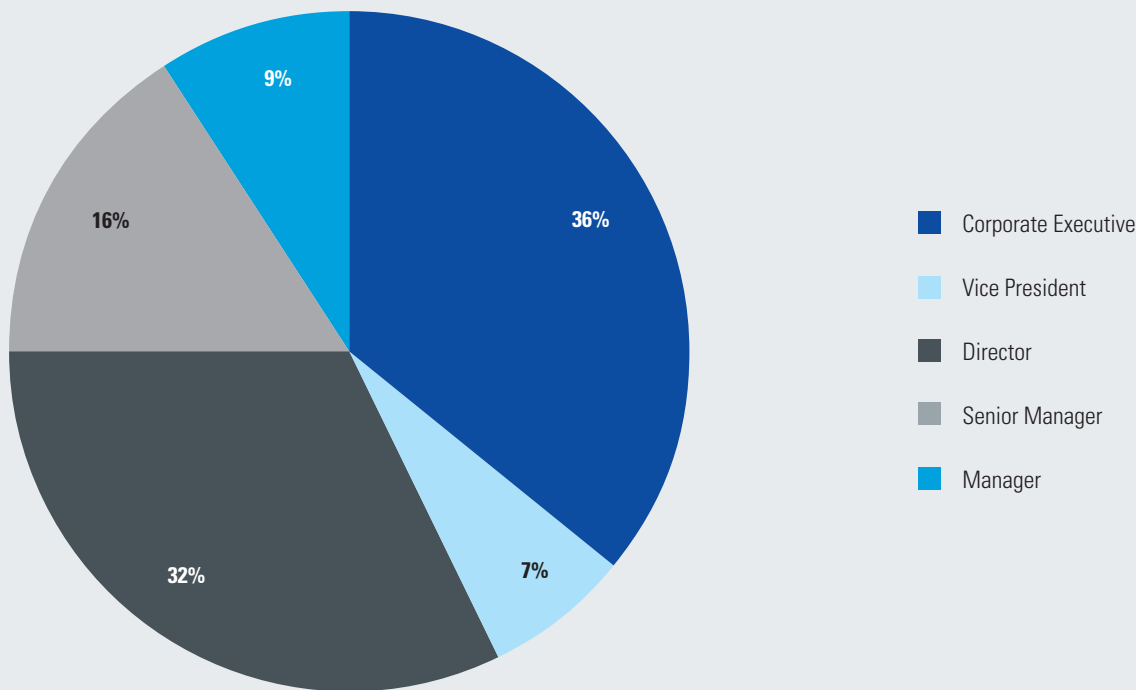
Figure 13: Overview of positions of survey participants (N=56)

Legend:
- Corporate Executive
- Vice President
- Director
- Senior Manager
- Manager

Pie chart values: 36%, 7%, 32%, 16%, 9%

HIGH-PERFORMANCE DIGITAL ORGANISATION

The High-Performance Digital Organisation challenge started in 2017 and is an industry initiative initiated by ICT Media and Informatica powered by TIAS Business School of Tilburg University, providing guidance on digital strategies and digital transformations to business and IT leaders. In this research study Tata Consultancy Services (TCS) is the knowledge partner. Over sixty-two organisations have actively participated in this challenge, including the flag bearers Alex Hurkmans, chief digital officer of Garantibank, Svend Lassen, head of reporting & data analytics of Tata Steel, Marcel van de Lustgraaf, chief information officer and member of the Executive Board of VIVAT, Richard Raats, program manager of Dutch national government and Perry van der Weyden, chief Information Officer of Rijkswaterstaat and Dutch CIO of the year 2019.

The participants joined one or more of the four challenger workshops and completed a survey. The outcomes of the challenger workshops are included in this research study. The survey was also submitted to the members of the community of ICT Media: chief information officer and chief data officer and their direct reports.

WORKSHOPS AND SURVEY

The data for this research was collected in workshops and by a survey, as well as global TCS DATOM™ database. The workshops took place on 6 November (Amsterdam), 12 November 2019 (Vught) and 12 February 2020 (Amsterdam). The survey was submitted by ICT Media. The members of this community are chief information officers and their direct reports. The response rate was 1.7% (62 responses, 3695 invitations). Since the survey was anonymous, it is not possible to establish to what extent the sample (62 responses versus total community of 3695 members) was representative. However, given the spread over the different sectors and the size of the organisations, which the respondents represent, there is no indication that the respondents are not representative of the community, which was also confirmed by ICT Media. The participants completed their response via a portal. The responses were collected from 15 October 2019 till 31 December 2019.

LIST OF PARTICIPANTS

The participants marked with an * are the flag bearers for this research project. The participants marked with an ** were interviewed. The remaining participants participated in the workshops and/or completed the survey.

Organisation	Participant
Achmea	Jaap Bosch
Allshare b.v.	Daniel Crawley
Amstelring	Sjoerd Broekman
AVR	Frauke Wessel
AWVN	John Simons
Beaphar	Erwin Kaal
Beslist.nl	Henk Munter
BinckBank	Arseniy Korobchenko
Bouwinvest	Vincent van Gerven
Canon	Nitesh Saini
Centraal Bureau voor de Statistiek	Matjaz Jug
Detailresult Groep	Joost van der Wal
Digital Governance Advisory B.V.	Ries Bode
DUO	Johann Schreurs
Dynniq Mobility	Nancy Roos-Beukers
EBN BV	Martin Hoff
ERIKS	Evert Romviel
Feenstra Warmte Totaalzorg	Nico van Zanten
FrieslandCampina	Aart Labee
Garantibank	Alex Hurkmans
Gemeente Almere	Michel Strijker
Global Collect	Erik Veer
Gyrus10	Miguel van Bodegom
GWK Travelex	Hans Ruedisueli
Helvoet Rubber & Plastic Technologies	Marcel Bul
Juva	Ronald van Wuijtswinkel
Kuiken Construction Equipment	Servaas van de Voort
Levarht	Dimitri Mayer
Manpower	Erik Janse **
Marqt	Bob Hentenaar
Mount Holland	Hylke Sprangers **
Neways Electronics	Joop Kempe
NLeSC+DANS	Patrick Aerts
NS Groep	Hessel Dikkers
PON Holdings	Ton van Dijk
Powerpeers	Chris Parker
Prominent	Frank Scholte
ProRail	Jan van Gorsel
Reed Elsevier	Audrey Coutinho **
Renewi	Maarten Buikhuisen
Rijksoverheid	Richard Raats */**
Rijkswaterstaat	Roeland Allewijn **
Rijkswaterstaat	Perry van der Weyden */**
Rotra Forwarding	Niels Janssen
Stedin Netbeheer	Arnold van der Bie
Stedin Netbeheer	Wim de Boer
TADCO	Ronald Franckaert
Tango Bravo bb	Henk van Tent Becking
Tata Steel	Svend Lassen */**
Technische Universiteit Delft	Paul Hillman
Teijin Aramid	Robert van Riessen
Unica Groep	Martin Misseyer
Universitair Medisch Centrum Utrecht	Corné Mulders
UWV	Arno Gerrits
Vergeer Holland	Jan-Paul Krijgsman
VION Food Group	Frans van Duivenboden
VWE voertuiginformatie en –documentatie	Karin Borst-Talen
Wehkamp	Kees Jans**

PROF DR ERIK BEULEN
AUTHOR, INTERVIEWER AND WORKSHOP MODERATOR

Erik Beulen (1969) is a professor at Tilburg University, the academic director of the executive MSc Information Management programme at TIAS School for Business and Society at Tilburg University and lectures on Disruptive Technologies at Manchester Business School. Furthermore, Erik is the chairman of the Dutch BXRL foundation and a board member of Sourcing Nederland.

Erik obtained his Ph.D. from Tilburg University in 2000. As an endowed professor he held the KPMG Global Sourcing Chair at Tilburg University from 2008 to 2015[9]. His research concentrates on information management, disruptive technologies, outsourcing and governance. His academic work has been published in Journal of Information Technology, European Management Journal, Information Technology & People, Strategic Outsourcing, Journal for Information Technology for Development and Communications Association for Information Systems. Erik is the leading author of the book Managing IT Outsourcing, published by Routledge, UK (upcoming third revised edition). He is also the co-editor of an upcoming Routledge book on managing digital outsourcing (2020).

Erik Beulen
e.beulen@tias.edu

[9] From 2008 – 2010 this was the Accenture Global Sourcing Chair.

ICT MEDIA

ICT Media facilitates knowledge exchange between decision-makers in IT and Digital, such as CIOs, CDOs and members of Executive Boards and Supervisory Boards. They bring together the supply and demand sides of the market through informal networks, sessions and our media.

ICT Media initiates surveys amongst the communities together with leading universities in the Netherlands. ICT Media is the publisher of CIO Magazine, BoardroomIT and IT-Executive.nl. ICT Media organises annual conferences - like CIO Inspire, CIO&CDO Insights and CIODAY, the biggest IT industry event in the Netherlands -, round-table sessions, workshops and exclusive dinners. ICT Media is the initiator of the CIO Magazine Innovation Awards and the CIO of the Year Award.

TATA CONSULTANCY SERVICES

Tata Consultancy Services (TCS) is an IT services, consulting and business solutions organisation that has been partnering with many of the world's largest businesses in their transformation journeys for the last fifty years. TCS offers a consulting-led, cognitive powered, integrated portfolio of business, technology and engineering services and solutions. This is delivered through its unique Location Independent Agile delivery model, recognised as a benchmark of excellence in software development.

TCS established its European headquarters in Amsterdam in 1992, and has close to 3,000 employees working for Dutch customers in the Netherlands, which include some of the country's leading and most respected companies. TCS strongly believes global challenges need global solutions. They are continually engaging with their employees, clients, partners, public institutions, start-ups, academia and community organisations across the world to step-up and rise to the occasion. Nurturing local talent thus also remains a prime area of focus, with the GROW@TCS trainee program that equips the workforce of tomorrow with the capabilities to anticipate future challenges.

As part of the Tata Group, one of TCS' core values is to give back to the community. To promote a healthy lifestyle, they are the title sponsor of the TCS Amsterdam Marathon, and multiple other large running events across the globe. Over 2,500 TCS employees, customers and business partners run the TCS Amsterdam Marathon each year to raise money for VUmc Cancer Center Amsterdam.

To give a platform to new ideas that are worth sharing, TCS partnered with TEDxAmsterdam, and also engages with organisations such as The Netherlands India Chamber of Commerce & Trade, and The Hague Security Delta to work toward making the Netherlands a center of innovation and business excellence.

DEFINITIONS

Business effectiveness:	Ability of an organisation to demonstrate the four critical business behaviours: 1) driving mass customisation; 2) creating new business models; 3) leveraging ecosystems; and 4) embracing risk.
Business Performance Score:	Percentage position of the sum of the products of each individual Business 4.0™ business behaviour score, multiplied by the contribution of data and analytics to each individual Business 4.0™ business behaviour (pairs, both 0-7 Likert scale), where the first quartile is ranging from 0-32, the second quartile from 32-64, the third quartile from 64-130 and the fourth quartile from 130-196. The percentage position set is linear within the relevant quartile.
Data management:	A process that includes acquiring, validating, storing, protecting, and processing required data to ensure the accessibility, reliability, and timeliness of the data for its users, this includes data quality, data governance, master data management and information life cycle management.
Likert scale:	Point scale used to allow an individual to express how much they agree or disagree with a particular statement – in this report ranging 0-7.
Sector Data and Analytics Maturity Comparison Score:	Percentage comparison of the data maturity score of an individual organisation against the average data maturity score of their sector. The sector average score is always set at 50%. The difference between the score of an individual organisation and the sector average is used to calculate the relative position from the sector average score in a 0-100% range, where the percentage position set is linear within the relevant half.

WWW.HPDO.NL

Media partner   Academic partner   Knowledge partner

ICTMEDIA   **TIAS**   **TATA**
CONSULTANCY
SERVICES