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EXCELLING IN THE DIGITAL WORLD

SHARING DATA IN ECOSYSTEMS

*A research study to discover how data sharing
strengthens end-to-end value journeys*

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PREFACE

“Getting your data right” is easily said. But everyone working in a business with more than two (2) people knows it can be somewhat daunting. People and departments, by extension, tend to sit on their assets; sharing without being asked for them has not been our modus operandi, let alone sharing them outside the organization’s limits. And if we do share, it’s often just plain data and no actionable insights. But the latter drives innovation and speeds up necessary change.

The good news is, however, that we are moving forward, this research shows. Organizations are becoming more mature when it comes to data. Yet, there’s always the danger of moving while the business environment we operate in moves faster. Because there are ever-changing rules, regulations, and technological capabilities, the amount of data is growing faster than ever. Ecosystems are developing rapidly because, unlike their real-world namesake, they compete. In this volatile, uncertain, complex, and ambiguous environment, we must keep adapting to the changes we can see coming and somehow be ready for unknown changes. It all comes down to agility and speed.

For this to work, an organization needs to acquire different talent than what they are used to — people who are driven by data, so to speak. But a business also needs to know where they are coming from, where they are going to and what they want to become in the end. They need to know their market, their place in it, and the regulatory environment. They need to redefine their strategy to go full circle and become mature, data-driven, and agile.

Take charge of your data and make it work for you!



Rob Beijleveld
Publisher & CEO - ICT Media

EXECUTIVE SUMMARY

Sharing data and insights is becoming more and more important in creating value in end-to-end value journeys. This sets a high bar for any organisation, as innovations are presenting themselves at an unprecedented pace, many ecosystems are very dynamic and data volumes grow and continue to grow significantly. On top of that legislation related to data and artificial intelligence is growing, but always lagging behind the pace of change - organizations must often define their own boundaries and policies. There is a lot to take in for organisations.

This market research confirmed the need for sharing data and insights, but also revealed that many organisations are still struggling in implementing and maintaining these concepts. Operationalising cross-organisational governance turned out to be particularly difficult, as investing in tooling/platforms that facilitate the exchange of data is not straightforward and challenging to integrate. Also security concerns need to be addressed when sharing data.

Organisations need to adjust their operating models to be on the one hand more efficient and on the other hand to enable sharing data and insights in ecosystems. The efficiencies achieved can be used to invest in innovations. To be clear organisations need to innovate, in order to disrupt and avoid being disrupted. Innovation potentially will also lead to new business models, which can be adopted in incumbent ecosystems, or in other or new ecosystems. Sharing data and insights drive innovation.

Specific actions are defined in this report to mature data sharing and insights in order to increase value creation in end-to-end value journeys. Organisations need to take a strategic orientation with a focus on understanding their market position, and market and regulatory developments. Also organisations need to continue to pay attention to the basics including data quality and resilience and defining conditions for data sharing. Based on both the strategic orientation and the focus on the basics, organisations need to continue to expand data sharing and implement data-driven decision making. All of the above requires dedicated talent management. The profiles needed for creating value in end-to-end value journeys are entirely different from the profiles in most organisations. Data and analytics have to become an integral part of the DNA of any organisation. This will facilitate sharing data and insights.

Where in previous HPDO studies we concluded that the data maturity required significant attention, organisations have moved on. Nevertheless, their next challenge has been addressed in this report. Ensure your organisation is benefiting from sharing data and insights!



INTRODUCTION

This report explores how data sharing strengthens end-to-end value journeys. Organisations need to enhance their capabilities in setting up, and operating in, ecosystems. In this day and age ecosystems are competing with other ecosystems. Organisations can be partners by collaborating in one ecosystem and can be competitors by participating in competing ecosystems.

Data sharing, is an essential element for achieving ecosystem success. Organisations need to deal with the continuously increasing number of ecosystems organisations are operating in, in conjunction with the relatively short duration of the existence of ecosystems. The reality is that an organisation is a partner in one or more ecosystems but also a competitor as this organisation also participates in one or more competing ecosystems. Organizations must ensure their internal cross-organizational interests are aligned as operating in multiple ecosystems does not disadvantage one organizational area over another. Advance transparency into these potential conflicts of interest must be addressed at the board level. Also, disruption puts significant additional challenges into ecosystems.

Sharing data in a VUCA world

Many organisations operate in a situation that can be characterised as VUCA. VUCA vulnerabilities can be extremely disruptive. Volatility means instability and leads to lack of control and increased risks. Volatility needs to be addressed with vision, which is detailed in a strategy addressing the partnering strategy and data sharing principles. Uncertainty can come from unpredictable outcomes. This includes market & technology developments, as well as upcoming legislation, such as, in an EU-context, Digital Operations Resilience Act (DORA) and the Artificial Intelligence Act.

Complexity is becoming an increasing course for disruption. As data volumes continue to grow exceptionally, the data quality remain insufficient. This is problematic for any organisation, even more so when organisations are sharing data in ecosystems. Finally, ambiguity can result in disruption. We see many organisations shifting gears by rigorously making incremental decisions. This is predominantly related to the partnering strategy, and as a derivative to data sharing. Agility enables organisations to deal better with ambiguity, but comes with a cost. Setting of partnerships requires significant effort, where sharing data also requires significant investments in interfacing systems and aligning processes, procedures & policies to enable data sharing.

Insights

In the survey different levels of disruption are distinguished, ranging from 'no disruption' to 'existential changes'.

This is detailed in Figure 1, over 70% of the participating organisations face at a minimum 'major changes'. The two organisations that face 'no disruption' are both governmental organisations. Furthermore, the banking and financial services sector is predominantly facing at a minimum 'significant changes'. This might well be due to a combination of increasing legislation such as the Corporate Sustainability Reporting Directive (CSRD) and competition from FinTechs. An upcoming update of the Payment Services and Electronic Money Services Directive (PSD3) will result in additional disruptions in this sector. Remarkably none of the surveyed organisations in the Life Science and Healthcare sector reported a higher disruption level than 'major changes'. Given the speed of innovation and high legislation scrutinising this sector, one would expect more increased levels of disruption.

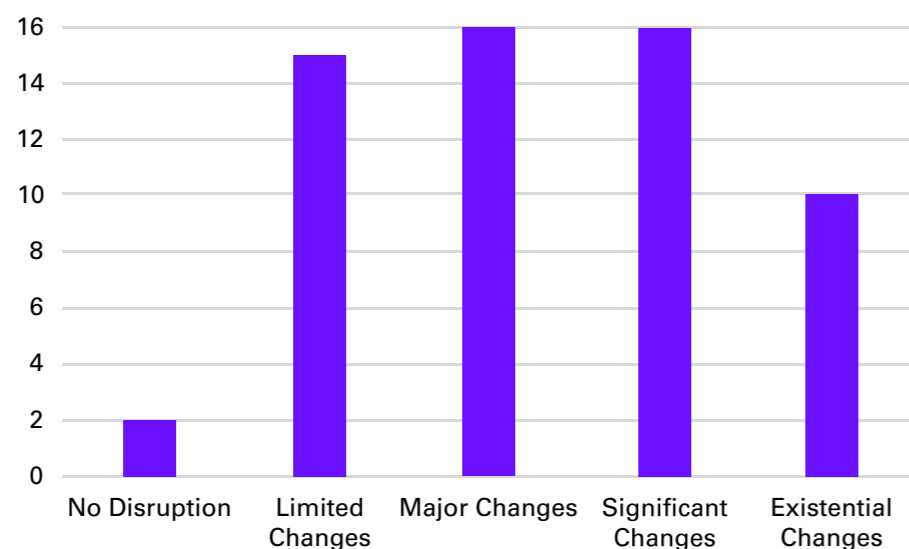


Figure 1 – Degree of Disruption (N=59)

Furthermore, the respondents representing Dutch organisations report less disruption than respondents representing international organisations. The modus of Dutch organisations for disruption is 'limited change', where the modus for international organisations is 'significant change'. Of the organisations that are facing 'existential change' only 20% is Dutch, where for 'significant change' this is less than 25%. All of this might be explained by the relatively high number of governmental organisations in the category of Dutch organisations. But most likely more important factor is the higher complexity of international organisations compared with Dutch organisations, as well as international organisations have typically ties with a larger number of organisations than national organisations.

Also the respondents representing small organisations, with a revenue/budget of less than 1b Euro, report less disruption than respondents representing large organisations. The modus of small organisations for disruption is 'limited change', where the modus for large organisations is 'major change' to 'significant change'. 80% of respondents reporting 'existential changes' represent large organisations, where 40% of this group represents organisations with a revenue/budget over 10bn Euro. Also here most likely the increased complexity of large organisations compared to small organisations explains the difference in the disruption level.

Addressing disruption

Organisations face disruption to various degrees. To ensure business continuity, an adequate response is required. Furthermore, organisations need to look for opportunities to disrupt. In addressing disruption organisations have to take the lead instead of focusing on defensive strategies.

This report explores data sharing in end-to-end value journeys. What do Value Chains look like in this day and age? In this exploration data quality and data governance need to be better understood. Also organisations must take a close look at Artificial Intelligence (AI). In this report the focus is on the aspects in adoption and implementation of AI that matter in addressing disruption. Furthermore, strategies are detailed to deal with Value Chain Dynamics by analysing current and potential partners and preparing scenarios for market making. Finally, any organisation must discover co-creation including the creation and fostering of Intellectual Property Rights to be in the center of innovation breakthroughs. Together organisations are strong!

INTERVIEW - PHILIPS



Edgar van Zoelen

Global practice leader Performance Analytics & Digital Transformation at Philips

For Philips to stay competitive it is important to demonstrate cost efficiency of using the device, staff experience and of course patient experience. Edgar van Zoelen: "Philips is making the difference with data. We are adding intelligent software to our products."

RESEARCH APPROACH

The high-performance digital organisation (HPDO) research programme was initiated in 2017. This fifth high-performance digital organisation research project of Tilburg University / TIAS School for Business and Society and ICT Media, conducted by prof. Erik Beulen, is embedded in Informatica's global Research & Development programme and also powered by the Boston Consulting Group and Wipro.

Sharing data in ecosystems is investigated, benchmarked and positioned in the partnering quadrant of the HPDO programme. The focus of this research was on identifying how organisations can create value by sharing data in ecosystems. The research investigates data sharing in end-to-end value journeys, data quality and data governance, Artificial Intelligence adoption and implementation, dealing with Value Chain Dynamics, and also co-creation.

Fifty-nine organisations participated in a global survey. The survey results have been discussed in interactive webinars and workshops with global technology leaders and independent experts. Furthermore, three interviews were conducted with global C-level technology leaders to colour the survey insights.

DATA SHARING IN END-TO-END VALUE JOURNEYS

Sharing of data is important as it enhances decision making and creates value by enabling additional insights for products and services. Sharing data is not straightforward within an organisation, let alone across organisations in ecosystems. Data sharing in end-to-end value journeys requires careful decision making, continuous monitoring, management attention and alignment of policies and procedures related to the sharing of data. Data governance in the organisations of all partnerships should be aligned. With data sharing, data driven decision making is important to ensuring a strengthened competitive advantage of the ecosystem, as well as addressing compliance with antitrust legislation and compliance with regulations in general.

Insights in the importance of data sharing

The overview of the importance of data sharing in end-to-end journeys is summarised in Figure 2. Less than 10% of the surveyed organisations consider the importance of data sharing in end-to-end value journeys as 'limited'. It is remarkable that these organisations are all large international organisations with a revenue/budget over 1b Euro. Furthermore, over 60% of the organisations consider the importance of data sharing in end-to-end value journeys to a 'great extent', which includes 80% of the Dutch organisations. This indicates that data sharing in end-to-end value journeys is understandably more difficult for large international organisations.

"While much of the data for organizations data is proprietary or even confidential, most also have data that is of limited direct relevance to the organization itself, but may yield significant dividends if shared with partners in the ecosystem. Examples would range from equipment performance data, anonymized medical statistics to even something like waste composition data. All of these provide vital insights to other parties, that can help improve the overall ecosystem sustainability."



Johan Stockmann, Partner & Associate Director, BCG

Types of shared data

In ecosystems organisations at a minimum need to share transaction data. Data sharing starts with sharing reference data. In addition organisations can agree to share commercially relevant data, such as data related to client profiles, market analysis and data related to product and-or services innovations. The market analysis data obviously includes market data related current and future end-to-end journeys.

In addition to these types of shared data, also compliance data in the context of reporting and open data are essential for individual organisations. The increased regulatory requirements drive the need for compliance data, where the advancement of artificial intelligence, machine learning and maturity of large language models increase the relevance of open data for any organisation.

Also reference data for external communication can be shared. This is essential for collaborative external communication toward existing customers, as well as potential new customers. Also shared reference data creates a bond between the partners in an ecosystem, as well as it strengthens the position of an ecosystem in the market.

Insights in types of shared data

Nearly 85% of the surveyed organisations share data in addition to transaction data with their ecosystem partners. However it is remarkable that two-thirds of the nine organisations that only share transaction data indicate that the importance of data sharing end-to-end journeys can be labeled as 'a great extent'. Apparently, these organisations don't see added value or are not able or allowed to share other types of data with their ecosystem partners. Nearly all organisations that also share other types of data, share data related to product and/or service innovations. The two exceptions are an organisation in the Hi-Tech and Professional Services sector and the other organization in the Information Technology sector.

The willingness to share data to support transacting in the ecosystem (current collaboration) is higher than sharing data related to exploring initiating innovation and/or future collaboration. The future collaboration is related to the demand as well as to analytics.

Surprisingly, reference data for external collaboration is the least shared data type as it is generally not proprietary or competitive information and instrumental for data sharing. Just over 20% of

INTERVIEW - DUTCH RAILWAYS



Hessel Dikkers
Chief Information Officer – Dutch Railways

"For our organisation data is essential to ensure our trains arrive on time, as well as to innovate. We are currently implementing Mobility as a Service with our partners."

the surveyed organisations share this data. The organisations are predominantly Dutch organisations and also small organisations are overrepresented. Figure 3 provides an overview of the types of shared data in end-to-end value journeys.

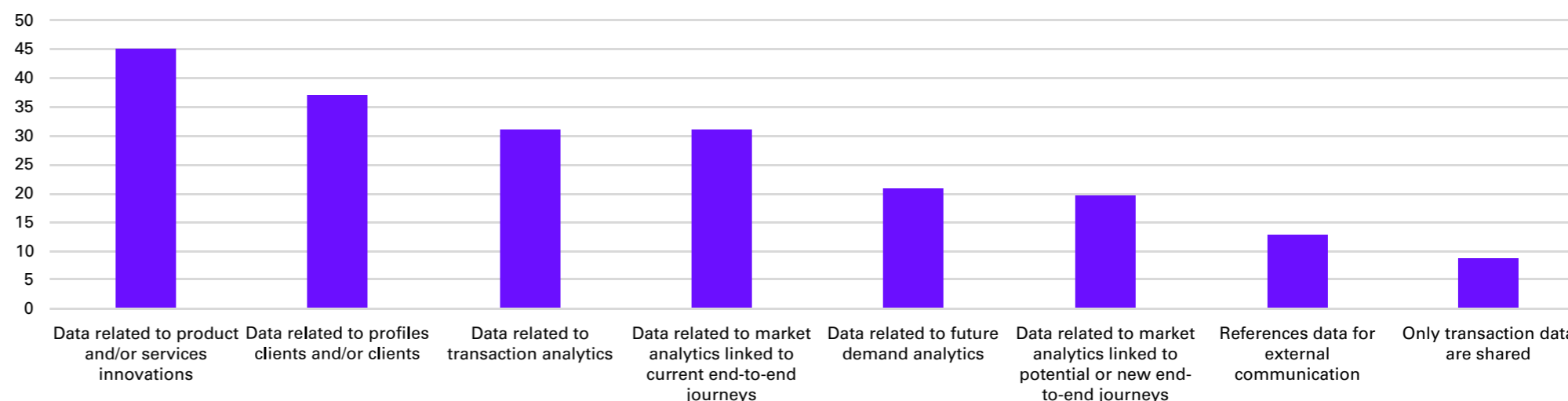
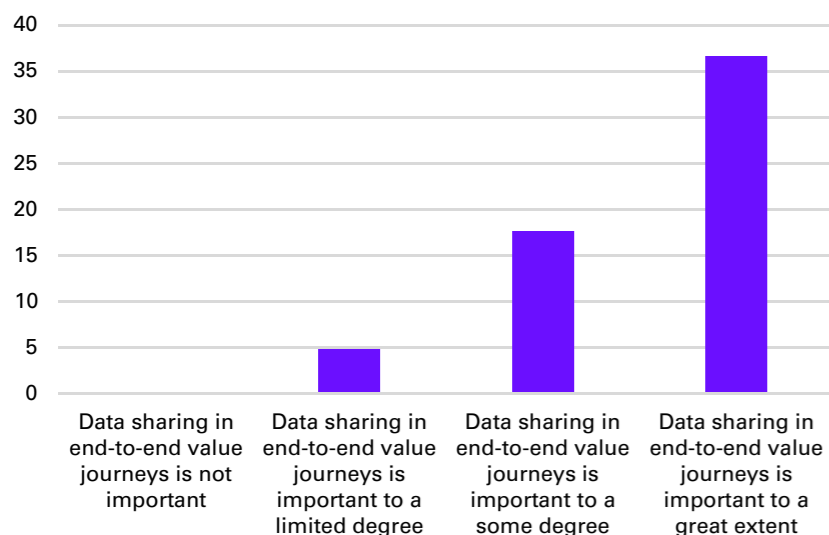


Figure 2 – The importance of data sharing in end-to-end value journeys (N=59)

Figure 3 - Types of shared data in end-to-end value journeys (N=59)

ARTIFICIAL INTELLIGENCE ADOPTION AND IMPLEMENTATION

Many organisations have put up high hopes on artificial intelligence enabling value creation in end-to-end value journeys. As Large Language Models are maturing, this expectation has been grown further. Nevertheless, organisations need to be realistic in terms of their expectations. Data quality and proper data governance are pre-requisites for leveraging artificial intelligence in ecosystems. Organisations need to be in control prior to exploring how artificial intelligence can power ecosystems.

Purpose of artificial intelligence

In the context of creating value in end-to-end value journeys, the purpose of artificial intelligence can be to achieve ecosystem efficiencies, create shared insights and stimulate innovation. This is not fundamentally different from the purpose of artificial intelligence for individual organisations, it is only more complex to implement across ecosystems.

For implementation, understanding the requirements and objectives, as well as the technology and tooling stacks, of ecosystems partners is essential. Furthermore, sharing insights based on artificial intelligence has an increased risk level, from both competitive sensitivity as well as compliance perspective. This requires additional ecosystem data governance diligence.

Furthermore, regulatory requirements both hinder the sharing of artificial intelligence insights, think anti-trust regulations, as well as drive the sharing of artificial intelligence insights. An example of the later, is European Union is putting sustainability legislation related to product passports detailing the bill of material in place. The impact of this upcoming legislation is yet not fully clear.

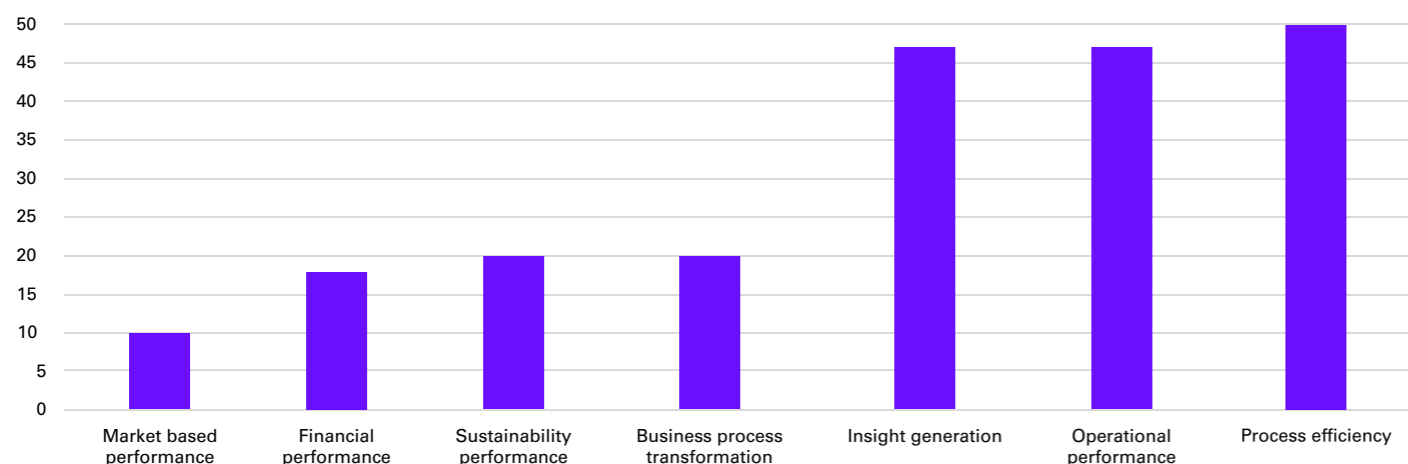


Figure 8 – Overview of purposes of artificial intelligence (N=59)

“We see organisations reshaping business boundaries by creating an Intelligent Ecosystems with AI & Data to create sustainable and innovative products and services, while enriching human experiences. We see different trends on how organisations leverage data sharing in their value chains and ecosystem to support process efficiencies, bring stakeholder delight, generate more revenue, value generation and even about saving lives.”



Malay Srivastava, Head of Data, Analytics & Intelligence, BeNeLux

Insights in the purpose of artificial intelligence

Three purposes of artificial intelligence stood out. Nearly all surveyed organisations acknowledged process efficiency, insight generation and operational performance as a purpose of artificial intelligence in their organisation. There were no distinct differences for sectors, size and geography across the surveyed organisations. This might be related to the limited sample size. The overview of the purposes of artificial intelligence are detailed in Figure 8.

In addition, the surveyed organisations also use artificial intelligence for quality improvement, compliance monitoring, and internal and external behaviour analytics. The latter can be used for fraud detection and cyber resilience.

Artificial intelligence level of automation

Many organisations still have large number of databases or multiple data lakes. Composing a fit for purpose data set for driving artificial intelligence insights requires a lot of effort in many organisations, let alone driving these insights in ecosystems. This is way in addition to the implementation of policies, procedures and tooling,

as well as data governance, automation in artificial intelligence is important. Automation frees up time for data scientists and citizen data scientists to implement checks and balances – basically human oversight. This is, in the context of growing data volumes and use of artificial intelligence in organisations, essential in avoiding the generation of incorrect insights and confidentiality, and compliance breaches.

Artificial intelligence governance level of maturity

Introducing artificial intelligence in ecosystems sets the same type of governance requirements as in individual organisations. Being in control is however much more difficult, as the data are originating in multiple ecosystem organisations which hinders the verification of the quality of the data. Also reviewing algorithms is more difficult as there will be differences in the (ethical) values of the ecosystem partners. The latter sets additional requirements for selecting and, over time, evaluating ecosystem partners. This might result in adjustments in the collaborating group of ecosystem partners.

Any organisation must focus on the highest possible maturity level of artificial intelligence as the impact of artificial intelligence is increasing due to the rise of data driven decision making. Therefore, the impact on the individual organisation and the ecosystem is significant. In addition to the effort of individual organisations, a collective ecosystem effort in implementing artificial intelligence governance is required.

Insights in artificial intelligence levels of automation and governance maturity levels

Only two of the surveyed organisations have a higher 1-7 Likert score for the maturity of artificial intelligence governance, than the artificial intelligence automation level. The differences are remarkable. Trusting that automation of artificial intelligence is not reducing the need for an adequate artificial intelligence governance, it is providing a solid basis for the implementation of governance. The organisations reporting high levels of automation are the sectors with extended experience with artificial intelligence, such as the banking, and life science and healthcare sectors. Also large organisations, with a revenue/budget of +1b Euro report a higher level of automation scores. The level of automation is a clear indicator for artificial intelligence maturity.

However, it is fair to say that it is more straightforward to automate artificial intelligence than to implement proper artificial intelligence governance. However organisations must focus on the implementn of proper governance to provide guiderails for automated artificial intelligence.

The insights in artificial intelligence levels of automation and governance maturity levels are detailed in Figure 9.

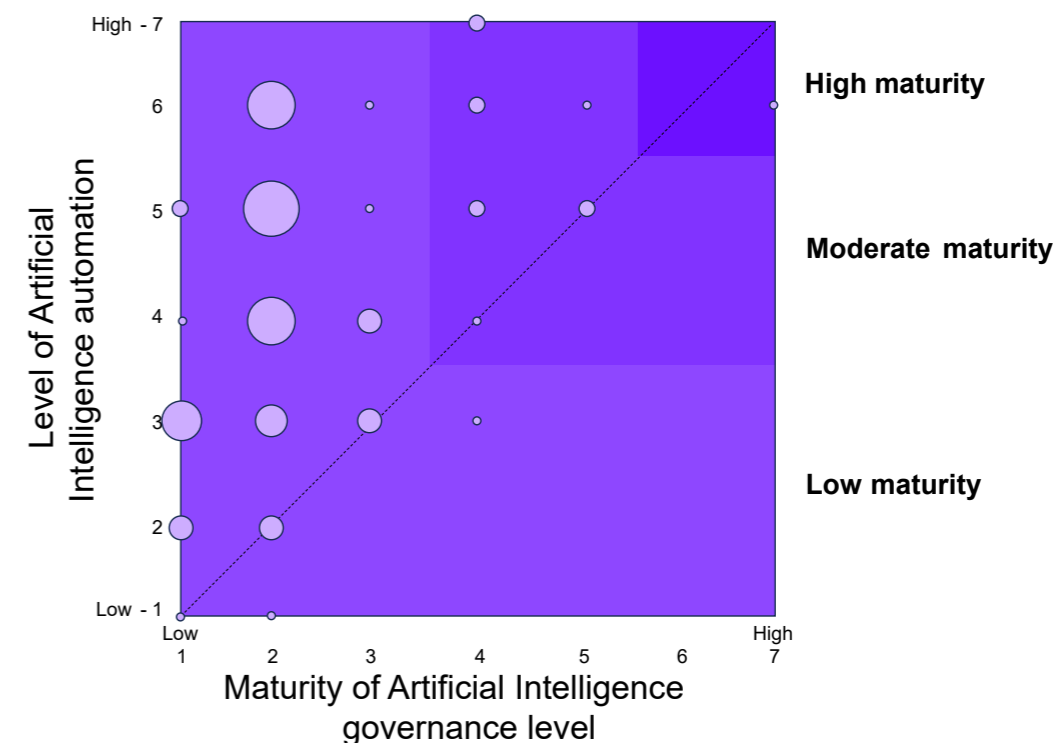


Figure 9 –The level of artificial intelligence automation and maturity of artificial intelligence governance level – Likert scale 1-7 (N=59)

Artificial intelligence operating models

Initially organisations started to structure their artificial intelligence teams centrally. This was due to the scarcity of data scientists and data quality issues that many organisations faced. Clustering this capability was the preferred artificial intelligence operating model for most organisations. Over time, many organisations have improved and expanded their data science capabilities. Data citizens have made their entrance into artificial intelligence many organisations, never more with the meteoric rise of platforms such as ChatGPT. This has significant implications for the artificial intelligence operating model. From a central operating model, these organisations are transforming into a hybrid model. Currently there are a very limited number of organisations who have adopted a 100% decentralized model. It is also questionable if there will be organisations that face no synergies at all, and as a consequence refrain from having a central data scientist team.

The reporting of both data scientists and data citizens is also important. Typically, data scientists are embedded in the technology and innovations teams of organisations. This also enables alignment and impact on the artificial intelligence and data technology, and the enterprise and information technology architecture.

Operating models support maintaining relationships with the business. Organisations might consider appointing a business sponsor for artificial intelligence. This will enable alignment and supports setting priorities. The data citizens are by nature embedded in the organisation, and outside the technology and innovation teams. This will also drive alignment with the business objectives of their organisational unit and support setting organisational-unit priorities. To ensure alignment with the central team, additional governance structures, including functional reporting into the central team and knowledge sharing sessions, have to be in place.

Organisations can also structure their artificial intelligence operating model fully decentralized. The implication is that there are no economies of scale, in effect artificial intelligence capabilities are in the DNA of all the relevant organizational units. In all fairness, the likelihood that this will happen in the foreseeable future on a large scale is very limited.

“We see a growing trend of federated yet collaborated model where in certain services are centralised maybe via IT while on other hand allowing flexibility to lines of businesses to build their own solutions and AI products.”



Malay Srivastava, Head of Data, Analytics & Intelligence, BeNeLux

Insights on artificial intelligence operating models

First of all, over 15% of the surveyed organisations don't even have an artificial intelligence operating model. This illustrates the maturity of these organisations, remarkably 40% of these organisations had a revenue/budget of +1b Euro. Most organisations have a hybrid operating model with a dominant central team, where just over 10% of the surveyed organisations reported a central model with dominant decentralized artificial intelligence teams supplemented by a central team, which is setting the standards to support the decentralised teams.

About 25% of the surveyed organisations report a 100% central model. Neither their level of artificial intelligence automation, nor their artificial intelligence governance maturity levels, were different for the reported levels by all surveyed organisations.

There was only one surveyed organisation that reported a 100% decentralized model – a large global financial institution with a high level of artificial intelligence automation but a low artificial intelligence maturity. For highly regulated organization, this operating model has high risk profile. The insights in artificial intelligence operating models are detailed in Figure 10.

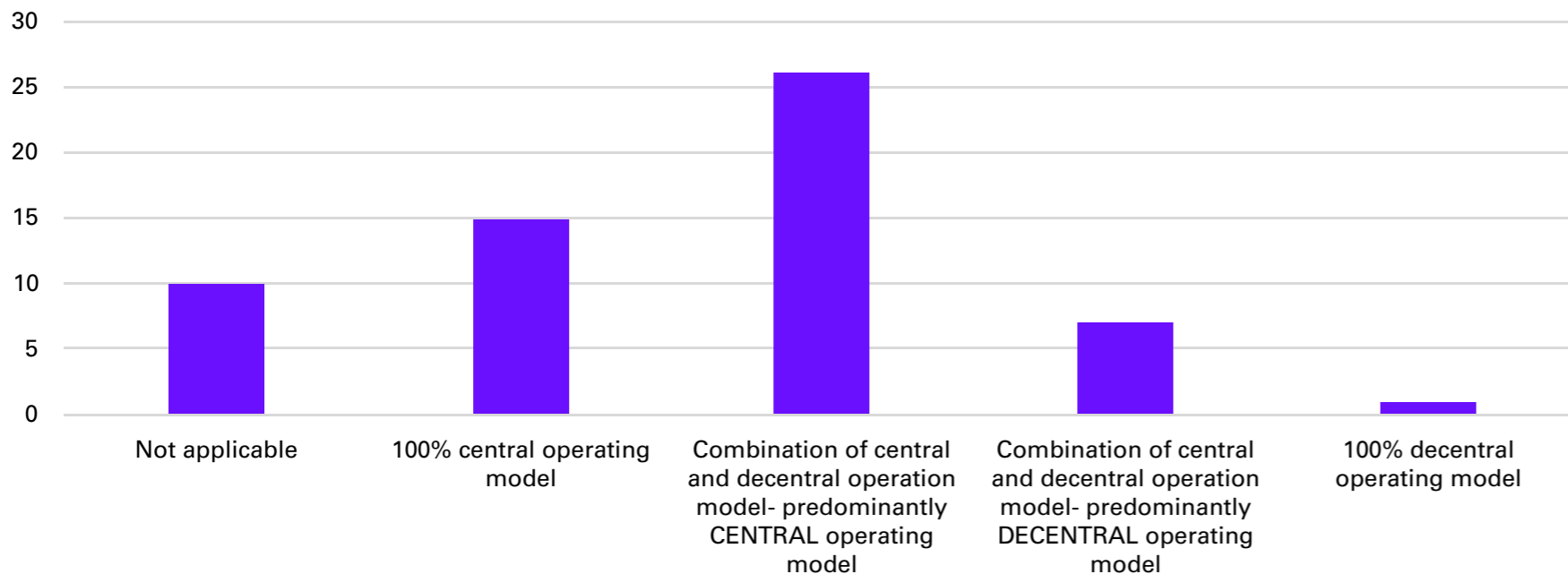


Figure 10 - Artificial intelligence operating models (N=59)

Insights in the impact of AI level of automation and AI governance maturity level on operating models and business models

The impact of artificial intelligence level of automation and artificial intelligence governance maturity level are about equal for operating models and business models. Where the maturity of the combination of these two factors is low - over 80% of the surveyed organisations. The remaining 20% of surveyed organisations reports a moderate maturity for these two factors. Only one organisation, a large financial institution, reports a high maturity.

The key question is the impact of an increase in the maturity of artificial intelligence governance on both operating models and business models. Obviously increasing the level of artificial intelligence automation should enable strengthening of governance. Especially for highly regulated organisations, it is important to be in control. Proper governance is a prerequisite to both operating models and business models. Also upcoming legislation related to artificial intelligence in combination with moderate governance might hinder organisations in making the necessary changes to be in compliance. Moderate is not good enough, governance must be high to enable agile responses to changing and growing legislation.

²Both the level of artificial automation (automation) and artificial intelligence governance (governance) maturity are scored on a 1-7 Likert scale. The maturity of the combination of automation and governance is classified as follows: Low maturity if either automation or governance, or both have a score <= 3. Moderate maturity if both automation and governance are > 3 and < 6. High maturity is both automation and governance >= 6.

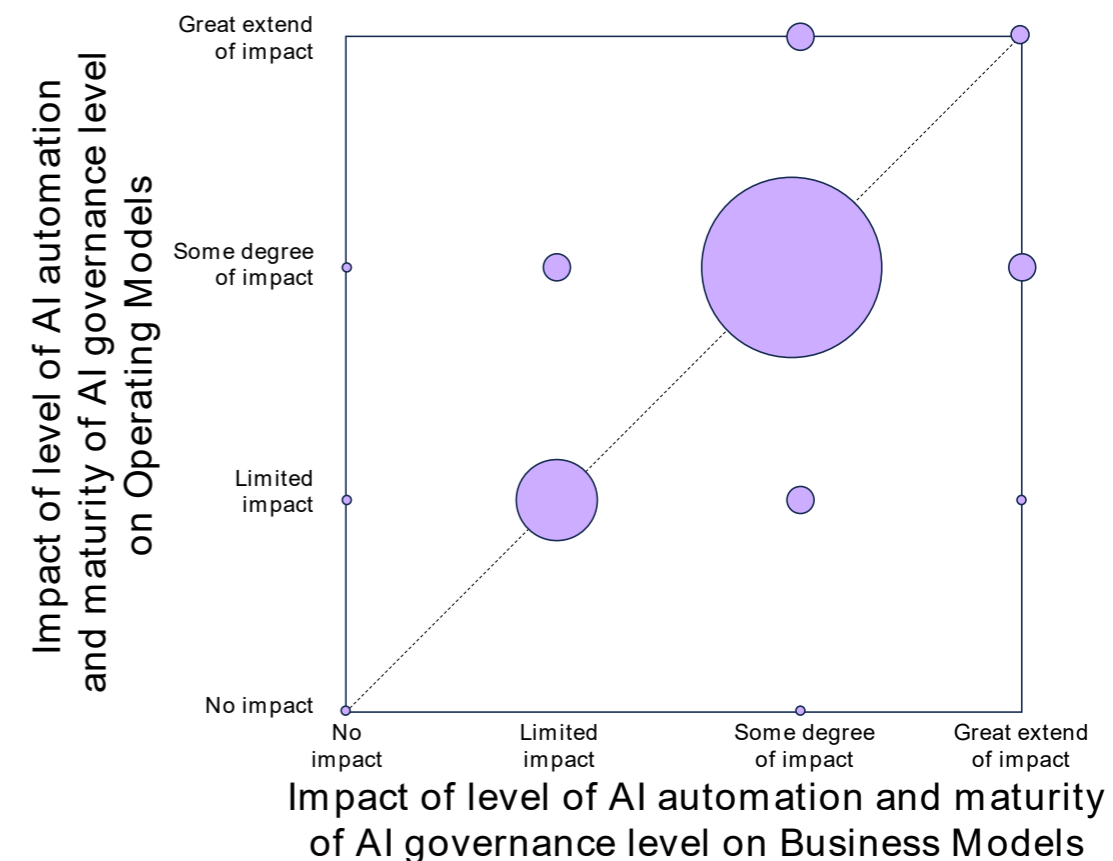


Figure 11 -The impact of level of artificial intelligence automation and maturity of artificial intelligence governance level on operating models and business models (N=59)

DEALING WITH VALUE CHAIN DYNAMICS

Over time the dynamics in value chains are continuously transforming faster. New partners join ecosystems, incumbent partners leave ecosystems and join competing ecosystems. Also changing market conditions and mergers & acquisitions or divestments impact the negotiation power in ecosystems. Sharing data in ecosystems in motion is not straight forward.

Value chain dynamics

Innovation drives value chain dynamics as innovation opens up new opportunities. As a consequence, organisations consider setting up new, participating in additional ecosystems and leaving ecosystems, as innovations present new opportunities. These decisions impact the market. Ecosystems that focus on innovation in combination with collectivism are impacted the least by value chain dynamics. Collectivism manifests itself best by keeping in mind and respecting the interests of all ecosystem partners. Attractiveness for all partners prevails. This requires a long-term perspective that is not always feasible, nevertheless any organization should always consider the impact of any decision on the value creation of the ecosystem.

Data sharing in more stable ecosystems is more straightforward as cross-organisation data governance and policies can be set. The alternative is that individual organisations contractually agree on data sharing. This is increasing not only the required contract effort, but also reduces the transparency in an ecosystem. Furthermore, organisations will be less involved in ecosystems and, as a consequence, the value chain dynamics will be higher. All the

above has a negative impact on value creation in end-to-end value journeys.

Negotiation power in end-to-end value journeys

Negotiation power is related to the position in an ecosystem, the positions in other value chains, market circumstances, as well as opportunities to participate in other value chains and/or set up new value chains. In short it is very difficult, but also very important for organizations to understand their room to negotiate and to understand the position of their partners and competitors.

This is where data sharing can be a key in collaboration. Exchanging data in ecosystems helps organizations better understand the requirements and interests of other partners.

Insights in value chain dynamics and negotiation power in end-to-end value journeys

The value chain dynamics are relatively high. On a 1-7 Likert scale the modus is 5. The surveyed organisations that report a value chain dynamic score of 5 or higher are predominantly large, +1b Euro revenue/budget, international organisations. In this category there are also three governmental organisations, which are all small organisations. This might be explained by the nature of their operations and the degree of engaging with non-governmental organisations.

The reported negotiation power is quite balanced, some organisations reported low negotiation power, whereas other

organisations reported strong negotiation power. As expected, size matters, the organisations that reported a high negotiation power score are predominantly large, +1b Euro revenue/budget, international organisations. Also three governmental organisations reported a high negotiation power score. This might be related to European tendering regulations in the European Union.

The combination of the Likert score on value chain dynamics and negotiation power in end-to-end journeys is detailed in Figure 12. The surveyed organisations reported they have more negotiation power than what they are facing in value chain dynamics for organizations to understand their room to negotiate and to understand the position of their partners and competitors.

This is where data sharing can be a key in collaboration. Exchanging data in ecosystems helps organizations better understand the requirements and interests of other partners.

The impact of value chain dynamics and negotiation power on the operating model and the business model

Due to the increasing value chain dynamics, organisations must focus on agility and on expanding the number of active ecosystems. Agility will reduce the risks, as organisations are able to respond faster and better to changes in the market.

On the other hand, value chain dynamics drive business model changes, as changes in ecosystem collaboration triggers the

opportunities to explore addition/alternative value propositions. Furthermore, negotiation power can be used to enforce new business models, such as subscription models. The changes in business models will be beneficial for some ecosystem partners at the detriment of others.

Insights into the impact of value chain dynamics and negotiation power on the operating model and the business model.

The impact of value chain dynamics and negotiation power on operating models and business models is about equal. None of the surveyed organisations indicated there is no impact on both the operating model and the business model. For most organisations, there is some impact on both the operating model and the business model.

Where the maturity of the combination of these two factors is moderate³ - for over 50% of the surveyed organisations. The remaining surveyed organisations report a low maturity for these two factors combined, expect for one organisation, a small financial institution, reports a high maturity.

³ Both the value chain dynamics and negotiation power are scored on a 1-7 Likert scale. The combination of value chain dynamics and negotiation power is classified as follows: Low maturity if either value chain dynamics or negotiation power, or both have a score <= 3. Moderate maturity if both value chain dynamics and negotiation power are > 3 and < 6. High maturity is both value chain dynamics and negotiation power >= 6.

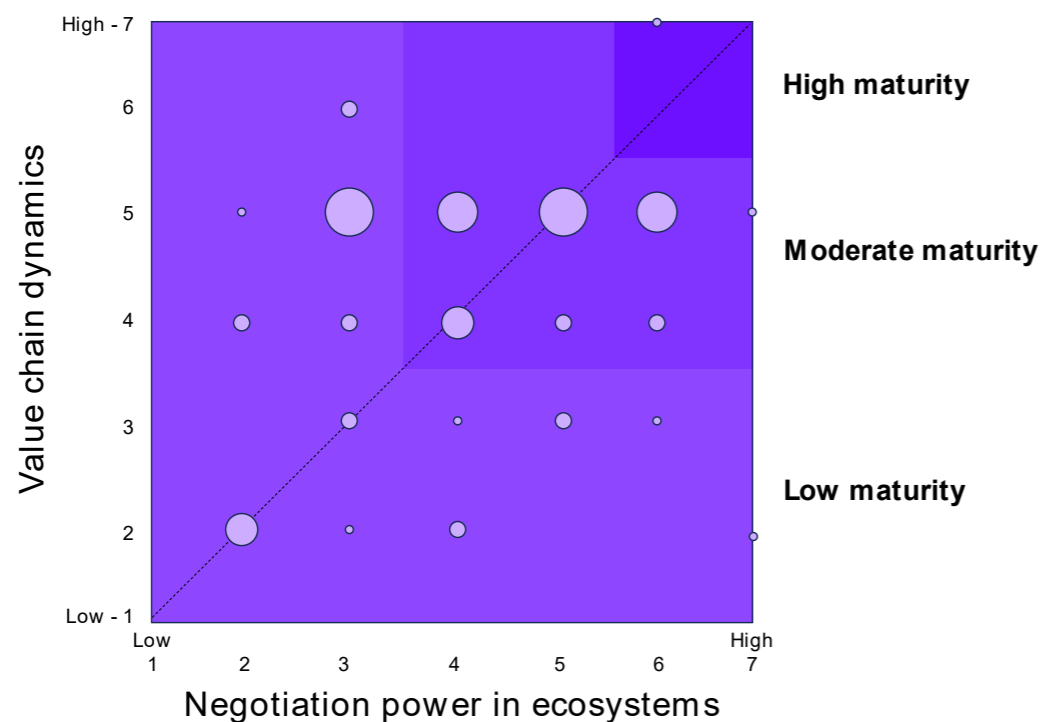


Figure 12 -The value chain dynamics and negotiation power in ecosystems – Likert scale 1-7 – where 1 = low and 7 = high (N=58)

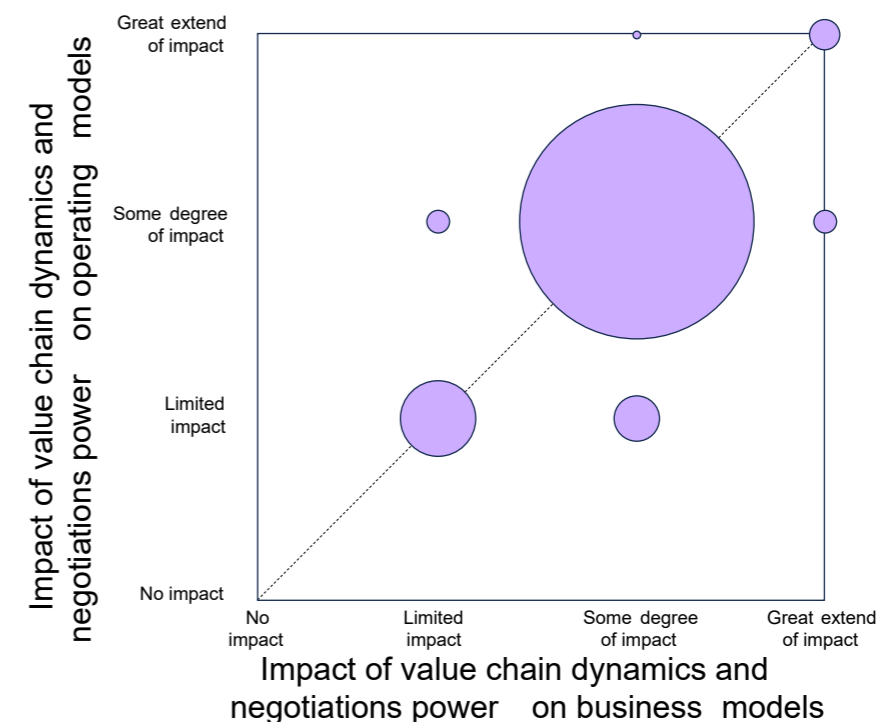


Figure 13 -The impact of value chain dynamics and negotiations power on operating models and business models (N=58)

Co-creation in ecosystems strengthens the value creation. In co-creation, organisations and ecosystems can decide to register Intellectual Property (IP) rights, which results in protection of interests as well as creates opportunities to monetise. Organisations need to balance the effort and cost associated with registration and protection with the benefits of registration. It's important to understand that most registrations have to be done per country and require country specific knowledge for each registration. Balancing this is a fine line.

The importance of creating Intellectual Property rights in ecosystems

The creation of Intellectual Property rights is not of equal importance to all sectors. Typically for organisations that produce goods it is more relevant than for services and governmental organisations. Also, the size of the organisation matters, as larger organisations have the ability to free up resources to focus on registering and maintaining and enforcing IP rights.

Furthermore, if organisations operate in highly competitive markets with a large number of ecosystems, IP rights can provide protection of both the market position as well as margin. Data sharing supports innovation and therefore it can be worthwhile to consider registering and maintaining related IP rights.

"IPR strategy is important to safeguard organizations' investments and benefit most out of research and innovation efforts and spend. Considering the fact that the AI is out there which can now even replicate and generate content, text, files, videos we need to be even more careful of our intellectual property."

Malay Srivastava, Head of Data, Analytics & Intelligence, BeNeLux

Insights in the importance of creating Intellectual Property rights in ecosystems

The importance of creating IP rights in ecosystems, and in that context sharing data, varies across the surveyed organisations. The importance of creating IP rights in ecosystems and the contribution of data sharing to the creation of IP rights go hand in hand, e.g. if the importance of creating IP rights in ecosystems is high, than the importance of data sharing to the creation IP rights is also high. This is detailed in Figure 14.

Furthermore, size matters, larger organisations report a high importance in both creating IP rights in ecosystems as well as in the contribution of data sharing to the creation of IP rights. The demarcation between international organisations and national organisations is less significant. Also remarkably, there are numerous service organisations and governmental organisations that report a high importance on both. Further research is required to understand these survey results better.

Intellectual Property strategies and defense mechanisms

Organisations which are creating and maintaining IP rights need to set strategies, ranging from no strategy, a defensive strategy or a collaborative strategy. The smaller the organization, the harder it is to set strategies and implement defense mechanism. Also organisations need to implement defense mechanisms which are aligned with their strategy. Good examples of effective defense mechanisms range from informal to formal/legal mechanisms. Organisations that would like to create value in end-to-end value journeys must consider the adoption of the collaborative IP strategy which combines a mix of informal, semi formal and formal/legal mechanisms.

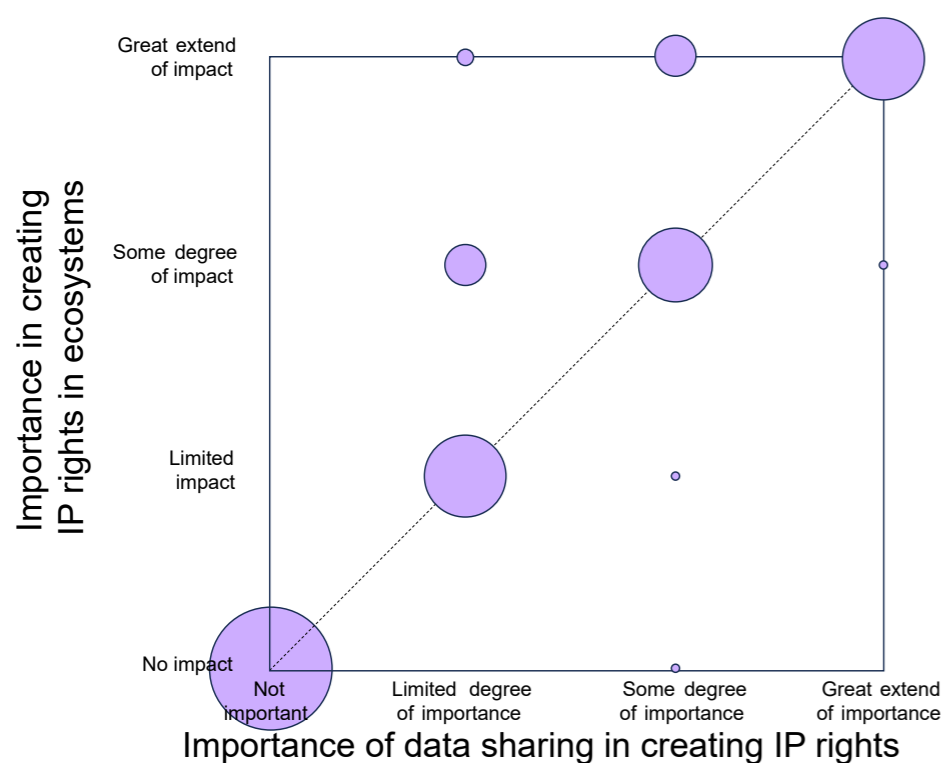


Figure 14 - The importance in creating IP rights in ecosystems versus the importance of data sharing in creating IP rights (N=59)

Impact of Intellectual Property strategies on operating models and business models

The intellectual property strategies have an impact on both the operating model as well as the business model. In the operating model, organisations can protect the production of their goods and services, whereas in business model, organisations can monetise their IP rights. The latter is rarer than making reference to operating models.

Insights in the impact of Intellectual Property strategies on operating models and business models

Organisations report a comparable impact of IP strategies on

operating models and business models. In twelve organisations there is no impact on both the operating model and the business model, this includes predominantly financial organisations and governmental organisations.

Also the impact of IP strategies in larger organisations is bigger on operating models than in small organisations. The impact of Intellectual Property strategies on operating models and business models is detailed in Figure 16.

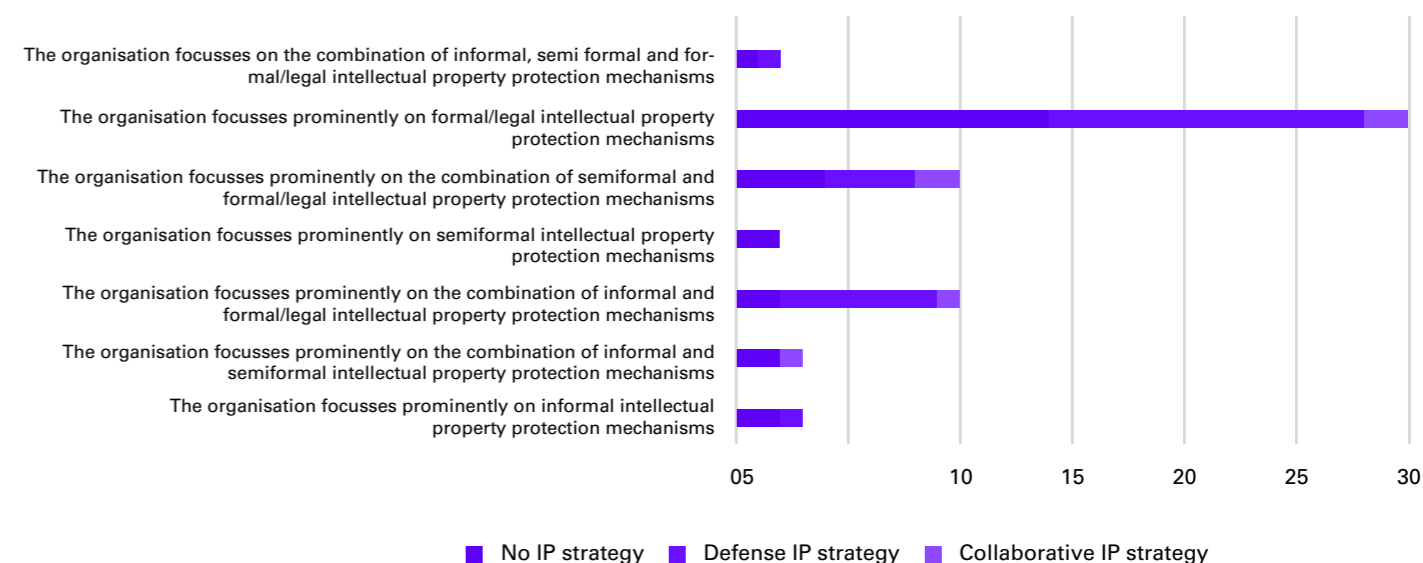


Figure 15 - The combination of IP strategies and the defense mechanism per strategy (N=56)

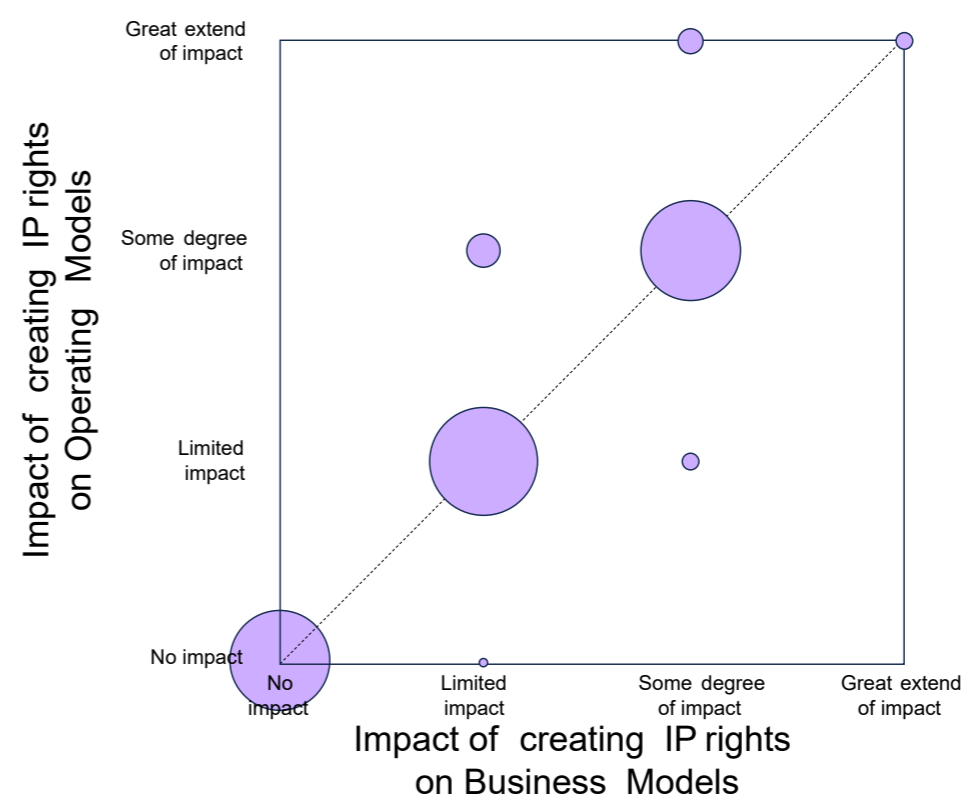


Figure 16 - The impact of creating intellectual property rights on operating models and business models (N=56)

ACTION REQUIRED

The survey and the round table have provided valuable insights. The most important question is, what are we going to do next? The ten actions below will keep your organisation in check. The actions are clustered into three themes: 1. Strategic orientation, 2. Getting the basics right and 3. Ecosystems. The actions will strengthen the position of your organisation in ecosystems and increase the value creation in end-to-end value journeys.

Strategic orientation

Understanding the current market position of your organisation and any upcoming market developments and legislation is important. The below actions are typically allocated to representatives responsible for operations.

1. Market position: Assess in which end-to-end value journeys your organisation participates and identify the profitability, risks and strategic importance of each end-to-end value journeys. Identify in which of the value chains your organisation has a pivotal role and in which value chains your organisation can be easily replaced by another partner, and include the likelihood of being replaced over time in 12, 24, +24 months. In the assessment of the value chains also map out the partners and their contributions to the ecosystems, as input for painting the overall market position of your organisation.
2. Market developments: Assess the relevant innovations for your organisation and for the end-to-end value journeys your organisation is involved in at this moment or in the future. Also include in this assessment the anticipated responses of your current ecosystem partners and competitors, as this might have implications for the power balance in ecosystems, as well as in the market. Furthermore, it is important to keep an eye on potential new entrants. These can be start-ups but also organisations that are expanding into your market. Prepare scenarios on how to respond best to the potential outcomes of the assessments.
3. Regulatory developments: Assess the impact of upcoming relevant legislation on your own organisation, the ecosystems your organisation operates in and on competition. The relevant legislation is not limited to national legislation, especially European Union legislations have a much broader impact. The assessment must be a balanced perspective, both risks, but also opportunities, must be taken into account. This helps organisations to anticipate on upcoming legislation, which is beneficial for all partners in the ecosystems. Furthermore, organisations need to set a strategy for dealing with legislation. Organisations should always operate in full compliance; alternatively an organisation can be more aggressive and operate more boldly by interpreting legislation.

Getting the basics right

Implementing proper data management and data governance is key to getting the basics right. The below actions are typically a joint responsibility of both the Chief Data Officer and the Chief Information Officer.

4. Data quality: Assess the data quality and the data governance of your organisation. This includes the data policies and data ownership. The data ownership must be in the business, where data owners must be supported by data stewards, who are also positioned in the business. All of the above must be addressed by the Chief Data Officer. Furthermore assessing data management tooling is important - what is the level of automation in your organisation? Addressing the data management tooling is with both the Chief Information Officer, related to the enterprise and IT architecture, and the Chief Data Officer, related to the information and insights requirements.
5. Data resilience: Monitor the quality and added value of data, especially for data and insights that your organisation shares with other partners in the ecosystem. As the volume of data and insights are continuously growing this is not a one-off action, in an ideal situation monitoring is real time. Organisations need to implement processes and tooling that are continuously monitoring. This data governance falls directly under the responsibility of the Chief Data Officer. With regards to insights, organisations need to keep a close eye on the algorithms and training data, which requires data analytics policies and a rule board to assess artificial intelligence.
6. Data sharing: Agreeing on the exchange and conditions for exchanging data in the ecosystem is important. For conditions it is important to explore the commercial, as well as the compliance implications. Organisations need to be mindful that, due to changes in the market and/or in legislation, the impact is different over time. In order to implement this properly, data governance needs to be implemented across ecosystems. With the dynamics many end-to-end value journeys are facing, cross-ecosystem governance can be replaced by contractual commitments. Typically, contractual commitments reduce data sharing. The responsibility for this action is predominantly with the Chief Data Officers, who have to align with their organisation to better understand the data needs of their organisations.

Ecosystems

Improve collaboration and drive innovation. The below actions are typically allocated to representatives responsible for operations and the Chief Data Officer.

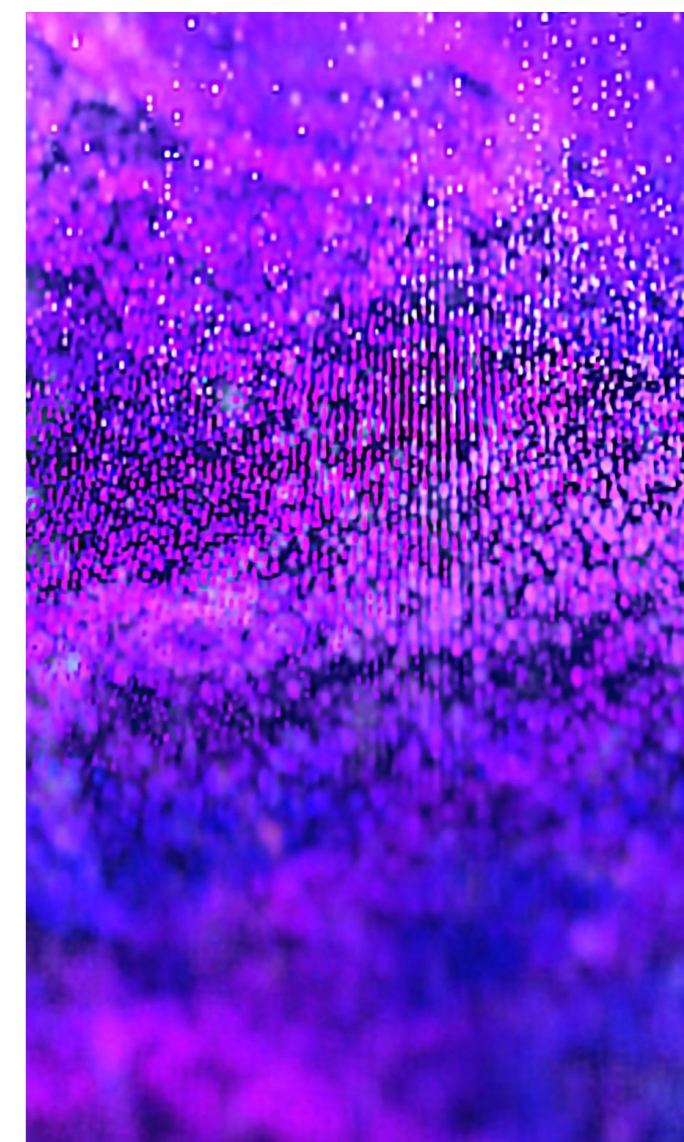
7. Expand data sharing: Participate in initiatives that focus on improving and expanding data sharing in ecosystems. The initiatives are typically innovation related, and more fixated on adjusting business models than operating models and are driven by representatives responsible for the business models. In addition, it is important to focus on setting up governance bodies across the ecosystem. This also requires additional focus on improving data quality, which is typically driven Chief Data Officers.
8. Implement data-driven decision making: Implementing a combination of algorithms enabling repetitive, simple, and automated decision making and making data available for one-off, complex decision making, will enable data-driven decision making in ecosystems. This not only requires clean data, but also strong governance to ensure that the outcomes of both categories are correct. A step-by-step approach for the implementation of algorithms reduces risks, where making data available is more a matter of gradually improving data quality. Setting priorities for data quality improvements will benefit both categories.
9. Focus on talent management: Educating, recruiting, and retaining talent are essential in sharing data in ecosystems. Organisations need to build up their capabilities in data and data analytics in both the technology as well as in the operational domain. Nurturing data citizens is essential for expanding data sharing and implementing data-driven decisions. Furthermore, embedding data ownership in the operational domain also requires evangelisation. Understanding the benefits of true data ownership is helpful in embracing data ownership responsibilities. Furthermore, organising support, in the form of data stewards, for the data owner is essential.

In summary – organisations have a lot on their plate. Let us continue to create value in the end-to-end value journey!

“As in most cases, technology is not the limiting factor here, and leveraging emerging technologies like AI only makes creating value with data sharing easier. Data-sharing ecosystems are fragile because they require collaboration and trust. Data is value, and data sharing means sharing value. Alignment of goals and measuring the impact of data sharing are crucial for eco-system-wide data sharing to be successful”.



Paul Verkerk, Business Development Director at Wipro



CONCLUSION

Over the last decade data, data sharing and data analytics have already had a significant impact on value creation in end-to-end value journeys. The exponential growth of data has opened opportunities to optimize operations, enrich products and services with data, and monetise data. Collaborating and sharing data in ecosystems enables further opportunities.

Keep in mind this is only the start, as artificial intelligence is still in its infant state. Setting up central data analytics teams and adding data citizens to organizational units will ensure artificial intelligence is also embedded in the organisation. For many organisations this implies that a significant effort is required to build up these capabilities. Also, for the foreseeable future, the artificial intelligence operating model will always have a central element. When the artificial intelligence capabilities mature, organisations might consider also having decentralised artificial intelligence resources. Having a fully decentralised artificial intelligence operating model is difficult to imagine.

Large scale leveraging of artificial intelligence generates additional and advanced insights in end-to-end value journeys. Artificial intelligence also triggers innovation. It supports collaboration between ecosystem partners and enables an agile approach in innovation, as simulations and pathfinding are contributing to innovation success.

However any organisation must acknowledge that increased data volumes and use of artificial intelligence increases the bar for both data management and data governance. These need to be implemented in organisations, as well as across the ecosystem. This is where tooling is essential, as this provides a foundation for improving the data quality and ensuring proper data usage by strict access management provisions. Also making templates and standard processes available enables the exchange of data and insights in ecosystems. What ecosystems need are plug-and-play concepts to share data and insights. This must be the focus of the governance body across the ecosystem.

Operating models

Data-driven approaches will adjust operating models of all organisations. Achieved efficiencies will enable investment in innovation. Sharing data and insights in ecosystems will result in innovations and new business models. The winner takes it all!

Some ecosystems are facing a lot of challenges by incumbent partners leaving the ecosystem, while on the other hand also new partners joining the ecosystem. These value chain dynamics jeopardise the sharing of data and the joint innovation. However, only anti-trust legislation can stop market dominance of a hand full of ecosystems. This is not challenging, legislation is a fact of life. Organisations must keep a close eye on legislation, including upcoming legislation, and make sure they understand the impact of

the legislation on their organisations and the ecosystems in which they are operating.

It is important that organisations set a clear strategy for dealing with data and analytics related legislation, given its importance for creating value in end-to-end value journeys and the number and impact of expected upcoming relevant legislations. Some organisations adopted more risk averse strategies where other organisations adopted more aggressive strategies. For setting the strategy, the sector in which the organisation operates, and corporate values of an organisation, provide important guidelines. Typically, highly regulated large organisations are more conservative, whereas new entrants, not limited to start-ups, are more aggressive. Deliberate decision making is important. However, organisations need to keep in mind that in turbulent times a too conservative approach to legislation potentially weakens the position of the organisation in ecosystems as well as competitiveness of entire ecosystems.

Business models

In addition to changing operating models also business models will change due to the sharing of data and insights. Due to the emerging developments in sharing data and insights, the impact is not as significant as the impact on operating models. It would be safe to assume that over time the impact on business models will exceed the impact on operating models.

With respect to co-creation the outcomes in this study were different from expected. For organisations that manufacture products the expectation was that creating and registering intellectual property rights would be important in creating value in end-to-end value journeys. Most of the surveyed organisations didn't have a focus on creating and registering intellectual property rights and either had no or a defensive intellectual property strategy. The main arguments were that the registration effort is significant and the protection is limited. Organisations consider the speed of innovation as a better strategy to stay ahead of the competition. With the continuous growth of data volumes and the potential of artificial intelligence, this is a defensible strategy, if not a better strategy.

In conclusion

Sharing data and insights in ecosystems will continue to fuel innovation and enable value creation in end-to-end value journey. In the next decade, organisations with strong capabilities in these areas will disrupt. This sets a clear agenda for the leadership of any organisation!





Edgar van Zoelen

Global practice leader Performance Analytics & Digital Transformation at Philips

INTERVIEW - PHILIPS

Data and data analytics power Philips' Quadruple Aim

The Philips portfolio consists of consumer and professional healthcare solutions. The focus in this interview is on professional healthcare solutions, which includes product related services. In designing new products and developing new services, leveraging data and data analytics are key. Edgar van Zoelen, global practice leader Performance Analytics & Digital Transformation, explains how Philips has transformed into a High Performance Digital Organisation.

Let us first understand Philips' quadruple aim. Edgar van Zoelen: "Philips' quadruple aim is all about enhancing the patient experience, improving health outcomes, lowering the cost of care, and improving the work life of care providers." Care journeys are a combination of providing care and operationally run a hospital where we have defined the objective to leverage the data within these care journeys to create more value in enabling care providers to provide better care in a changing health and care world.

There are three distinctly different but related data domains in healthcare: 1) medical devices, 2) patient data, and 3) care pathways operational data. The first data domain is related to medical devices, which includes maintenance data, as well as data to innovate the next generation devices. The second domain is patient data focusing on improving care. Related to the patient data is the care pathways data, which includes personal and clinical data.

The sensitivities related to data in this sector cannot be underestimated, as this sector is highly regulated. Obviously, there

is patient data, where sensitivities are privacy related. Also data related to clinicians and doctors, where sensitivities are related to privacy as well as competitive positions. Finally, the sensitivities related to hospitals, which are predominantly related to competitive positions, are important. The hospital's sensitivities are not limited to providing care but also to contributing to and participating in research projects.

Differences

Despite the different data domains and data sensitivities, it is important to acknowledge that comparing performance across different geographies is difficult to impossible. First of all, this is related to culture and the local health system setup, which impacts the design of healthcare processes. Edgar van Zoelen: "In the Netherlands the general practitioner is the first point of contact for most care, where in the US patients, go straight to the Emergency Department (ED) in a hospital." Also differences in contractual agreements between hospitals (providers) and healthcare insurance companies (payers), for example the differences between result oriented payments (Value based healthcare) versus fees per treatment (effort based), and the healthcare systems impact on performance comparability across the globe as well as in country. Edgar van Zoelen: "It is close to impossible for Philips to benchmark hospitals across the globe given the legal and logistic complexity of accessibility of the patient data and hospital operational data."

Competing

For Philips to stay competitive it is important to demonstrate cost efficiency of using the device, staff experience and of course patient experience. Edgar van Zoelen: "Philips is making the difference with data. We are adding intelligent software to our products. This increases the efficiency and effectiveness during the analysis performed by the physicians. For example a specific software tool provides the images of a heart complemented with the proposed dimensions of the stent." The specialist only needs to analyze both the images of the heart and the stent instead of analyzing the image of the heart and then measuring the dimensions of the stent. This saves time and improves care quality.

For developing intelligent software Philips teams in consortia with healthcare organisations including hospitals and universities. They provide anonymised data sets, which gives the consortium the ability to develop and add the software to their product portfolio. A research agreement between partners provides the foundation for the collaboration. Philips does not own the data, where ensuring data security and quality is a key priority, validation and checking are an integral part of Philips innovation process. Also transparency and understanding algorithms is important.

Needless to say that after developing the intelligent software, Philips needs to seek approval from the relevant authorities prior to expanding their product portfolio with intelligent software. Edgar van Zoelen: "We are rightfully under a strict supervision by different authorities (ie FDA), this is quite comparable with the process of getting approval for introducing a new drug. This is where quality management is of the essence."

Data Quality

To check data quality Philips has implemented three data principles and five Artificial Intelligence (AI) principles. The data principles include first and foremost security, focusing on protecting against vulnerabilities and managing incidents and privacy, ensuring Philips is compliant with the applicable privacy regulations of the countries they operate in. Secondly, the data privacy principles are also aligned with Philips' code of conduct which governs the data transfer and processing within Philips. The third data principle is the need to be beneficial to customers, patients and/or society.

In this context Philips has also implemented five AI principles. Well-being is the first principle. An AI algorithm must benefit the health and well-being of individuals and/or contribute to the sustainable development of society. The second principle is oversight. The AI algorithm augments and empowers people with appropriate human supervision. Robustness is the third principle. The AI algorithm has an appropriate protection against deliberate or inadvertent misuse and has no intent to harm. Also fairness is an important AI principle. This fourth AI principle states that the data is representative of the target group of the intended use and avoids bias or discrimination. The last AI principle is transparency.

Philips discloses which functions and features are AI-enabled. Furthermore Philips provides full insight into the validation process and clarity related to the responsibility for ultimate decision-making.

Registering Intellectual Property Rights

In safeguarding Philip's competitive position, tough decisions have to be made. Typically device-related innovations qualify more often than innovations related to intelligent software for registering intellectual property rights. The guiding principles for registering intellectual property rights are related to the likelihood that the same results can be achieved differently, as well as the expected required effort for the registration process. Edgar van Zoelen: "The expected required registration effort should never be underestimated."

Partnering

In addition to co-creating with hospitals, Philips also has a set of ecosystem partners to deliver turn key projects, such as operating rooms. Edgar van Zoelen: "A good example of a partner in this context are our operating table partners. As these are highly specialized manufacturers, they are typically not imitable on short notice." Partnering with specialized partners enriches Philips' portfolio, as they offer highly complementary products and services. Together they operate with one face-to-the-customer. This is as essential in out-competing other consortia, as sharing data with these specialised partners.

Value creation

Being a global company, Philips has to comply to many regulations, and faces market dynamics of any kind. This is why Philips' quadruple aim is powered by data and analytics. This health informatics strategy requires strong data and data analytics governance, as well as a focus on data quality, in combination with investing in partnerships. This is Philips' solid basis to confidently relevant share data with their ecosystem partners to create value in a changing health and care world.

Global data-sharing creates public value

The Port of Rotterdam shares data at scale. Claudia de Andrade, Director Digital & IT at Port of Rotterdam explains: “Of course the volumes of the transshipment in our harbor but also the increased levels of communication and need for earlier alignment between carriers are required to ensure seamless supply chains.” The importance of this has been articulated further by the outbreak of the COVID virus and the Suez canal crisis.

The Port of Rotterdam has public duties. The Port Authority ensures sustainable development, management and operation of the port and maintaining the safe and smooth handling of all shipping. The Harbour’s Master Division is responsible for traffic guidance, inspection and incident control. Furthermore, the Port of Rotterdam has commercial departments, which focus on retaining existing customers, finding new customers and identifying yet unknown customers of the port.

In order to share data, the Port of Rotterdam has defined a data transparency KPI and identified over 200 data points. Claudia de Andrade: “We strongly believe that sharing data, as well as transparency, will improve supply chain efficiency, but also will increase innovation. Currently around 27% of these data points are transparent.” At the end of next year, the data transparency target is around 35%. These data points are related to public duties as well as to the commercial activities. Claudia de Andrade: “We don’t differentiate – we focus on what is relevant for the logistic process of our port.”

Competitive advantage

The transparency triggers questions related to the competitive position of the port. Claudia de Andrade: “We believe that it is important to share data as supply chains are global supply chains. The reality is that container ships dock in Antwerp, followed by docking in Rotterdam, then go to Amsterdam and/or Hamburg. It is essential we collaborate and share data.” Currently the Port of Rotterdam is also engaging with the Port of Singapore to design a data corridor. In data sharing, data standards are important. There are too many maritime data standards. Claudia de Andrade: “Even within the European Union there are too many standards. Fortunately, the International Maritime Organisation has a strong focus on (data) standard setting.” The Port of Rotterdam has initiated defining berth information data, which is highly relevant in further improving the efficiency of global supply chains.

Data quality and data governance

Standardisation is instrumental in ensuring data quality. In the Port of Rotterdam most data is related to the operational process. Claudia de Andrade: “We spent eight years aligning the terminals

and barge operators on an integral planning process. This has been a major step forward.” The integral planning also includes intraport and the inland shipping. The implementation, in addition to the implementation of the data standard, required a significant change management effort. Claudia de Andrade: “After the implementation we noticed that some of the barge operators indicated that containers were arriving earlier to push out competitors by claiming capacity while not actually using the claimed capacity. Also, we had opportunistic barge operators claiming to have capacity which they didn’t have. Both result in low data quality and disrupt the supply chain processes.” This standardisation provided detailed insights into the port processes and its participants. The performance of individual barge operators and terminals was not shared, as this is commercially sensitive information. Claudia de Andrade: “We provide a dashboard detailing the performance of individual party compared to the the port performance. The terminals can compare their performance with the average performance of all terminals in the harbor.” The Port of Rotterdam’s daughter Nextlogic also proactively interacts with the all parties involved to improve the process even further. Data quality is improved because it is directly linked to the performance of the process.

Co-creation

In the past the Port of Rotterdam has been involved with initiating and collaborating with start-ups and scale-ups to stimulate innovation and improve its competitive position and performance. This was instrumental in building up knowledge and getting insights. Claudia de Andrade: “Nevertheless creating intellectual property rights and monetisation is not necessarily aligned with our mission. Currently we evaluate partnering opportunities mission driven, on a case-by-case basis.” For the Port of Rotterdam facilitating start-ups and scale-ups is more important than participation. An advanced and seamless ecosystem creates value for all. Claudia de Andrade: “Also, we have a neutral position, which potentially conflicts with monetisation.”

Artificial intelligence

The Port of Rotterdam for example uses artificial intelligence in assessing the risk profile of docking during strong winds. Furthermore, all types of maintenance activities are also leveraging artificial intelligence. Sensor data as well as camera and satellite footage are essential input for the algorithms. Claudia de Andrade: “We are currently experimenting with drone inspections, as this is more efficient than reaching out with one of our ships. Furthermore, I believe it is important to share that we use artificial intelligence only to support the decision-making process of our employees. In the end they make the decisions.” A good example of successful artificial intelligence is improved risk analysis. AI proved The Port of Rotterdam can increase safely

allowing 10% more ships in bad weather conditions due to improved windmodelling. Other artificial intelligence use cases are hydro meteorological and docking sensors triggering a complete redesign of docks. Ultimately the Port of Rotterdam is considering not only to share data but also share insights generated by artificial intelligence. Claudia de Andrade: “We are collaborating with the Delft University to bring this to the next level.”

In optimizing global supply chains and responding to disruptions such as the outbreak of the COVID virus and the Suez canal crisis, the Port of Rotterdam is working its way around physical overflows. In aligning with partners, artificial intelligence and data sharing is essential.

Claudia de Andrade: “For me it’s obvious, it essential that organisations sharing data in their ecosystems. This should be in the DNA of any organisation and its ecosystem.” It is very apparent that the ecosystem of the Port of Rotterdam has data sharing in its DNA.



Claudia de Andrade

Director Digital & Information Technology
at Port of Rotterdam

Hessel Dijkers

Chief Information Officer at Dutch Railways

INTERVIEW - DUTCH RAILWAYS

Dutch Railways's client centric data sharing approach

Despite the impact of COVID, the railway network is crowded and in peak hours the passenger volumes are high. In order to ensure reliable and safe transportation, Dutch Railways shares, analyses and collects large volumes of data. Furthermore data analytics is used to develop innovative propositions with partners. Hessel Dijkers, Chief Information Officer Dutch Railways: "For our organisation data is essential to ensure our trains arrive on time, as well as to innovate. We are currently implementing Mobility as a Service with our partners."

Let us take a closer look at the use of data for daily operations. First of all Dutch Railways, as all public transport organisations in the Netherlands, is a member of Translink. This is a cooperative organisation that enables the clearing and settlement of public transport payments. Hessel Dijkers: "With the OV-chip card also check-in and check-out data are shared. We share this information with municipalities. They are able to anticipate the number of expected visitors for events, such as Koningsdag or the Formula 1 in Zandvoort." Dutch Railways only shares aggregated passengers information related to the train onboarding and exiting, no information is shared on journeys, none on a passenger level. This information enables local authorities to set up crowd control for their events.

Furthermore Dutch Railways has the obligation to provide travel information. This includes the time table, but also information about delays. This is all public information and available via an

API and includes information related to prices, current departure times, disruptions and work, a list of stations showing all stations in the Netherlands including geodata, and station to station travel advice. Hessel Dijkers: "Google uses this information to present travel alternatives in Google Maps, comparing the anticipated time to travel from A to B by train and by car. For road travel, traffic congestion is taken into account." This is useful for any of us in making travel decisions.

NS-App

In communicating with their passengers, the NS-App is essential. Not only the time table and delays are communicated. Hessel Dijkers: "We also transact via the App. Our passengers can buy their train tickets in our App. Furthermore we provide real time information of the journey for all our trains. The App shows where your train is and what are the expected arrival times at the upcoming stations. Very convenient for our passengers." Also the App provides information on the passenger volumes in the train. Hessel Dijkers: "This information enables our passengers to adjust their travel schedules if and when needed. We also use this information in coordinating and prioritising train journeys." In coordination, Dutch Railways and ProRail, which operates the rail network, exchange a lot of information to ensure safe and reliable rail transportation.

Artificial Intelligence

As in many organisations, also for Dutch Railways, artificial intelligence is instrumental in their business operations. Hessel Dijkers: "We use artificial intelligence in adjusting our time table in case of disruptions. There are many considerations that need to be taken into account, however the train driver in responding to disruptions is minimizing the impact on our passengers." Based on check-in and check-out data decisions are made. These decisions vary from cancelling trains to reducing or extending the number of carriages. Hessel Dijkers: "What is also important is ensuring that all trains are available for the next day." Trains need to be inspected and in the morning ready to embark on the set time table. In case of major disruptions this is not easy, and artificial intelligence is instrumental in making decisions in these matters.

Furthermore Dutch Railways is increasingly using artificial intelligence for maintaining the trains. Hessel Dijkers: "We use cameras in addition to visual inspections of our trains. This results in significant savings in the required effort for the inspection of our trains and is also more cost efficient."

Furthermore Dutch Railways uses algorithms to annually update the time table. Hessel Dijkers: "This is not artificial intelligence, but is data intensive. We take into account demographic developments, including new schools or tourist attraction and new train stations, as well as historic travel information." This makes annual updating of the time table far from straightforward.

Rivier – Mobility as a Service

Rivier is a joint venture of Dutch Railways, HTM and RET offering Mobility as a Service. The offering supports seamless and convenient travel and partners with Siemens Mobility. In addition to public transport, the mobility providers are car, e-scooter and bike sharing mobility providers, as well as water taxis. Hessel Dijkers: "This is an open platform. Passengers can procure a single ticket for their journey, regardless of the number of involved mobility organisations. Obviously weather conditions, (rail)road works and traffic jams are taken into account in the real time presentation of the mobility alternatives." The platform is not only convenient for the passengers, but also for the mobility providers, as the platform ensures the mobility provider's transaction settlement.

Market dynamics

The prices of train tickets are set by the government. Despite the tendering of concessions, there is no competition on passenger rail transportation in the Netherlands. Hessel Dijkers: "However, we use subscriptions, combination tickets and promotion tickets to pursued potential passengers to travel by train." Dutch Railways for examples has "combi" tickets with KLM, combined train and air travel, and with Efteling, combined public transport and park entrance. Despite the set pricing for the train tickets, these mechanisms are also instrumental to avoid peaks in passenger volumes. Hessel Dijkers: "This is context - our off-peak subscriptions are instrumental."

No data sharing = no mobility

It is fair to say, no data sharing - no mobility. Increasing communication is required to operate trains and meet passengers' continuous demand for more convenience. Increased data sharing is also related to mobility safety and ESG targets, not limited to regulatory requirements but also related to the Sustainable Development Goals of the United Nations, net-zero and the circular economy. Hessel Dijkers: "Sustainability is an important topic for us." Furthermore with Mobility as a Service on the rise, data sharing will become even more important in providing mobility. A growing number of passengers will attract new mobility providers. Hessel Dijkers: "The network effect drives growth of our mobility platform Rivier." Let us take stock three years from now, by then the mobility platform should be the mobility connector in the Netherlands.

APPENDICES

Workshops and survey

The data for this research was collected in webinars and workshops and by a survey. The webinars and workshops took place on 9 March, 11 May, 4 July 2023 and 16 January 2024. An overview of the participants is detailed in

The survey was conducted by ICT Media. The members of this community are chief information officers, chief data officers, and their direct reports. This community was also invited via LinkedIn. This invitation resulted in 59 responses.

Since the survey was anonymous, it is not possible to establish the extent to which the sample was representative of the community. However, given the spread over the different sectors and the size of the organisations that the respondents represent, there is no indication that they are not representative of the community, which was also confirmed by ICT Media. The participants completed their response via an online portal. The responses were collected from 26 April until 17 August 2023.

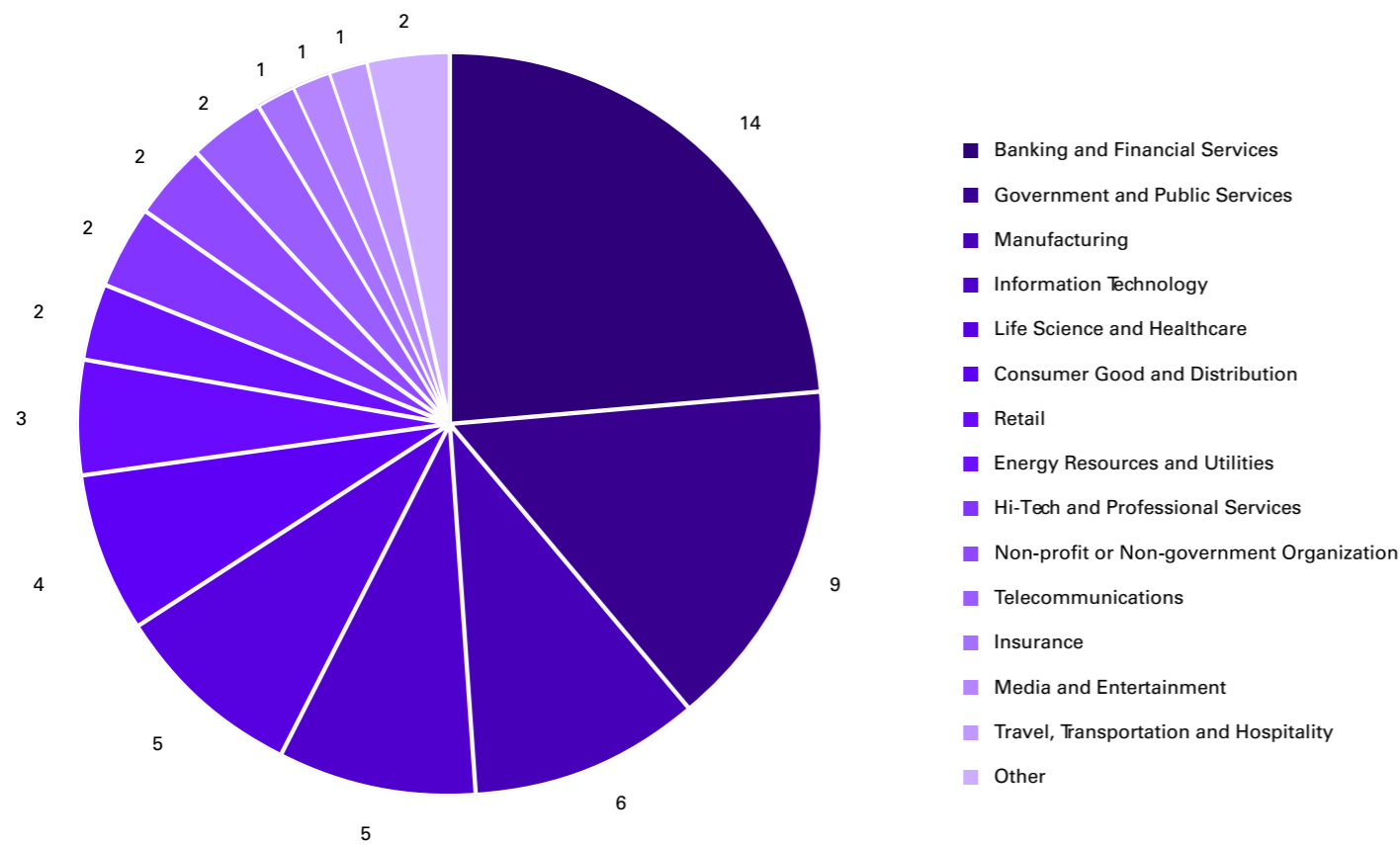


Figure 18 - Overview of sectors of the surveyed organisations (N=59)

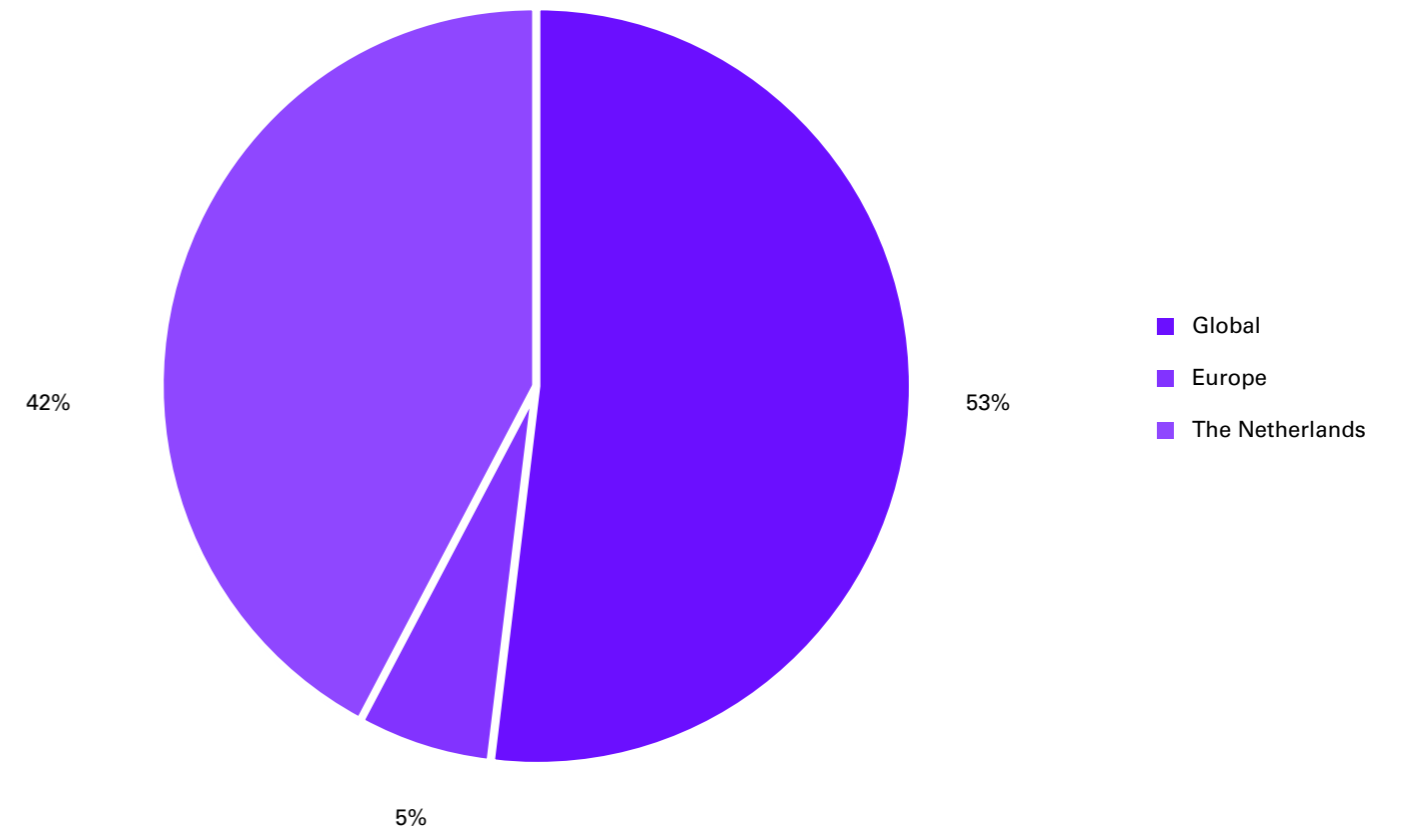


Figure 19 - Overview of the geographical spread of the surveyed organisations (N=59)

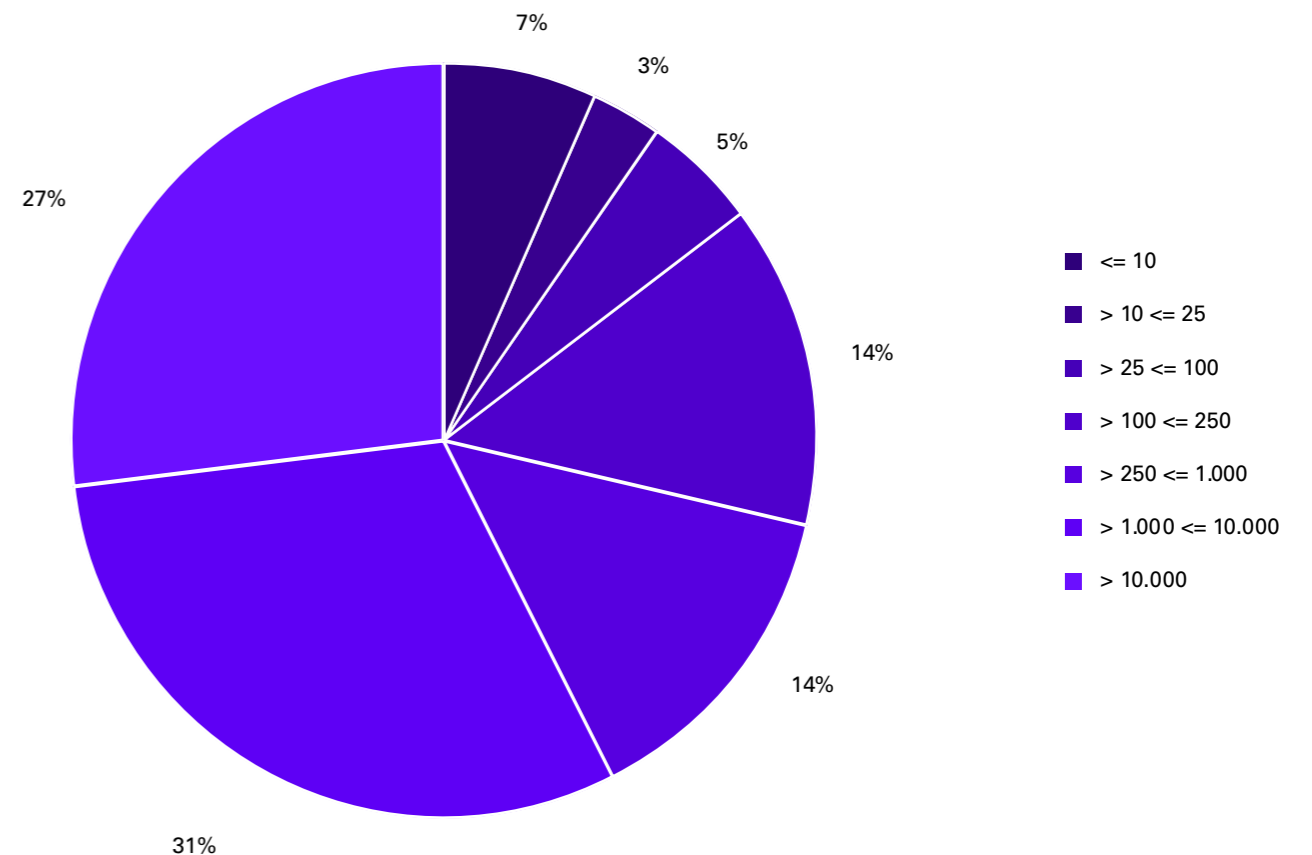


Figure 20 - Overview of the revenue/budget of the surveyed organisations in m euro (N=59)



PROF DR ERIK BEULEN AUTHOR, INTERVIEWER AND WORKSHOP MODERATOR

Erik Beulen (1969) is a professor at the University of Manchester, as well as at Tilburg University. Furthermore he is the academic director of the executive MSc Information Management & Digital Transformations programme at TIAS School for Business and Society at Tilburg University. Also, Erik is an independent member of the data committee of Royal FloraHolland.

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. His research concentrates on information management, digital transformations, disruptive technologies, outsourcing and corporate governance. His academic work has been published in the 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 lead author of the book Managing IT Outsourcing. He is also the co-editor of a book on managing digital outsourcing (2020) and is the lead author of an upcoming book on data analytics and digital transformations (2023). All his books are published with Routledge, UK.

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