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Developing Data and Analytics Maturity Framework to Support Business Transformation

Case: Veho Oy Ab

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<p>The purpose of this study was to find ways the case company Veho Oy Ab could address the challenge of not using data to its full potential. Veho is a Finnish downstream automotive company selling, importing and repairing passenger and commercial vehicles. Veho's digital strategy emphasises the importance of good quality Data and Analytics services, but the company lacks the means to bring this statement into reality. Maturing into an organization that is able to fully benefit from its data assets needs a maturity framework to steer leaders when prioritizing projects, planning needed actions and measuring the progress.</p> <p>Existing knowledge was used to gain better understanding on how Data and Analytics are changing modern business culture and why maturity matters. Relevant maturity dimensions were chosen from existing maturity models and best practises were studied more closely. Research in the case organization was conducted through a comprehensive set of qualitative interviews to build a holistic view on the current state of Data and Analytics maturity. The current state analysis was combined with conceptual framework and used for building the framework suitable for Veho's business. The maturity score for the current state was assessed based on the analysis. The target stage was set through workshops and additional interviews.</p> <p>The outcome of this study is a Data and Analytics maturity framework designed for Veho. The framework includes five dimensions: strategy and vision, organization and people, technology, analytics, and data management. It introduces a five-level scale for assessing the maturity for each of the dimensions. The current state analysis revealed that Veho is at level two out of five and is targeting to reach level four in 2021 when the actual benefits of data can be seen realized. From the framework, Veho can find the needed criteria to gain the next level of maturity and eventually reach the target.</p> <p>The author suggests that Veho uses the maturity framework when planning and measuring Data and Analytics transformation programme for years 2019-2021. By doing this Veho is able to make more accurate plans and decisions when growing maturity throughout the organization. Eventually Veho will more likely achieve the targets described in digital strategy and gain value through better business decisions and results.</p>	
Keywords	Data, Analytics, Maturity model, Business intelligence

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1 Introduction

1.1 Overview

Veho is one of the biggest downstream automotive industry companies in Finland. Customer experience and efficiency are at the core of Veho's business values and Data and Analytics has many possibilities around challenges related to these. To get the competitive advantage analytics offers, Veho needs a plan on how to increase Data and Analytics maturity.

1.2 Business Challenge

Data can be seen as an asset to a company and a competitive advantage when utilized properly. Data analytics can help to reduce costs, find patterns in order to predict events, optimize processes, find new prospects and focus resources. Without data companies can guess what has happened and what will happen but to minimize risks and to find new customers or profitable sales, analytics is an essential part of modern business management and decision making. Especially for a sales and marketing organization, having a 360-view of a customer with full information on sales, marketing actions, contact information combined with external information that affect sales, is an advantage over competitors.

Veho is storing large amounts of customer and product data. The data is used in marketing, financial services and in business to understand the customers better. Yet it is not utilized in a structured way to support strategic actions and decision making.

Veho is launching a new corporate strategy in 2018 with a focus on digitalization and connectivity. This means that when the industry is moving from product centric to customer centric, Veho wants to be a forth runner in this. It is stated in the new strategy that one way to increase the customer centricity is to increase operational and profitable transparency by developing and utilizing analytical capabilities. It is highlighted even more in the digital strategy which is built from the corporate strategy goals. The digital strategy states 'Veho will have a competitive advantage from its advanced inter-

nal analytics services and high-quality, up to date customer and product information. We will have the needed competencies and resources for it'(Veho, 2018:p.13). The challenge is that Veho is missing a clear view of the steps it needs to be able to succeed in the cultural change to data-centric corporation.

1.3 Case Company

Veho Oy Ab is a Finnish downstream automotive industry company established in 1939. It sells, imports, repairs and maintains passenger and commercial vehicles serving consumers and corporate customers in Finland, Sweden and the Baltic countries. Mercedes-Benz is the core of Veho and the biggest brand.

Veho's turnover in 2016 was 1.2 billion euros, from which around 80 % came from Finland. Veho employs 1890 people, of whom 150 work in administration. The organization is split into commercial vehicles, passenger cars and common functions such as Digital services, Finance and HR. Veho is a customer focused company and it values sustainable actions, customer satisfaction and employee wellbeing. (Veho Oy Ab, 2016).

The team responsible for developing analytics is the Information management team in Digital services. The team is developing more into a Data and Analytics team and will have a major role in implementing analytics into the whole corporation.

1.4 Objective and Scope

The objective of this study is to create a framework for management to increase Data and Analytics maturity. Getting better use of Data and Analytics will support strategic targets, gain competitive advantage and generate business value. The maturity framework will be used in further long- and short-term action planning.

Growing analytics maturity depends on several factors such as organization with supporting roles, technologies and tools and operating model. The thesis views Data and Analytics more in broad level than deep level which means that it will include the most suitable maturity dimensions for Veho but will not go into details such as data sources

or models. The data scope of this thesis is in product and customer Data and Analytics for sales and marketing organizations.

Outcome of the study will be a Data and Analytics maturity framework designed especially for Veho's business culture. It will have a five-level assessment scale with Veho's current and target states included.

1.5 Key terms/Concepts

Business Intelligence (BI) refers to gathering, utilizing and analysing business information. In some cases BI is used as a term to describe reporting or analytics solutions.

Enterprise Data Warehouse (EDW) refers to a system used for storing data from multiple sources that is used for reporting and analytics.

Data and Analytics refers to the field that includes business intelligence solutions, data analytics, data science and data management.

Data Science is a concept that uses methods like statistics, algorithms, machine learning and scientific processes to get knowledge and insights from data.

CDO can be a Chief data officer or a Chief digital officer. In Veho's case it means "digital". Gartner uses it for "data".

1.6 Thesis Outline

The research was done by using qualitative methods; interviews, internal documentation and workshops. Literature used to support the research is mostly academic journals and papers published by consulting companies.

The thesis is organized as follows. Firstly, the importance of Data and Analytics maturity is studied, and different existing maturity models are researched. Different aspects and dimensions of maturity most closely related to Veho are selected and researched. Secondly the current state of Data and Analytics related to chosen dimensions is researched by doing interviews among different levels of stakeholders. Thirdly the pro-

posal of for the framework is built and the targets are set. Finally, a maturity framework will be finalized based on three-level validation by the project team, by using it on practise and by Veho management team.

2 Research Design

This section introduces the research approach and design used in this thesis as well as an overview on data collection and validity.

2.1 Research Approach

This research is an applied empirical research and it is done using the gate model. The research is constructed from seven gates.

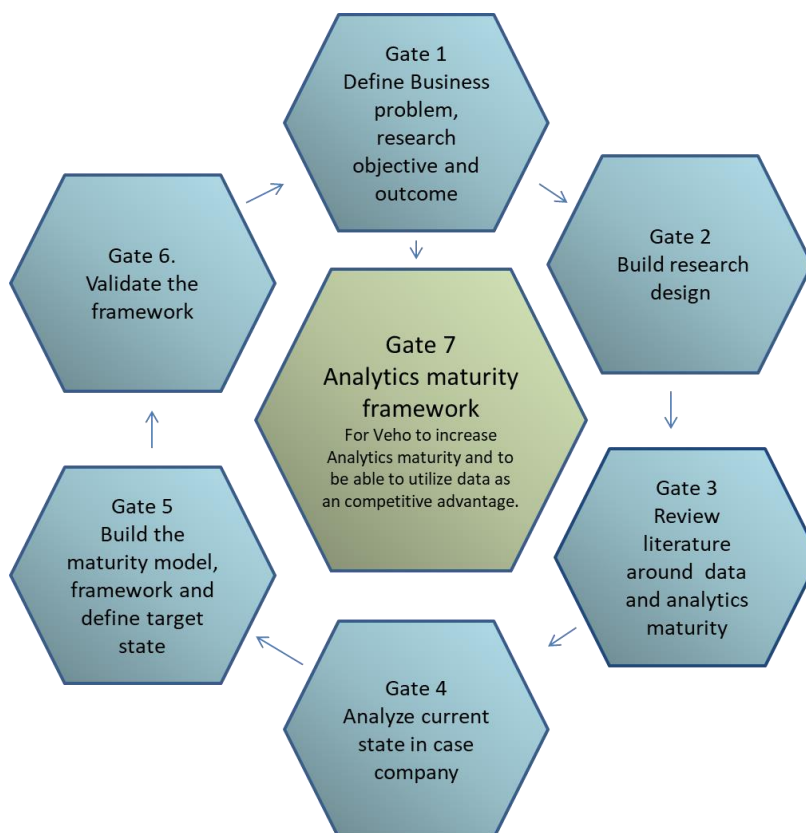


Figure 1. Gate model used in Metropolia University of applied sciences in the Business Informatics MBA programme (2018)

With the first two gates the business problem, objective and the thesis outcome are described, and the research design is built. The third gate focuses on existing knowledge and the fourth gate on analysing the current state in the case organization. The fifth gate is about building the proposed solution which is the outcome of the thesis. The sixth gate will be the validation of the proposal, and the outcome of the final,

seventh gate is going to be the finished Data and Analytics Maturity Framework. The progress between gates is evaluated in gate seminars after gates 1, 2, 3, 4 and 7 by thesis supervisors.

The study itself will start with the existing knowledge. This approach was chosen because it is better to first understand why Data and Analytics are important for an organization and what aspects an organization needs to consider when building a culture for mature Data and Analytics usage. There are existing maturity models designed for organizations to help in long- and short-term action planning and target setting. From these the most relevant dimensions are chosen to further study the best practises. These dimensions are used for the current state analysis and proposal building. After the existing knowledge has been studied, data collection for the current state can be more precise and the interview questions and workshops can be designed based on relevant matters from existing frameworks.

The research method used is qualitative through a set of interviews, observations and documentation. This is because the collected data is more about people's thoughts and views than hard statistics. The interviews are conducted in semi-structured manner, with room left for discussion.

2.2 Research Design

Research design is based on the gate model and it introduces data collection and outcomes as well (Figure 2).

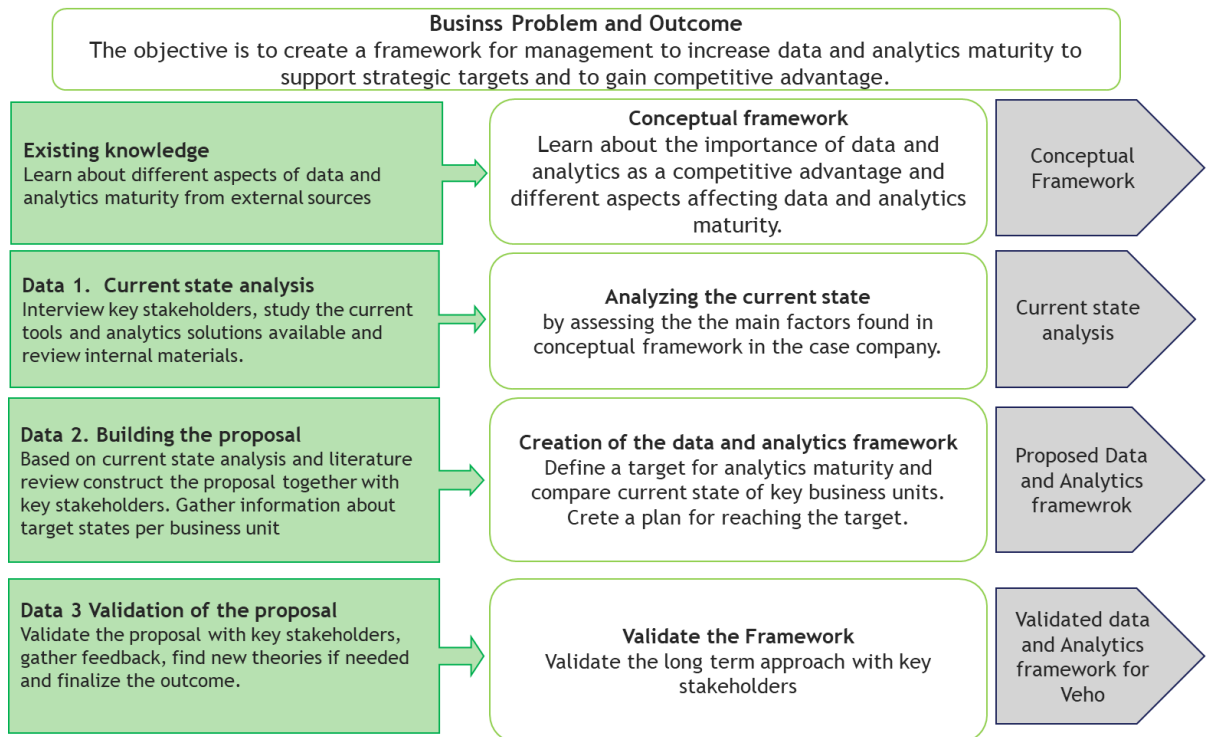


Figure 2. Research design

The first part of the research phase is conceptual framework, where analytics as a competitive advantage, maturity thinking, existing maturity models and dimensions are researched from external sources. This part includes the first phase of the proposal building when dimensions found from existing models are chosen for Veho. These dimensions are studied more thoroughly to find the best practises. The objective is to learn about maturity models and different stages and dimensions affecting analytics maturity in order to later compare the current state to the these. Literature in this study is mostly gathered from journals and papers published by consulting companies, field specialists and analysts, many of them related to Gartner (Figure 3). It is a challenge to find up-to-date information about Data and Analytics maturity since the industry is evolving constantly. Gartner is regarded as one of the leading Data and Analytics consulting company giving guidelines for management.

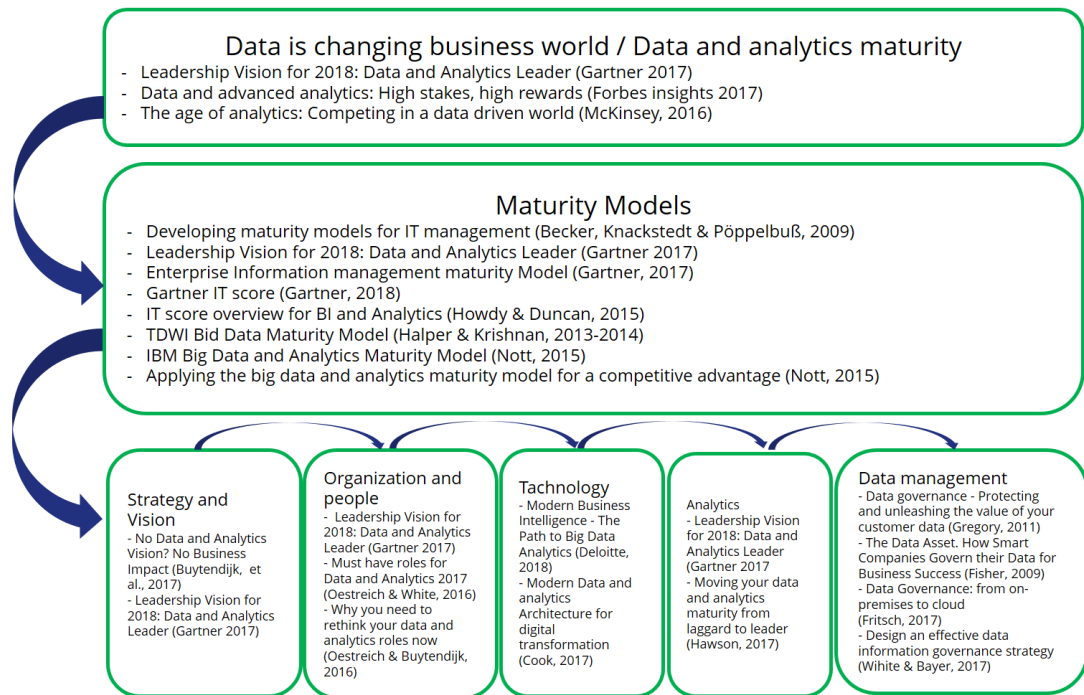


Figure 3. The sources used for literature review

Key questions to get answers from existing knowledge are:

- Why Data and Analytics is important for modern organizations?
- Why maturity matters?
- Why maturity models are suitable tools for strategic planning?
- What kind of maturity models exist and what are their maturity dimensions?
- What are the best practises involved in the chosen maturity dimensions?

The second part of the research is current state analysis. The objective is to learn about the current state of Data and Analytics maturity in the case organization from the perspective found in conceptual framework. Current state analysis is used for assessing the future state of Veho's Data and Analytics maturity. Data is gathered with interviews and from internal documentation. Current state analysis is done for the main business units in Finland and all levels of data users are involved. The focus is on customer and product related analytics for internal purposes.

The third part is to create a proposed framework for overcoming the challenge. A project team from Veho is involved in the creation process. Further information is collected for defining the desired target state through interviews and workshops. A version is drafted where indicators from existing models are combined and enriched with best practises for the chosen dimensions. Current state analysis is used for assessing cur-

rent maturity score for different dimensions. The proposal will include a five-stage maturity framework suitable for Veho's culture with chosen maturity dimensions, current stage and target stage.

The proposal is validated first with the core project team involved. The second part of the validation is to use it in practise as a framework for long- and short-term action planning done in summer 2018. Third validation is done by presenting it to the leadership team to get the support for defined target state. Based on feedback, the framework is developed and finalized.

2.3 Data Collection and Analysis

Data is collected in this research to get evidence for the current state analysis, building the proposal and validating it. The data collection plan is presented in Appendix 1.

The first round of data gathering is done for current state analysis. Data is gathered with 42 interviews with key stakeholders from three purpose focuses: 10 with high-level, 16 with mid-level and 16 with root-level experience. High-level experience includes executives, directors and other leaders who have more strategic view on the subject. People with mid-level experience include people who are usually in managerial positions and who could be seen as data users and consumers. People who have a root-level experience are involved in Data and Analytics development or are super users in the current solutions provided. The objective of the interviews is to gather knowledge about current state of Data and Analytics for chosen dimensions. Interviews are recorded, and questions are asked based on the experience level (Figure 4). The question framework is presented in Appendix 2 and works as a basis for the conversation. Interview sessions last from 30 minutes to an hour. Customers or other outside stakeholders are not involved since the focus is on internal analytics. Internal documentation is studied to further understand the current organization, strategies and processes around Data and Analytics.

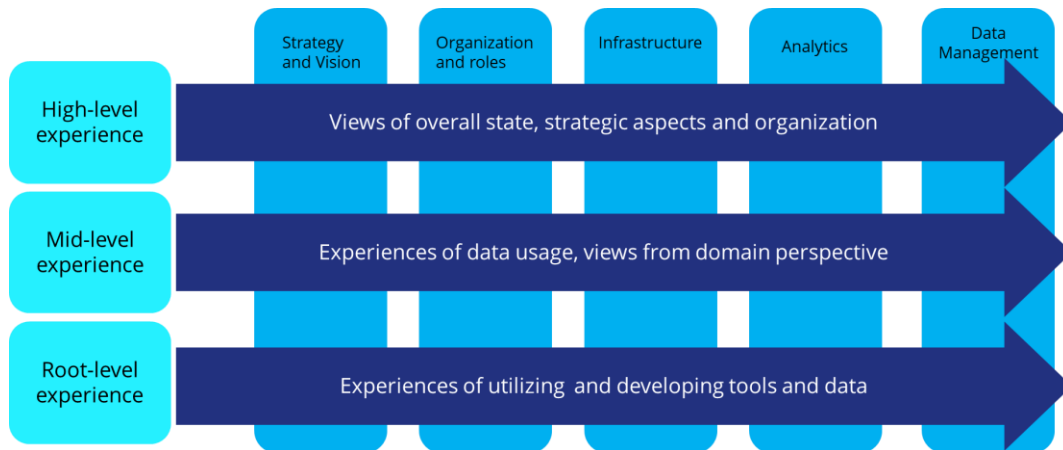


Figure 4. Interview framework for different stakeholder groups

The proposal is build based on the best practises and maturity indicators found from existing knowledge and current state at Veho. Current state analysis is used for choosing the indicators most suitable for Veho's culture and assessing the current maturity score. Veho is given a score from one to five for each indicator. The score is summed up to dimension level score and eventually to overall maturity score. At this stage data gathering is focusing on workshops and interviews with key stakeholders to define a target state for each dimension.

The third data round, the validation, is done in three levels. Firstly, data is gathered from the project team group interview and a separate interview with the project sponsor, the CDO. Secondly data is gathered and used for alterations from the practical validation done with strategy planning. Thirdly data is gathered from the management team in the final validation stage.

2.4 Validity and Reliability

The basis of the conceptual framework is concluded from existing maturity models and industry best practises from variety of sources. The framework is enriched with the information gathered from Veho employees. All the interviews are documented, and notes taken from workshops. Nothing is based on assumptions and can be traced back to either existing knowledge and current state analysis or other data gathered from case company. The outcome of the thesis has gone through a three level validation process.

3 Conceptual framework

Conceptual framework first looks at how data is changing the business world. The Data and Analytics maturity and why it is important are addressed in the second section. The third section looks at the existing maturity models and the last section focuses on the chosen maturity dimensions and best practises found from existing knowledge.

3.1 Data is changing the business world

Digital era has entered the business life. More and more operational work takes place through systems, and data is collected along the way. Data and new technologies have enabled organisations to find new ways to utilize their existing markets, to find new business models and to even create new markets. For early adopters of this idea it can open significant opportunity to gain competitive advantage. (Gartner, 2017a) Gartner's (2017a) assumption states that 'By 2018, more than half of large organizations globally will compete using advanced analytics and proprietary algorithms, causing the disruption of entire industries.' (p.10).

According to Gartner there is a division seen in IT where IT-word is being divided into Technology and Information, meaning that information including Data and Analytics will be separated from traditional IT-operations and getting closer to business. This can be seen as the biggest paradigm shift in the way business is done in the age of technology. Therefore, IT and business need to start working closer together to find ways to operate in the digital world. Data and Analytics should be made part of the organisational culture by everyday decision making, guiding business operations toward better results. (Gartner, 2017a)

The rapid growth of data volumes is disrupting business. According to McKinsey (2016) the amount of data doubles every three years. The change is getting bigger when Data and Analytics reach the big masses. Most of the companies are able to capture only a fraction of the benefits Data and Analytics can offer. The difficulty lies in turning the organizations into data driven in practise. (McKinsey Global Institute, 2016)

Organizations are using data and advanced analytics to be more competitive, increase profit and reduce risk. New less traditional organizations are using data as a strategic

asset and getting advances from that. These organizations leverage data to deliver better products and services. According to Forbes Insights (2017) it is the key for an organization to understand the value of data in order to make it a core of their business strategy. (Forbes Insights, 2017)

The information is more connected than ever. There are endless opportunities to utilize data and generate value for business. There are also many obstacles in the way of getting the best out of it. Budgets are tight, skills are lacking, and leadership is missing. To be able to utilize technologies and data, it is important to have right organizational and cultural elements in place. Data and Analytics programs need to be embedded in all parts of the organization since the need for analytics is everywhere. (Gartner, 2017a)

3.2 Data and Analytics maturity

In the recent study of Forbes(2017) it is stated that Data and Analytics maturity can't be bought just with money. They surveyed more than 1500 global executives to get insight on the needed maturity aspects around analytics and to understand how the maturity relates to business success. The study states that only 7% of the enterprises belong to the leading category of analytics maturity. By Forbes (2017) 'leading' means that 'Their analytics strategy is well-established and central to the overall business strategy. Their current state of competitive ability in Data and Analytics is market-leading.' (p.6). Most belong to the challenging or developing categories where analytics strategy is established but still not fully aligned with the enterprise strategy or starting to be seen as a key strategy. Figure 5 shows that the organizations leading in analytics maturity are the ones that have most likely increased revenue growth, operating margin and improved risk management. (Forbes insights, 2017)

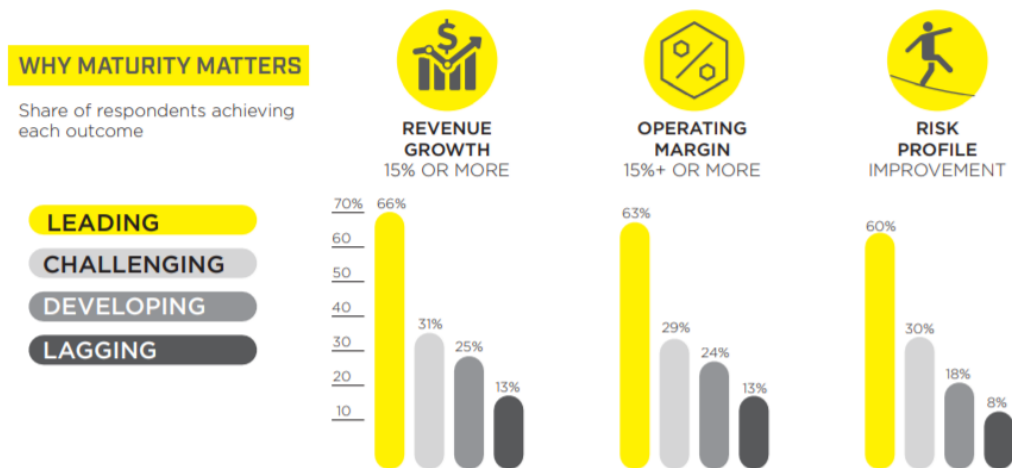


Figure 5. Why maturity matters? (Forbes insights, 2017:p.6)

The research compares different industries and geographic areas and ranks them against each other. Finland shows an average score, when for example Sweden and Norway are above average. When comparing eleven different industries from telecommunications to healthcare and technology, automotive industry is ranked in the last place. Automotive industry was seen as one of the most impacted sectors when the specific question business tried to solve with Data and Analytics was related to increase in customer satisfaction or retention and developing new products or services. (Forbes insights, 2017)

The study scores maturity levels by industry using percentages. Automotive industry was scoring 58 % which means that it is half way on the journey when the leading industry, telecommunications, is scoring 73 %. In other words, automotive industry is the most immature industry studied in this research. Only 15% of automotive industry leaders see Data and Analytics central to their business strategy. The leaders are struggling with advanced analytics methods and processes more than leaders from other industries. The insights and analysis based on the data are not well integrated to processes. From positive side the trust in data is higher than in other industries. (Forbes insights, 2017)

3.3 Maturity models

Maturity models have become important tools for IT management. These models have been developed to position organizations against others and to find solutions to gain desired maturity. Maturity models offer organizations a possibility to compare their current status against a scale, to better prioritize the actions for improvements and to control the progress. The models consist of different maturity levels that show a typical evolution path to gain the desired stage. To be able to move one stage up, the organization needs to fulfil needed criteria and characteristics. (Becker, Knackstedt & Pöppelbuß, 2009)

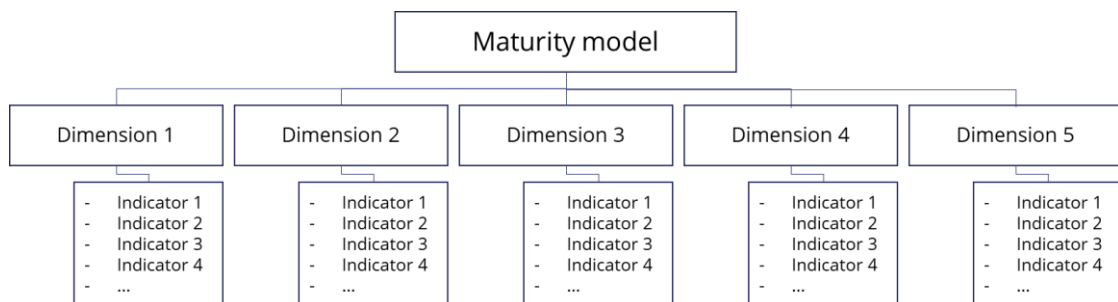


Figure 6. Maturity model hierarchy

There are many maturity models out in Data and Analytics market. Many consultancy companies and associations have their own models. The idea of these models is the same as with other IT maturity models. The hierarchy of a typical maturity model presented in Figure 6 shows that dimensions have indicators that have individual characteristics and criteria. Different maturity models related to Data and Analytics are presented in the next three chapters.

3.3.1 Gartner's Enterprise Information Model (EIM) and IT Score Overview for BI and Analytics

Gartner has two maturity models that can be associated with Data and Analytics; the Enterprise Information model and IT Score for BI and Analytics maturity.

3.3.1.1 Enterprise Information Model (EIM)

The idea behind Gartner's Enterprise Information Model is to utilize Data and Analytics for getting the best business outcomes. It is developed for Data and Analytics leaders to enable establishing a roadmap to support continuous development. (Gartner, 2017a)

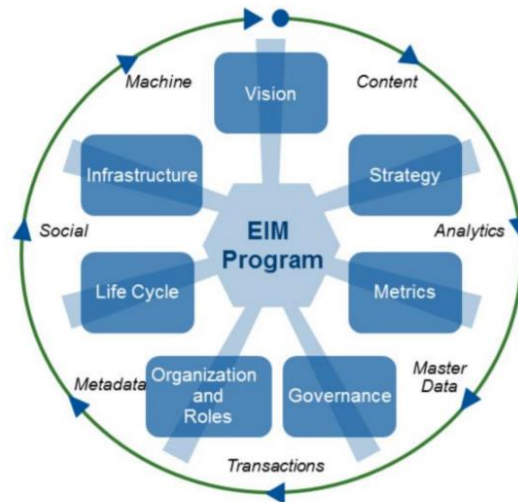
Gartner sees that Enterprise information management can't be implemented as a project but more as a program. It is seen to be transformational, taking several years to reach the desired target. The EIM is supporting assessment and planning of the EIM journey. With the maturity model, the leaders can identify the stage of maturity and actions for reaching the next stage. (Laney, 2016)

EIM has seven building blocks that are assessed with five levels. (Laney, 2016)

- Level 1 (10%): The organization is aware of the challenges but lacks the needed resources and/or leadership.
- Level 2 (30 %): The organization operates reactively and addresses problems as they come.
- Level 3 (40%): The organization works proactively in some information related topics and starts to think in the enterprise level. Programs are not aligned but some are effective.
- Level 4 (15 %): Organizations that are industry leaders in aligned information management. The decided approach makes sure people, processes and technologies are coordinated appropriately.
- Level 5 (< 5 %): Organizations have optimized ways of acquiring, administrating and applying information as an asset and having high-functioning organization, talent and technologies at hand.

(Laney, 2016)

Think Programmatically: *Enterprise Information Management*



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Gartner

Figure 7. Enterprise information management building blocks (Gartner, 2017a:p.13)

EIM identifies seven building blocks: Vision, Strategy, Metrics, Information Governance, Organization and roles, Information life cycle and Enabling infrastructure. The building block or dimensions are not hierarchical, but all linked to each other like presented in Figure 7. (Gartner, 2017a)

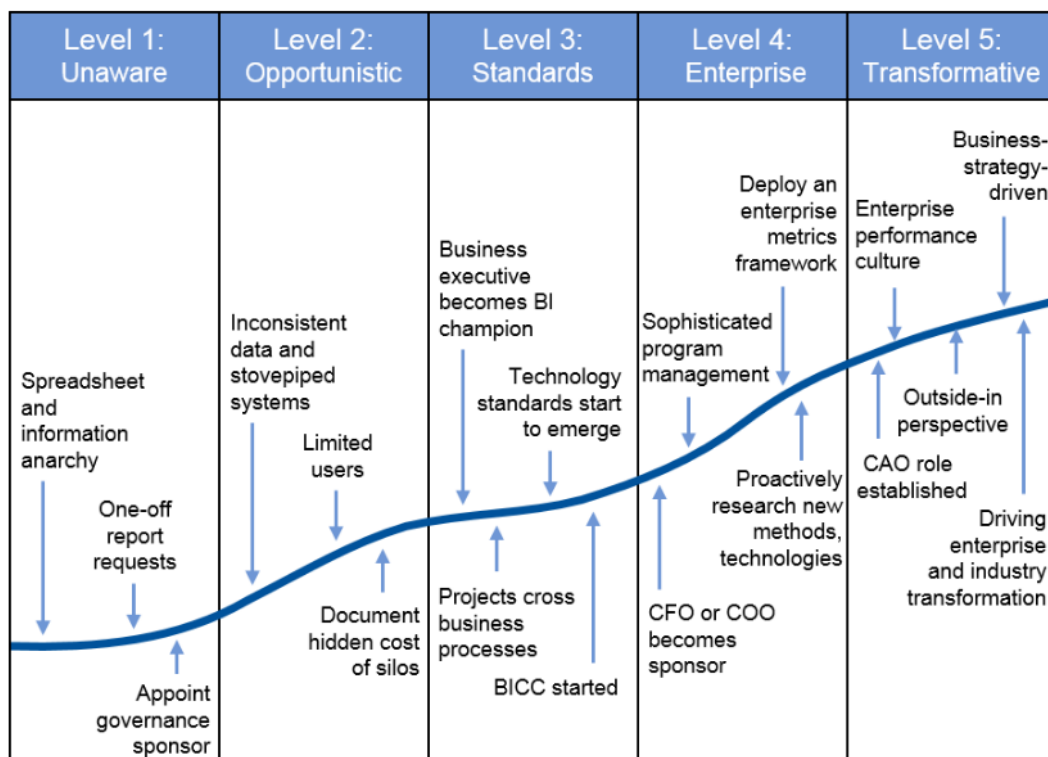
The suggestion is that the maturity is assessed periodically to follow up improvements in these capabilities over time. The information strategy should be aligned with these capabilities and aimed to reach a few steps higher maturity than in the existing situation. It is recommended to have the maturity of different dimensions on similar level to make sure the waste of resources is minimized. (Gartner, 2017a)

3.3.1.2 *IT Score Overview for BI and Analytics*

Gartner IT score is a maturity model designed for leaders. It gives them opportunity to assess maturity in IT organizations in the five dimensions: people, practises and processes, value and financial management, technology and relationships. (Gartner, 2018a). It is addressing overall landscape and as one element the BI and Analytics maturity aspects, giving ways for leaders to build a roadmap for improvements in order to reach the desired target. Gartner sees that there is a need for organizations to increase their maturity since new methods, concepts and technologies are emerging.

The model they offer helps the organizations to take a strategic approach in business intelligence (BI) and analytics. (Howdy & Duncan, 2015)

Gartner BI and Analytics maturity model is looking at dimensions like people, skills, processes and technologies when assessing the maturity. It has five stages: unaware, opportunistic, standards, enterprise and transformative. The assessment is done with a questionnaire and the results should be utilized to create a road map for next steps to increase the maturity. (Howdy & Duncan, 2015)



BI = Business intelligence
BICC = BI competency center

SOURCE: GARTNER (SEPTEMBER 2015)

Figure 8. BI and Analytics Maturity Model (Howdy & Duncan, 2015)

The model consists of 5 stages presented in Figure 8 (Howdy & Duncan, 2015)

1. Unaware – BI and analytics is needed in ad hoc basis. There are no infrastructure, processes or performance metrics.

2. Opportunistic – BI and analytics projects are handled in separate business units that have their own tools, infrastructure, specialists and metrics. Analytics applications are mainly reports and dashboards and have domain specific content.
3. Standards – Enterprise co-ordination starts to emerge through BICCs (Business intelligence competence centres). Technology standards including architecture, BI platforms and data warehouses are emerging. Yet only few processes share data models.
4. Enterprise – Executives are sponsoring BI and analytics projects. The business strategy is guided by common performance metrics and BI supports decision making. Corporate wide rules and practises are applied to Data and Analytics initiatives.
5. Transformative – BI and analytics has become a strategic initiative sponsored by executive level. Business and IT is working together and focusing on business value. Data is seen as a strategic asset and it is trusted.

3.3.2 IBM Big Data and Analytics maturity Model

IBM's Big Data and Analytics maturity model is developed for taking the business and technological factors into account when laying out a path to success through analytical investments. The model is based on six dimensions which are assessed with five stages of maturity. These are: Business Strategy, Information, Analytics, Culture and Operational execution, Architecture and Governance. (Nott, 2015a)

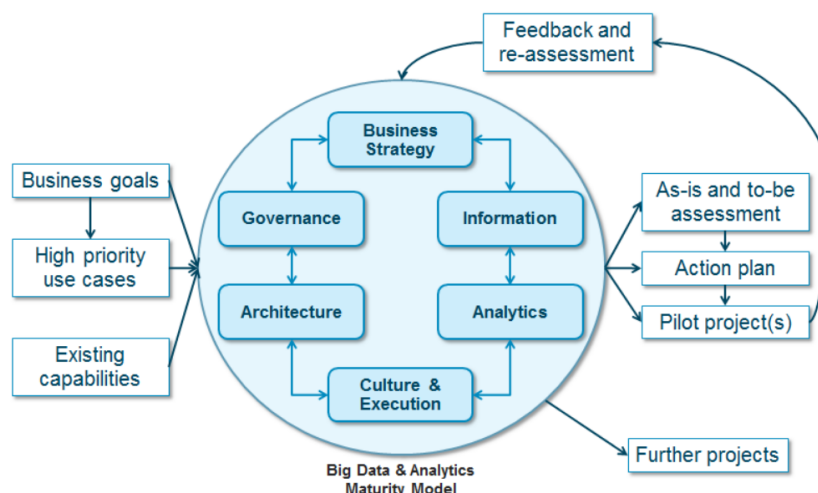


Figure 9. Big Data and Analytics maturity model (Nott, 2015b)

Figure 9 illustrates the integration between all dimensions and the inputs and outputs to and from the assessment. The detailed criteria are presented in Table 1.

Table 1. IBM Big Data and Analytics maturity model (Nott, 2015a)

	Ad hoc	Foundational	Competitive	Differentiating	Breakaway
Business strategy	Big data is discussed but not reflected in business strategy in which use of data extends simply to financial and regulatory reporting.	The business strategy recognizes that data can be used to generate business value and return on investment (ROI) though realization that is largely experimental.	The business strategy encourages the use of insight from data within business processes.	The business strategy realizes competitive advantage using client-centric insight.	Data drives continuous business model innovation.
Information	The organization uses its historical structured data to observe its business.	Information is used to effectively manage the business.	Information is applied to improve operational processes and client engagement.	Relevant information in context is used as a differentiator.	Information is used as a strategic asset.
Analytics	Analytics is limited to describing what has happened.	Analytics is used to inform decision makers why something in the business has happened.	Analytical insight is used to predict the likelihood of what will happen to some current business activity.	Predictive analytics is used to help optimize an organization's decision making so that the best actions are taken to maximize business value.	Analytical insight optimizes business processes and is automated where possible.
Culture and operational execution	The application of analytical insight is the choice of the individual and has little effect on how the organization operates.	The organization understands the causes behind observations in business processes, but its culture is largely resistant to adaptation that takes advantage of the insight.	The organization makes limited business decisions using analytical insight to improve operational efficiency and generate additional value.	Decision makers are well informed with insight from analytics, and the organization is capable of acting to maximize resulting business value.	The organization and its business processes continuously adapt and improve, using analytical insight in line with strategic business objectives.
Architecture	The organization does not have a single, coherent information architecture.	An information architecture framework exists but does not extend to new data sources or advanced analytics capabilities.	Best-practice information architectural patterns for big data and analytics are defined and have been applied in certain areas.	Information architecture and associated standards are well defined and cover most of the volume, variety, velocity and veracity capabilities and structured and unstructured data consumption needed for differentiation.	Information architecture fully underpins business strategies to enable complete market disruption with volume, variety velocity and veracity specifications applied.
Governance	Information governance is largely manual and barely sufficient to stand up to legal, audit and other regulatory scrutiny.	Understanding of data and its ownership are defined and managed in a piecemeal fashion.	Policies and procedures are implemented to manage and protect core information through its life in the organization.	The degree of confidence in information and resulting insights is reflected in madding decisions.	Information governance is integrated into all aspects of the business processes.

The maturity assessment starts with identifying business goals, analytics use cases and details about existing skills, culture and processes related to analytics. Understanding these from the as-is situation leads into action plan and pilot projects. IBM states that conducting a maturity assessment helps organizations to identify prioritized cases, make better decisions related to architecture or organization and take strategy into account. (Nott, 2015b)

3.3.3 TDWI Big Data Maturity Model

TDWI (The Data Warehousing Institute) Big data Maturity model is created for organizations to understand their big data deployments compared to their competitors. The model is based on the idea that data is only useful when it can be analysed and therefore it focuses mainly on big data analytics. It helps organizations to understand where they are now, where they are going and what are the steps along the way and gives guidance and best practices for the ones starting their journey. (Halper & Krishnan, 2013-2014)

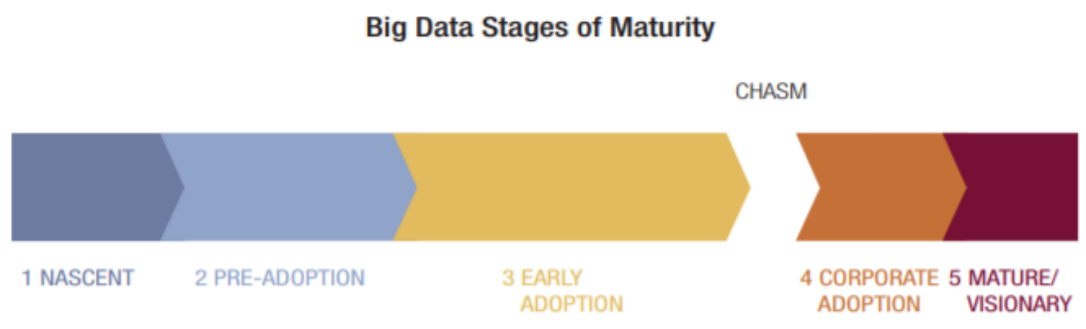


Figure 1. Stages of maturity in the TDWI Big Data Maturity Model.

Figure 10. TDWI Big Data Maturity Model (Halper & Krishnan, 2103-2014:p.6)

The TDWI Bid Data Maturity Model has five stages presented in Figure 10: nascent, pre-adaptation, early adaptation, corporate adoption and mature/visionary. These stages are assessed based on different dimensions seen in Figure 11: organization, governance, infrastructure, data management and analytics. The assessment gives guidance on how the different dimensions support analytics programs and initiatives. (Halper & Krishnan, 2013-2014)

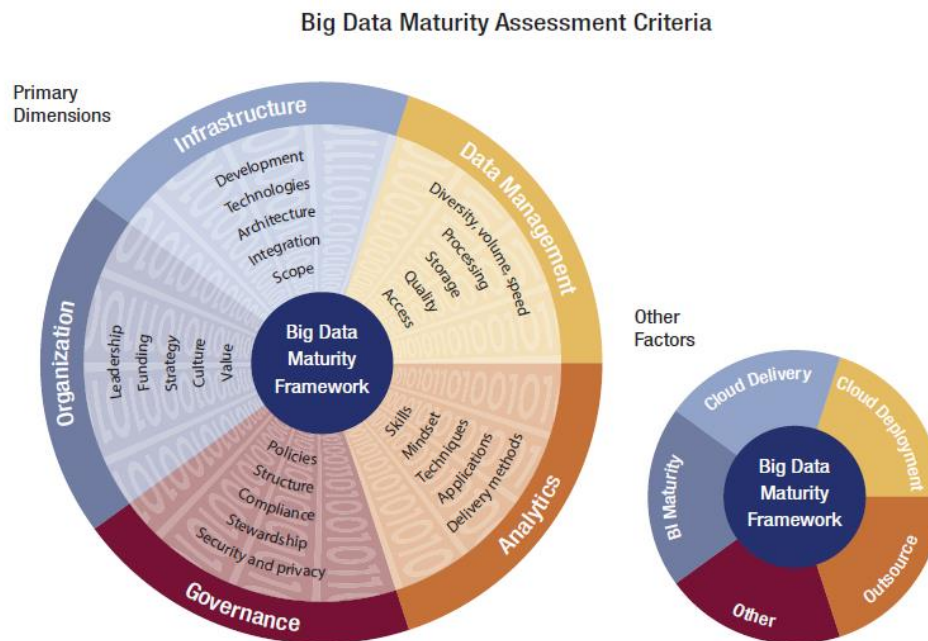


Figure 11. TDWI Big Data Maturity assessment criteria (Halper & Krishnan, 2013-2014)

Five stages of maturity (Halper & Krishnan, 2013-2014)

1. **Nascent** – Most companies are unaware of big data and its value. There is a lack of support from leadership. People interested in big Data and Analytics are scattered around the organization. The governance is more IT specific and the exploration of analytics and big data has just begun.
2. **Pre-adoption** – The interest in big Data and Analytics is rising. There are plans on implementing big data solutions in the near future. The support comes usually from IT side instead of business.
3. **Early adoption** – Few Proof of Concept (PoC) -projects have been implemented. Executive level sponsorship is emerging, and more people are involved throughout the organization. The analytics projects are mostly descriptive, but some predictive solutions are tested.

Between the early adaptation and corporate adaptation is the chasm. It describes the time-consuming obstacles an organization needs to overcome. There are open questions about e.g. data ownership and gaining a common vision for big Data and Analytics.

4. **Corporate adaption** – End users are involved, and the way business is driven is changing. Data infrastructure supports business strategy.

5. Mature/Visionary – Big Data and Analytics programs are executed fluently, infrastructure is highly tuned. The organization is excited about Data and Analytics and the initiatives arise from business. Only a few organizations are at this level.

(Halper & Krishnan, 2013-2014)

3.4 Chosen maturity dimensions

Based on the existing maturity models, five dimensions were chosen for more detailed viewing and are described in the following sub paragraphs. These dimensions were chosen because of their importance to the holistic view. Most of the dimensions mentioned in existing models can be linked to these (Table 2). Without any one of these dimensions maturity is not able to grow.

Table 2. Chosen maturity dimensions versus existing models.

Chosen for more detailed viewing	Dimension in existing models	Maturity Model
Strategy and vision	Business strategy	IBM Data and Analytics
	Vision	Gartner's EIM
	Strategy	Gartner's EIM
Organization and people	Organization	TDWI Big Data
	Culture and Execution	IBM Data and Analytics
	Organization and Roles	Gartner's EIM
Technology	Infrastructure	TDWI Big Data
	Architecture	IBM Data and Analytics
	Infrastructure	Gartner's EIM
Data Management	Governance	TDWI Big Data
	Data Management	TDWI Big Data
	Governance	IBM Data and Analytics
	Information	IBM Data and Analytics
	Life cycle	Gartner's EIM
	Governance	Gartner's EIM
Analytics	Analytics	TDWI Big Data
	Analytics	IBM Data and Analytics
	Metrics	Gartner's EIM

Without the support from strategy and vision there will be difficulties in getting enough human and monetary resources and needed weight in action planning. Without suitable skills and roles, the organization is not able to develop needed solutions or use them. The trust in data builds up from people understanding it. Technologies are quite often seen as the main barrier when trying to increase analytics in organization. It is a factor

but not the main issue. The analytics use cases need to be highlighted, since they are driven by needs and business value that are the reason why business is willing to invest in the journey. The implementation of different analytics types can benefit organization in more ways than traditional BI solutions. The solutions implemented will raise the awareness and commitment in the organization. The last dimension chosen was data management since analytics is based on data and good quality of it. The stage criteria for all chosen dimensions combined from existing models is listed in Appendix 3.

3.4.1 Strategy and vision

Since organizations are led by a strategy, it is important that Data and Analytics is embedded in it. Gartner analysts state that if a leader is not able to convert their Data and Analytics vision on the first page of their strategy, there is a likelihood for failure (Buytendijk et al., 2017).

Building a Data and Analytics strategy starts from the vision. Since all organizations are different they should have their own vision for Data and Analytics appropriate to their business and needs. Data and Analytics vision should be created so that all key stakeholders have the same expectations. The vision should explain the value adding aspect of Data and Analytics. (Buytendijk et al., 2017)

Commonly a vision can be divided into three types; Data and Analytics as a utility, as an enabler or as a driver. According to Gartner information surveys (2017), 80 % sees Data and Analytics as an enabler, meaning that Data and Analytics is used mainly for a specific business goal. The approaches can be different but the ultimate target of enabling business success is the same. According to Gartner analysts the vision is a combination of these types and organization's value discipline. The three value disciplines are operational excellence, product innovation and customer intimacy (Buytendijk et al., 2017)

When there is a clear vision, a strategy to implement it should be created. Gartner emphasises the role of CDO (Chief Data Officer) in building Data and Analytics strategy. The strategy is needed for turning the demand into actionable and measurable objectives to deliver business value. One key message is that these should be aligned with

business strategy, create business value and focus on new innovations. (Gartner, 2017a)

3.4.2 Organization and people

There are multiple ways and best practises for building an organization to support the growth of Data and Analytics maturity. There is a high demand for Data and Analytics professionals who master the technical, business and data science skills of Data and Analytics. The traditional data modelling has become more mainstream and new innovations in artificial intelligence, Internet of things, machine learning and advanced analytics are coming. To support the demand from business and development with new technologies, new skills and a new organizational structure are often required.

3.4.2.1 Organization

Gartner sees that organizations need both central and distributed analytics functions. The role of central function is to describe and optimize the analytics landscape across domains to improve productivity and governance and to harmonize the decentralized analytics into a leveraged strategic discipline. The actual analytics is then carried out under various labels across business domains. (Gartner, 2017a)

Gartner's strategic planning assumption (2016) is that 'By 2019, 50% of centrally organized analytics programs will be replaced by a hybrid organizational model that shares power with local domain analytics leaders'(Oestreich & White, 2016; p.2). Data and Analytics is used across the organization and therefore multiple individual teams or a single centralized team can be identified. According to Gartner there is a shift towards the office of the CDO that will lead the analytics strategy, practises and development of use cases and manage information assets by delivering insights as described in Figure 12. The idea is that the centralized team works together with domain teams. (Oestreich & White, 2016)

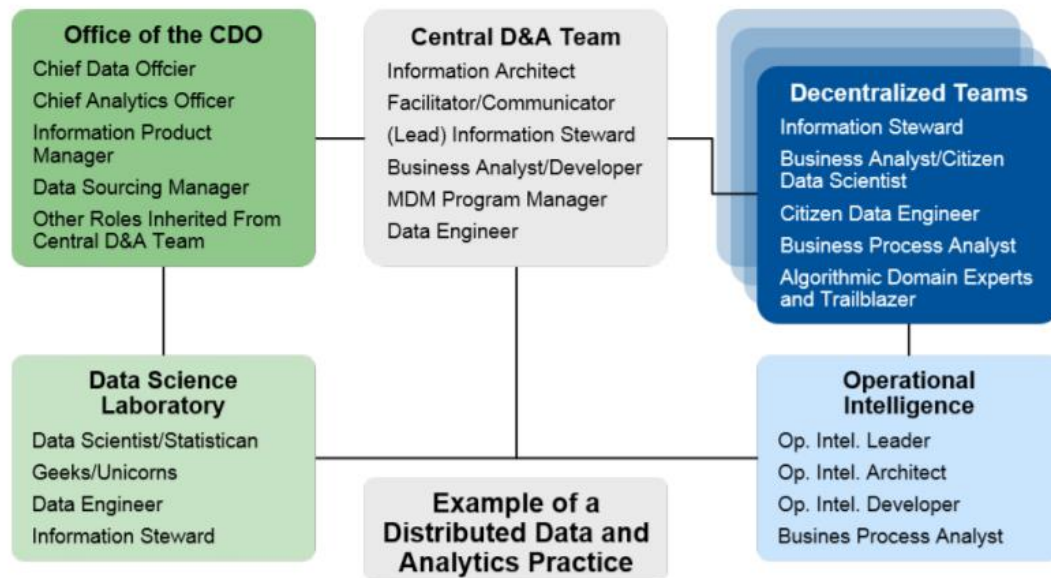


Figure 12. Example of a distributed Data and Analytics practise. (Oestreich & White, 2016:p.4)

To be able to move from BI application and reporting development to enabling organizations, Gartner is proposing to evolve technically oriented BI competency centres into analytics centres of excellence that have a wider set of capabilities and understanding of business. These centre units (ACE) should focus on five capability types: organization, project, education, data and technology. ACE would be responsible for enabling Data and Analytics for business more than executing it. (Gartner, 2017a)

3.4.2.2 Skills

Gartner's study from 2016 proposed that 'in 10 years, the skills and knowledge in your organization will have little resemblance to the skills and knowledge you have today.' (Gartner, 2017a:p.6.) and 77% of the 149 IT and business executives who responded to the survey agreed. This means a huge impact on the skills needed. Digital business leaders such as Amazon and Alibaba find that data and analytical skills would be their first priority. A shift from technical specialists to more business-focused generalists is seen to take place. Still there is a need for both of these groups and Gartner finds that there is often a lack of shared understanding and a set of common approaches be-

tween BI and data management people and the new generation of users and practitioners. (Gartner, 2017a)

According to Gartner analysts, algorithmic business is developing and therefore new kinds of skills are required to utilize advanced analytics. When analytics is turning more into prescriptive and predictive, algorithms are a skill that is needed besides the technical and business knowledge. (Oestreich & Buytendijk, 2016)

New skills are not only for IT and business analysts. Gartner sees that the cultural change will create citizen data stewards and scientists who will have an important role in the organisation and as part of the change. The responsibility for data management and quality will be shared with business functions and the tools used will have self-service capabilities to get more diverse insights faster. Real-time analytics can only take place if the people running the processes are able to obtain their own insights. This will require new skills and will be a huge change for an organisation. (Gartner, 2017a)

3.4.2.3 Roles

Gaining maturity in Data and Analytics needs new roles. Often these roles are a hybrid between IT and business, some working in centralized team and some in business. According to Gartner it is important to recognize these roles and a virtual team should be established. The role of this team is to collaboratively execute the Data and Analytics strategy and governance model. This will be to avoid having too many analytics use cases in silos and to help develop the needed competencies all over the organization with training. (Oestreich & Buytendijk, 2016)

The strategic importance of Data and Analytics is led by digitalization and there is a need for an executive level leader. In the past the leaders of data management, integrations, business intelligence and analytics have been middle management roles. The problem is that these roles have not had the needed power to drive the strategic importance of Data and Analytics on corporate level. According to Gartner, an increasing number of organisations are creating the role of CDO to underline the importance of the matter. CDO is an executive level leader who is responsible for information assets and leading the cultural change. (Oestreich & White, 2016)

There are multiple types of analyst roles in an organisation depending on the use cases. Analytics consumers are the ones using ready-built interactive reports and dashboards. Data analysts and statisticians develop reports and interactive visualizations and work with data warehouses, modelling and integrations. Citizen data scientists use technological tools such as smart data discovery tools to derive advanced insights. Data scientists have understanding of the end-to-end process and can extract various types of knowledge from the data. (Oestreich & White, 2016)

There are other important roles that are needed to make sure that Data and Analytics can be utilized. Facilitators ensure that stakeholder requirements are identified in the best possible way. Facilitators are responsible for increasing data-driven thinking and stakeholder participation in data-driven culture and making sure that initiatives are focused on business needs. Data engineers make the data available for analytical use. They help in preparing data, enable access to data and are part of establishing guidelines regarding data management. Information architects are responsible for discovering Data and Analytics requirements for all information use cases. They work with leadership and give strategic, information-based recommendations on how to utilize data and to make sure current solutions are operating. Information stewards are responsible for making sure information governance policies are executed in all functions of the organization. They monitor, implement and resolve issues related to the policies. (Oestreich & White, 2016)

One way of making sure algorithms are experimented and developed is to establish a data science laboratory. The possible roles needed for this are data analysts, data scientists and statisticians. (Oestreich & Buytendijk, 2016). For bigger enterprises, there are several other roles that would enrich the skillset from Chief Analytics Officer to data visualists.

3.4.3 Technology

Technological solutions are an essential part of Data and Analytics. The traditional BI solutions have been offering users the ability to analyse historical data by ad-hoc and static reporting. These solutions are usually built on top of an enterprise data warehouse (EDW). There data is cleaned, structured and handled for reporting purposes. There has been a change in user needs and today the users need a more direct ac-

cess to data without IT specialists involved. Deloitte (2018) lists three challenges related to traditional BI solutions pointed out by agencies:

1. Lack of on-demand analysis capabilities: Users want free access to data when they need it and for their specific purposes.
2. Need for predictive analyses: Traditional BI is focusing on historical analysis and the demand is for predictive and future-looking. Using predictive models, businesses want to base their actions on data.
3. Analysis of mixed data types: Traditional BI is focusing on structured data. The demand is for unstructured and new data sources connected to existing structures.

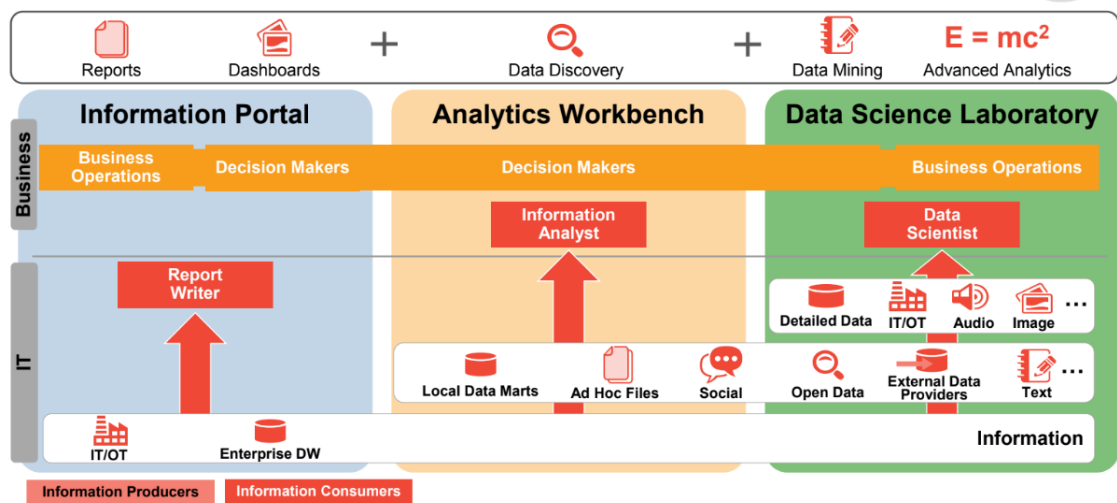


Figure 13. Example of needed analytics solutions (Cook, 2017:p.30)

Gartner analyst Henry Cook (2017) presents the needs for modern analytics (Figure 13). It consists of three tiers: Information portal with reports and dashboard, analytics workbench with data discovery and data science laboratory with data mining and advanced analytics. (Cook, 2017:p.30) Data discovery answers to the need of on-demand analysis and data science to the need of predictive analytics.

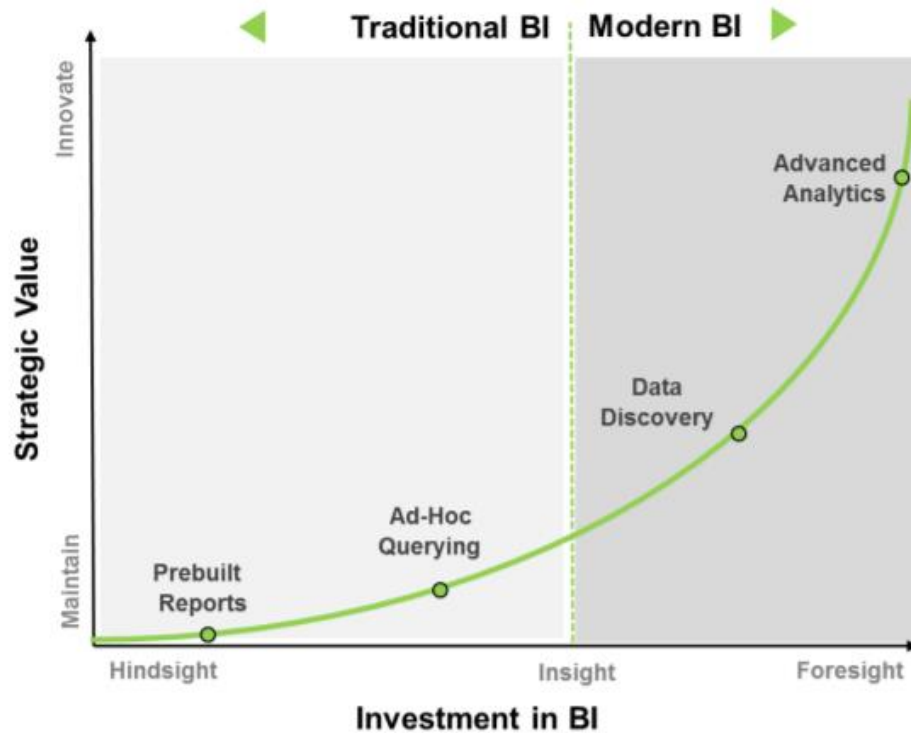


Figure 14. Example of how investing in modern BI correlates with generating strategic value (Deloitte, 2018:p.2)

Modern BI platform is suitable for many types of analytics solutions and is integrated with the traditional one. Data warehouses still play an important role in end-user analytics when the user wants an easy access to data. Data lake is a concept used in modern analytics. It stores the raw data without filters and rarely perform any cleaning activities or transformation, so the data can be ingested more efficiently. This will shift the responsibility of data preparation and handling to business users. (Deloitte, 2018)

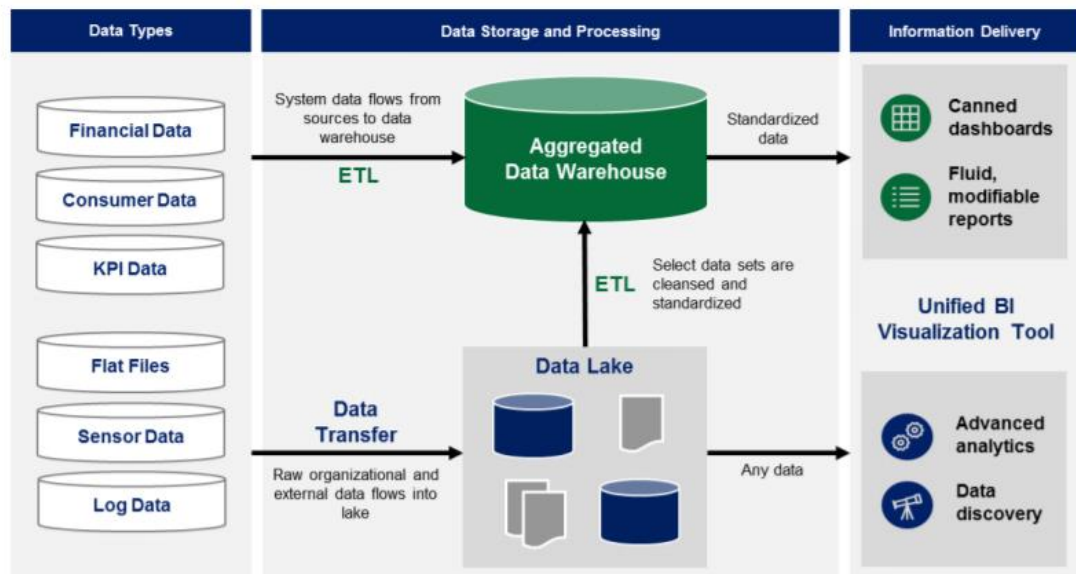


Figure 15. Example of a modern Data and Analytics architecture (Deloitte, 2018;p.4)

Data warehouses are often used for more accurate metrics and financial data. They are visualized with dashboards or list reports. Data discovery tools can be connected to a data warehouse or a data lake. These tools are used for analysing the data through summary statistics, visualizations and what-if analysis. The users are usually business analysts or more advanced business users. (Deloitte, 2018)

Data lake platforms support tools that are needed for advanced analytics. Advanced analytics refers to techniques used for gaining deeper insights, data driven actions and analysis from diverse set of data. Methods used are usually the same used in statistics or artificial intelligence scene like machine learning algorithms or regressions. (Deloitte, 2018) Models created for advanced analytics need huge sets of data and therefore the more efficient way is to use cloud-based data lakes. The use of advanced analytics and data lake requires special skills and experience and the tasks are performed usually by data scientists, data analysts or IT specialists. Outcomes of the models such as the predictions can be inserted into data discovery tools, reports or end user systems.

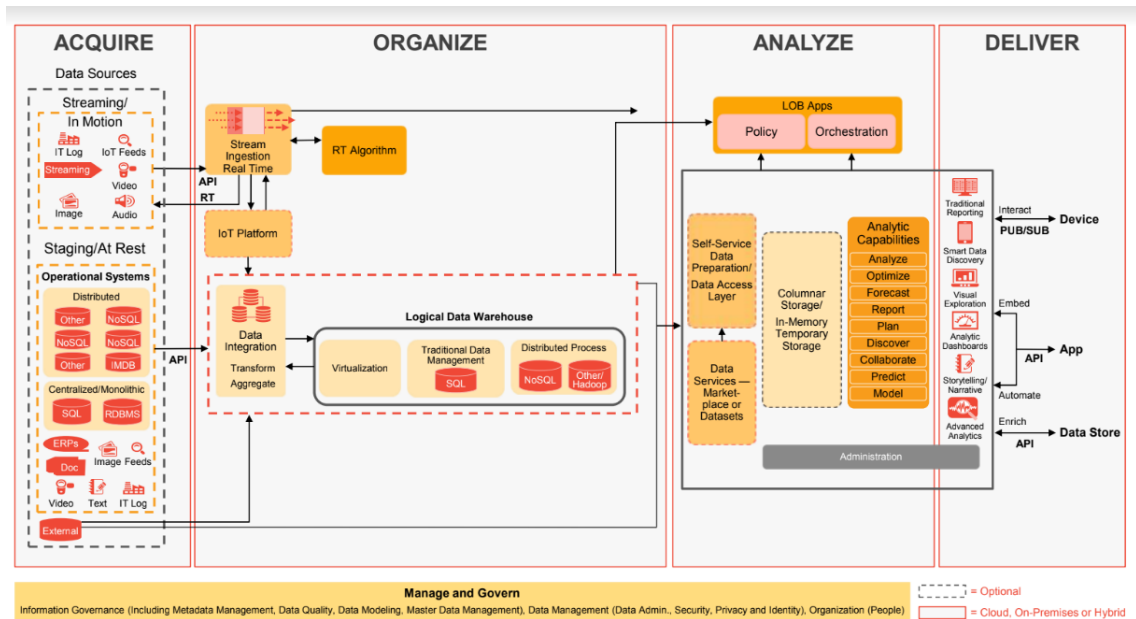


Figure 16. An example of a documented modern BI and analytics architecture (Cook, 2017:p.10)

Data and Analytics architecture needs planning and experiments. The architecture should be well-documented, and a road map crafted for upcoming years.

3.4.4 Analytics

Gartner divides analytics into four different capabilities. They categorise analytics based on the questions answered, what kind of tools and techniques are used and what is the level of human input until actions can be taken based on the data. Organization's Data and Analytics maturity rises when they are able to use these different capabilities. (Gartner, 2017a)

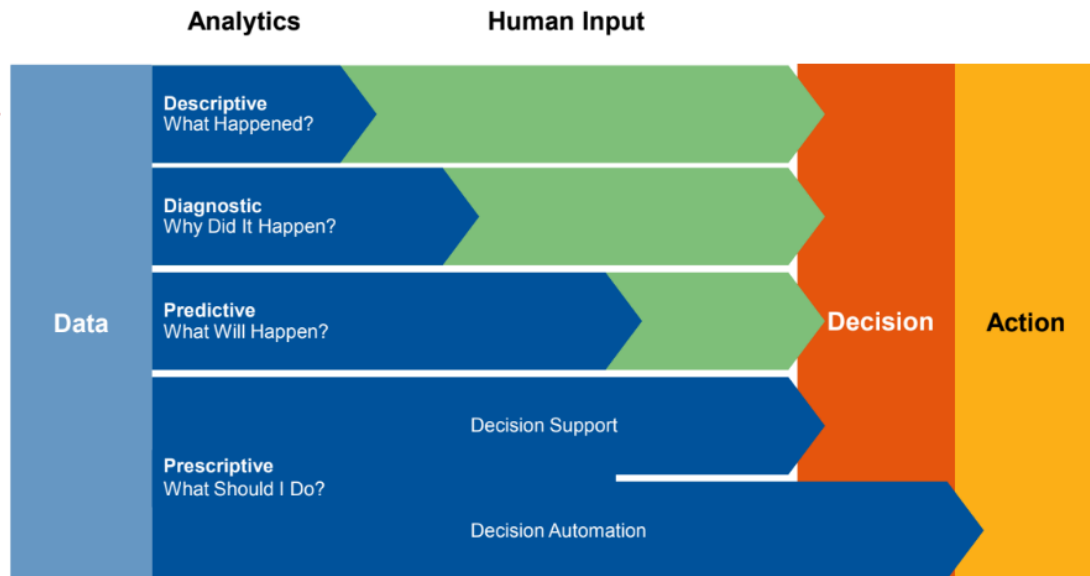


Figure 17. Analytics spectrum (Howson, 2017:p.13)

Descriptive analytics answers the question “What happened?”. This is usually what traditional reporting answers to. The data is queried and summarized to give valuable information to leaders who will then use their own experience for decision making and actions. Diagnostic analytics answers to question “Why did it happen?”. This is done usually with visualization and data discovery tools. Diagnostic analytics gives the leader more insight to which the decisions can be based upon and less human input is needed. Predictive analytics answers to question “What will happen?”. This can be achieved by recognizing patterns and predicting outcomes by using statistical and machine learning techniques. This gives decision makers even more support with forward looking insights. Prescriptive analytics answers the question “What should I do?”. This is done by calculating expected outcomes from the decision options. Prescriptive analytics is used for decision support or automating decisions. (Gartner, 2017a)

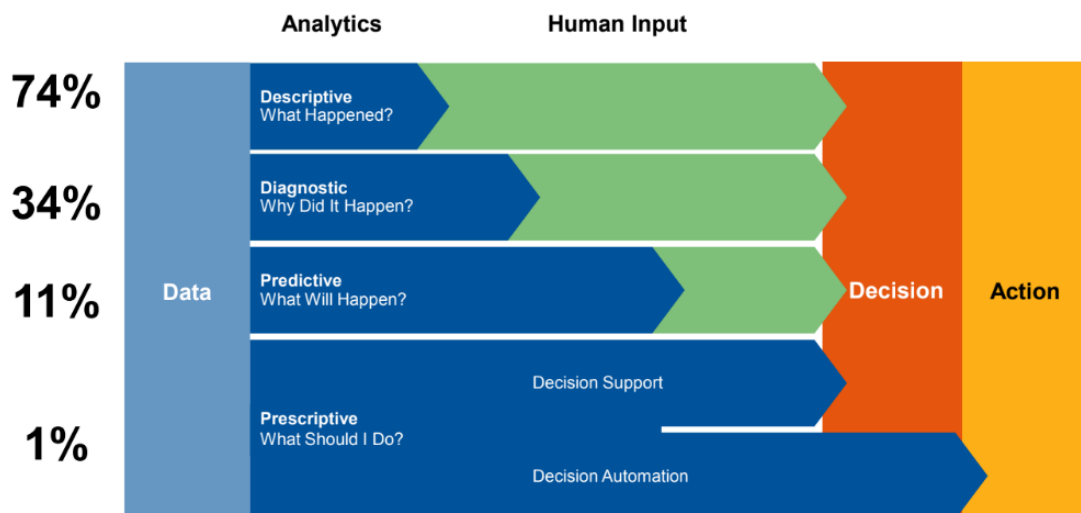


Figure 18. How organizations are doing analytics (Hawson, 2017:p.13)

Most of the organizations are not doing advanced meaning predictive and prescriptive analytics. Figure 18 illustrates that majority of organizations are doing only descriptive analytics. (Hawson, 2017) All of these analytical capabilities should be combined and used in the right content. This will help organizations to address a larger amount of problems, base decisions on facts found from data and to optimise processes (Gartner, 2017a)

3.4.5 Data management

Data is only important if it can be trusted. Data management supports all processes alongside analytics. To be able to process e.g. transactions, the data quality, integrations, metadata, master data and application management should be practiced. (Gartner, 2017a) Data should be seen as an asset that needs governance. It is an investment that has impact on business profit and growth. It will help in creating more value to customers and reducing errors when processes that demand manual work will be automated. (Gregory, 2011)

Governance consists of privacy and regulatory compliance, security and data quality. The role of data governance is growing in organizations. It has been defined as 'the exercise of decision-making and authority for data related matters' by Gwen Thomas from The Data Governance Institute (2010) cited by Gregory (2011:p.235). It also has been described to be 'the business practice that defines and manages strategies for

people, processes, and technologies to ensure that valuable data assets are formally protected and managed throughout the organization' (Gregory, 2011:p.235). Data governance can be seen as a methodology for maximizing the value of organization's data assets instead of ways to fix the data (Fisher, T. 2009).

Gartner introduces the concept of Effective Information strategy. Many organizations have hard time in categorizing and prioritizing their data. It is for the Data and Analytics leaders to gradually improve information governance, sharing and managing. It is important to understand the different use cases for data and the importance of it. (White & Beyer, 2017)

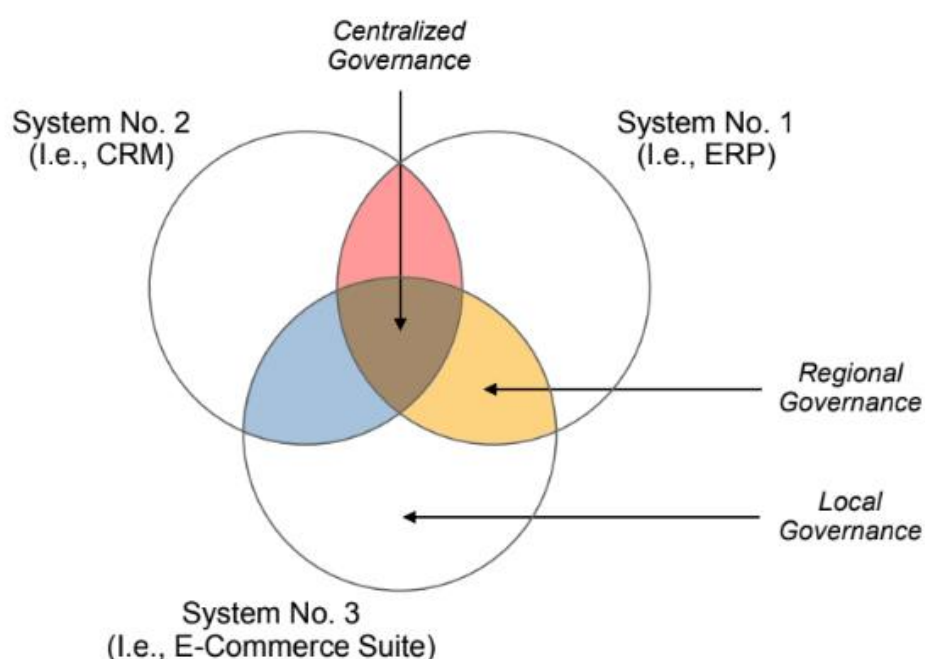


Figure 19. Local, regional and centralized governance (Fritsch, 2017:p.16)

A part of data governance is the organizing of it. Like seen in Figure 19 data governance can be local, regional or centralized (Fritsch, 2017:p.16). This means that there will be a need for different roles such as data owners and data stewards that need to be organized accordingly and the responsibility should be in business. IT is responsible for technological solutions, not the data itself.

According to Adrian Gregory's paper, poor data quality has a risk of leading up to possible data thefts, data privacy breaches or poor quality. Poor quality of data is very

common and leads into failing development programs and not reaching business targets. In an organization that manages their data assets optimally data helps in optimizing business processes and personalizing customer relationships. The governance related processes such as life cycle management, quality monitoring and housekeeping are automated. The governance strategy is corporate wide when the goal is to enforce the best practises throughout. The internal data itself is enriched with external data. (Gregory, 2011)

4 Current state analysis

42 people were interviewed at Veho for current state analysis. The questions are based on conceptual framework and the analysis compares Veho to best practises.

Veho is willing to invest in Data and Analytics and the leaders see the importance. The maturity concept is unfamiliar, and the current focus seems to be on data quality and traditional BI solutions. A vast amount of effort has been put to customer data management and it has gained support from the leaders. The quality issues seem to be on everyone's mouth despite the actions taken. Technology is seen as the answer to the problems while other factors play a smaller role.

Since hiring a CDO (Chief digital officer) in 2017, Data and Analytics has gained more strategic visibility as one of the core elements of digital strategy. The CDO sees that there are lots of possibilities for improving efficiency and customer experience, the corner stones of Veho, with data. He sees that there is a long road ahead but highlights the support from him and from other members of the management team. One of the practical embodiments of the support is that a development manager for Data and Analytics has been hired in early 2018.

Analytics as a concept seems to be unfamiliar. When asked about how data is utilized, most of the interviewees relate data to contacting customers or operational or financial reporting. Most of the directors interviewed stated that data should be used more but yet many of the interviewees asked about the meaning of analytics. When explained, most of them said that currently reporting is focusing on historical data and it is up to the readers how they interpret the information. It is recognized that analysis based on data is done and that information is used for decision making.

Veho as an organization is willing to invest in analytics and most of the leaders recognize the importance of it in the current and future business world. Still the means of building a data driven culture are missing. In many cases analytics is seen to come as a side product of projects and technological solutions. It is seen as a something generated in the digital services department. One of the managers who was interviewed asked for a tool to get analytics. This is a good example of not understanding that the change needs maturity in other aspects as well, such as skills, strategy and data management.

These observations support the holistic cultural approach needed for taking next steps on building the maturity. There is excitement and enthusiasm about Data and Analytics and the opportunities that it can give, but hesitation regarding the efforts it needs to reach the level that will bring the advantages. The dimensional analysis is opened more in next chapters.

4.1.1 Strategy and vision

In a mature organization Data and Analytics is a visible part of business strategies. As part of the new strategy Veho has listed four main changes that will affect the business. Under one of those it is stated that 'one way to increase the customer centricity is to increase operational and profitable transparency by developing and utilizing analytical capabilities' (Veho, 2017:p.13). Analytics is a part of actions to be taken when reacting to the changes, but it is not a top priority in business strategy. Customer data has been lifted up on business road maps in the last years. According to one of the controllers the focus is on data quality and later enabling the use of data for further analysis. As a conclusion from the interviews it seems that the leaders from business side feel that Data and Analytics is important, but they don't fully recognize the benefits or the efforts it needs.

Veho has an ICT and Digital strategy (2017) with a statement about Data and Analytics saying 'Veho will have a competitive advantage from its advanced internal analytics services and high-quality, up to date customer and product information. We will have the needed competencies and resources for it'. This could be seen as the vision for 2021. The digital strategy is a guideline for the organization of digital services but involves the whole organization. The digital strategy lists the elements and the target state for analytics with focus on data management, data utilization and organization. Business leaders are not familiar enough with the content to commit to the targets.

CDO (Chief Digital Officer) oversees and supports Data and Analytics transformation. He is a part of Veho's management team. Discussion around Data and Analytics has accelerated during past years and interest in it is growing among leaders, management and some specialist groups. The sales and maintenance managers interviewed still don't see the importance of future oriented analytics and are mainly focusing on the

floor-level operations and historical performance. In many occasions the focus is in technology and data management instead of a holistic view of the culture.

4.1.2 Organization and people

A mature organization can be organized in different ways. Veho currently has a central data team inside digital services formerly known as ICT. The team is responsible for business intelligence, ETL, data warehousing and reporting related development and maintenance. The team is technically oriented and distant from business. Team creates all BI solutions such as reports for business and is focused on execution rather than enablement. There is a chronic recourse shortfall that is transformed into occasional inefficiency.

Organization and people is seen by the interviewees as the dimension having most issues. When asked the finance organization the roles were quite clear, and the main challenges were on gaining more skills and competences. From business side the roles were not that obvious and the need for analysts was bigger. In business there are people who use reporting solutions, some who manage their own data and some who do analysis based on the data but there are no full-time roles for Data and Analytics related tasks. Some business people are participating in small enhancement activities done related to BI and reporting but not the actual development. Because this involves a limited amount of people and does not cover all parts of the organization, the maturity level is uneven and is more ad-hoc than planned in long term. It is difficult to find resources from business side due to the initiatives not being part of business road map. The co-operation between the central data team and business is not working well and there are issues with prioritizing and defining the projects and in communication.

The role of a business analyst does not exist, and it is not fully understood what it is needed for. The controllers perform tasks related to business analytics but a person who is searching for use cases and developing analytics is missing. Business and finance controllers are acting as BI key users in some business areas and they are doing analysis to support leadership mainly from financial perspective. There are no data stewards, coordinators or data scientists. Skills needed for advanced analytics are missing in the whole organization. The centralized team is lacking business skills because of being far from the daily business operations. According to a BI specialist there is a need for reporting and data discovery developer. These skills are outsourced even

though they are seen as part of much needed business skills for the central team. Business is lacking know-how from basic reporting, BI and data handling skills. According to the head of development, the need for basic and advance training exists.

CDO is overseeing that the vision for Data and Analytics comes to life. A development manager for Data and Analytics is driving the transformation. There is support from business leaders, but a lack of commitment. This is seen in the organization as there are no analysts, data owners or BI responsible in business.

4.1.3 Technology

Veho does not have any plan for the future or documentation for the current Data and Analytics architecture or tools. The current data warehouse has been built from 2012 until now and is evolving all the time. It uses mainly batching data from internal sources through ETL processes and sends the data to reporting solutions and CRM system (Figure 20). The data is not organized based on any known model but is more evolved from the need when new layers and data are added on top of the old structures. There are many issues with performance and the time spent on maintenance is huge. Data is in siloes since all the major business units have their own database. Veho's data warehouse specialist states that data integrity can be seen as the biggest challenge.

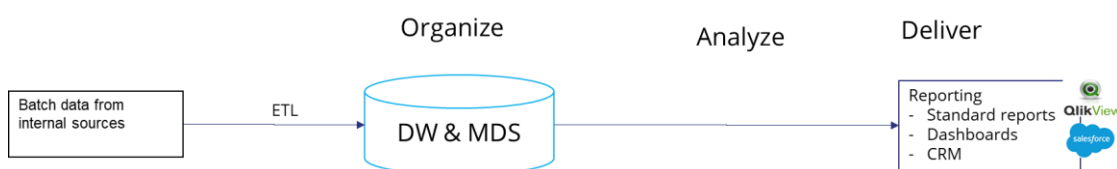


Figure 20. Current BI architecture. (Veho, 2018)

The reporting tools that Veho is using are not modern analytics tools, but more suited for static reporting. There are several reporting solutions built that give users answers to various questions with historical data, but the usage is not versatile enough for advanced users who would need a wider access to data. One of the controllers stated that current reporting solutions don't address all their needs for visualization and data discovery. The problem according to the head of development is that the business end users don't know how to use and utilize the tools. Currently there are about 250 active users and 800 in total. The performance of the reporting tools is in reasonable state

and the data is trusted. Generally, the key users are satisfied with reporting and think that they are sufficient enough.

Data is not real-time but refreshed daily. Open data is not used at all. According to a BI specialist there could be more opportunities to utilize the current data and to enrich it by buying more data outside. The problem has been that there is no place or tools for storing and utilizing all different data source types that can be used for advanced analytics. Advanced analytics needs experimenting, and the possibility for that is missing. Tools for advanced analytics typically use data stored in a cloud-based data lake. Veho has no existing cloud solutions for analytics and the cloud strategy for that is unclear. Azure has been tested but is not in use.

There are no self-service options, visualization capabilities are very limited, and the mobility and sharing options are non-existent. There are no data discovery tools available except for an external olap cube used by a very limited number of users. Visualization and presenting results are done by Power Point and are based on manually updated Excel sheets. This needs a lot of effort and resources and there is a high risk of mistakes.

4.1.4 Analytics

The director of commercial vehicle sales has been an advocate of data quality and management in his organization. He sees that the financial reporting and analytics is on a good level but to actually lead sales and marketing with data more efforts are needed. In some business units, data is analysed and even predictions made based on it. That's why there is a need to identify the difference between analytics and analysis. Analytics means the answers data gives the user and analysis describes the part from data analytics to decision done usually by a human. For people analysing data, analytics gives more effectiveness and accuracy and possibilities to use much bigger and versatile data masses.

Descriptive analytics explaining what happened is in good shape and done using Qlik-View reporting. Dashboards and metrics are defined for main business processes to support leaders and operational data is available for management. Sales people and technical specialists don't have any access to summarised data related to them, except for what is shared with them by their managers. Traditional BI solutions exist in all

business areas and are answering the questions of most reporting needs. One of the main functions of descriptive analytics according to the CFO is to keep track of the quality and monitor processes. He also highlights that a lot of time is spent currently on creating the information for the business users when the time should be used more on creating additional value. The people reading reports are not necessarily analysing the information and their decisions and actions are not always based on it. Current BI vendors offer help to traditional BI solutions related to descriptive analytics. There is an ongoing discussion about using outside help for cases needing advanced analytics.

Diagnostic analytics asking why it happened is done mostly by controllers and some business managers. It is based on data, but the answers are mostly gathered and generated manually in Excel. There are some drill-down capabilities in the current reporting solution but no data discovery possibilities. It was also clear that diagnostic analytics does not take place in all business areas. There are needs to be able to track deviation and even automate tasks based on the findings.

Predictive analytics asking what will happen is not used. Controllers are forecasting performance and financial figures based on data but are not using predictive analytics or models supporting their work. The analysis is based on combination of business knowledge and numbers from previous periods. There is some development done that could be continued with adding predictive models. According to the CFO there is a need to predict losses and prevent them within operations.

Prescriptive analytics does not exist at Veho except for few experiments with marketing automation. Some automated messages are sent to customers based on their maintenance history. These are not complex or very accurate and are not based on large data sets.

4.1.5 Data management

Veho did a data governance study in 2014 and as a result of that launched a customer data governance model including organization, quality and monitoring related aspects. The material is versatile and also precise. Data concepts and standards were defined, and data was systematically monitored. It was done with the help of a consulting company. When the project ended the material was not updated. The data concepts are unclear, and the principles are forgotten.

The organization defined in the governance model is not in place. Data owners are missing, there are no data stewards. The group managing the governance still exists and meets once a month, but the purpose is unclear. System users don't understand the current principles and they are not committed to feeding the necessary and correct data. User guides are outdated, and open questions arise from the same issues. There is an eminent need for more training for users to understand the current principles.

Most of the data initiatives done concern customer data. Other aspects of master or meta data are not handled systematically. Data architecture exists on some levels due to the implementation of a master data system and semantic layers used for reporting. Still the architecture is not documented or in place for all areas.

Support from C-level and leadership is gained when communicating data related issues and tasks. Data quality is monitored monthly, but the metrics need updating to suit current purposes. Due to GDPR data life cycle management work has been started, but implementation is slow. According to the specialist responsible for customer data quality, systematic housekeeping activities are done with the data both manually and automatically. The head of development highlights that much more could be done with the data if it was in a better shape. As a summary, the IT personnel who have experience from other data environments say that there are a lot of activities done but business people say that not enough. The truth lies somewhere between. More could be done and one of the main challenges is to get the users understand why and how data should be handled.

5 Building the proposal

Building of the framework is conducted in three stages

1. The maturity indicators and best practises given by Gartner and other sources are collected for chosen dimensions and adjusted for Veho's business culture
2. Current state is analysed and compared to existing knowledge and an assessment score of the current stage is given
3. The target state is defined and a target stage set.

The maturity indicators found from the models and best practices for different dimensions are assessed in tables found in subchapters. Veho is given a score for all of these stages based on current state analysis and an overall score is calculated based on the average.

5.1 Strategy and vision

Veho is currently at stage two (2.3) when it comes to strategy and vision (Table 3). The main challenge is to get business leaders to commit to Data and Analytics. They support it but are not committed due to not fully understanding it. To first reach stage three, it is necessary that a high-level sponsor is appointed also from business side and that the business strategy will recognise the use of insight from data.

Table 3. Veho's maturity assessment: Strategy and vision (Nott, 2015a:p.1, Laney, 2016:p.6-7, Halper & Krishnan, 2013-2014:p.7-14)

Veho Maturity Assessment	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Veho's score
Business strategy	Data and analytics is discussed but not reflected in business strategy. The organization does not see a reason why and don't recognize what it means to be data driven.	Business strategy recognizes the importance of data and analytics	The business strategy encourages the use of insight from data within business processes	The business strategy encourages the use of insight from data within business processes	Data drives continuous business model innovation. Business strategies high-light this importance	1
D & A Vision	No Data and analytics vision exists	Main focus is on technologies	Data and analytics Vision exists	Vision for data and analytics exist for coming years	Vision for data and analytics exist for coming years and it recognises all aspects related to maturity	3
D & A Strategy	No Data and analytics strategy exists	Progress of data and analytics initiatives is hampered by culture, contradictory incentives, organizational barriers	Strategy definition is shifting from a static, annual process toward more of a dynamic one.	Data is seen as valuable asset	Data is a recognized corporate asset, competitive differentiator, source of transformation, and a product itself	2
Leadership sponsorship	No leadership sponsorship	Lack of leadership	High-level sponsorship is named	Executive level leaders support and sponsor data and analytics	Executive level leader and managementsupport and sponsor data and analytics	3
Veho's overall score						2,3

At target stage, Veho's strategy and not just the digital strategy, will encourage and recognise the usage of data in business processes. The executives will understand the

benefits of Data and Analytics maturity. Instead of seeing data now more as part of technology, in 2021 it should be seen as a valuable asset. Data and Analytics strategy and vision exists for upcoming years. The stage Veho is targeting to reach at 2021 is four.

5.2 Organization and people

Veho is lacking the needed defined organizational structure, roles and some core skills to be able to grow Data and Analytics maturity and therefore is at stage two (2.3) like seen in Table 4. The organization and people dimension was seen as the most challenging one since it needs more resources and the change takes place slowly. To reach stage three, Veho needs to have a Data and Analytics organization defined and to have first business analysts and data analysts or scientists named. Executive level sponsorship needs to emerge.

Table 4. Veho's maturity assessment: Organization and people (Laney, 2016:p.11, Halper & Krishnan, 2013-2014:p.7-14).

Veho Maturity Assessment	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Veho's score
Organization	Data and analytics related responsibilities are resourced based on applications and business people manage their own data	Business is involved in resolving data related issues but not in development or planning. IT and business are far from each other.	Data and analytics organization is established	Data and analytics moves away from IT as a separate unit closer to Business. Former data team is turned into a competency center which is doing less but enabling more of what business is doing.	Collaboration between centralized team and business functions is part of the culture. Data and analytics initiatives are more business centric and driven.	2
Skills	No data and analytics skills or training	Technical skills exist in the IT team. Business is does not have needed skills. No training organized for employees	Implementation of data and analytics related projects is difficult due to finding needed resources from business side. POCs are helping to gain more interest and engagement from business	Skills start to emerge in business. On going training is organized	Business executives see data and analytics as an essential part of their operations.	2
Roles	The organization does not have any devoted people handling data and analytics	IT based data related roles exist and are handling data administrative and modelling related tasks	Business unit-based data analyst and data scientists start to emerge.	Data scientists, coordinators and analysts are prevalent part of business.	Data scientists, coordinators and analysts are prevalent part of business in all business units	2
Leader	No leader	IT leader is sponsoring data activities. Business leaders are involved but not fully committed	Executive level sponsorship exist	CDO is leading and supporting data and analytics initiatives and cultural change	CDO leads the data and analytics organization that support the data and analytics lifecycle	3
Veho's overall score						2,3

The stage Veho is targeting to reach in 2021 is four. The aim is to have a hybrid organization where a centralized team is enabling analytics, governing Data and Analytics initiatives and managing data policies. As a result of a workshop with relevant business

managers and other key persons, the target model for analytics organization was built. Business was divided into process-based units where there would be analysts and data stewards doing the activities inside business. The central team that is now more technologically oriented and has projects related skills would be working with all these business processes seamlessly. As a whole Data and Analytics are in the core of business and the central team supports it closely. CDO's role is going to continue but it has to be made sure that Data and Analytics is of high priority and as close to the management team as possible or that there will be another high-level position appointed to lead the transformation.

At target stage, training of the staff needs to be ongoing, especially for the key users. Others should have good know-how on the tools they are using, the data they handle and how they could get benefits from these. For key users this means learning new skills related to data science, for IT personnel learning business skills, and for business personnel learning IT skills.

5.3 Technology

Currently Veho is at stage two (1.6) in Data and Analytics technology (Table 5). This is because the current architecture does not support adding new data sources and advanced analytics. Old data warehouse is siloed and not performing well. There are traditional BI tools in use, but the ability to do data discovery is missing.

To reach stage three in technological maturity, it is necessary that the architecture is defined and applied in certain areas. New data technologies and tools are also needed.

Table 5. Veho's maturity assessment: Technology (Nott, 2015a:p.1, Halper & Krishnan, 2013-2014:p.7-14)

Veho Maturity Assessment	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Veho's score
Information architecture	There is no coherent information architecture	Data and analytics architecture exist	Best-practice data and analytics - architecture is defined and applied in certain areas.	Information architecture is defined and applied	Information architecture fully support all data and analytics initiatives and business strategy related projects and on-going activities	1
Data handling	It is not understood how big data masses should be handled	Does not support adding new data sources	Various data technologies are in use	Ability to use structured and unstructured data and different sources	Fully supported	2
Information portal tools	Some reporting tools, no dashboards	Traditional BI working in ok level.	Traditional BI support multiple business needs	Traditional BI support multiple business needs and is performing well	Fully supported	3
Data discovery tools	No data discovery tools	Some experiments are done with cloud-based solutions regarding big data.	Some technologies are in use	Most needs covered	Fully supported	1
Data science tools	No data science tools	Does not support advanced analytics	Not well managed analytics	Most needs covered	Fully supported	1
Veho's overall score						1,6

The target stage for 2021 is four and it means having the architecture defined and applied to maturity of business functions.

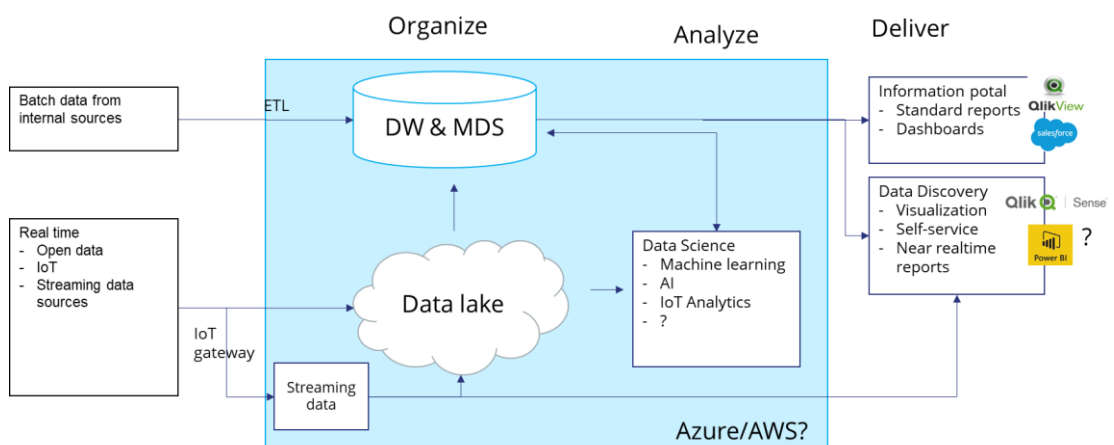


Figure 21. Suggestion for Data and Analytics architecture for 2021 (Veho, 2018)

The target state for 2021 in terms of Data and Analytics architecture was outlined with specialists (Figure 21). It covers most of the needs for Data and Analytics including all three types: information portal, data discovery and data science. It is necessary to have

a possibility to use structured and unstructured as well as external and internal data. A cloud environment where tools for advanced analytics are available is set up. A tool for super user's data discovery, data visualization and agile needs has been chosen and implemented.

5.4 Analytics

As a summary of the assessment, Veho is at stage two (1.8) regarding analytics (Table 6). Veho is doing mostly descriptive analytics meaning backward-looking reporting and traditional BI. There is a need to gain better access to data in order to have the opportunity to analyse it. To reach stage three there must be ways to understand from data why something happened and what will happen next. This will mean managing large data masses and being able to utilize them in some business questions.

Table 6. Veho's maturity assessment: Analytics (Nott, 2015a:p.1, Halper & Krishnan, 2013-2014:p.7-14)

Veho Maturity Assessment	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Veho's score
Descriptive	Analytics is used to understand what has happened. Traditional BI and reporting solutions exist for e.g. financial and other regulatory purposes.	Data is mostly used for reporting purposes	Reporting is versatile and suits many needs	Reporting has changed to analytics and is used in most business units	Fully functioning	3
Diagnostic	Does not exist	Analytics is used to understand why something has happened	Diagnostic analytics is part of daily operations in some business units	Diagnostic analytics is part of daily operations in most business units	Fully functioning	2
Predictive	Does not exist	Interest in analytics has grown inside the organization and some outside partners are used to do some experiments even with advanced analytics.	Analytics is used to predict the likelihood of what will happen to some business-related questions	Predictive analytics is used to optimize decision making to enable optimal actions for better business value	Fully functioning	1
Prescriptive	Does not exist	Interest in analytics has grown inside the organization and some outside partners are used to do some experiments even with advanced analytics.	A company might be able to manage large data masses but not able to utilize it through predictive models or other advanced ways.	Analytics supporting the organization by integrating it into business processes and automating some decision making and actions.	Analytics is used in optimizing business processes and is automated where possible. All kind of data is used in integrated way for analytic	1
Veho's overall score						1,8

The target stage for 2021 is level four and this means optimal decision making based on predictive analytics. Analytics should be integrated into processes and some business decisions and actions automated. During 2019-2021 this means implementing analytics solutions of all four levels: descriptive, diagnostic, predictive and prescriptive in all business units. From user perspective this means more analytics solutions for key

users, and for other users integrated models in their everyday work e.g. optimized sales activities for sales people based on data models, segmenting customers and predicting their behaviour. The maturity in analytics will help growing the maturity in other dimensions, since building the solutions are the way to bring analytics into reality. It will increase the skills and need for new roles, gain support from executives and highlight the importance of data management when the actual business benefits are realized monetarily or effort-wise.

5.5 Data Management

Veho is at maturity stage two (1.8) regarding data management (Table 7). There are several data management and governance activities done on customer data, but Veho is missing a comprehensive view of all data, updated policies and a governance organization.

Table 7. Veho's maturity assessment: Data management (Nott, 2015a:p.1)

Veho Maturity Assessment	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Veho's score
Management	Manual information governance for regulatory purposes is done. No overall data strategy or plan for lifecycle management.	End state data architecture such as semantic layer might exist. No overall data strategy or plan for lifecycle management.	MDM programs are started but focus is on subsets of data	Data life cycle management exist.	Data management is part of business culture	2
Quality handling	Ad-hoc, data not trusted	Upstream data quality is performing well enough	A company is aware of data issues and monitoring is for the most parts	Data quality monitoring is mostly automated.	Data quality monitoring is automated and part of business culture	3
Definitions, policies, procedures	Few policies	Some reactive policies for data management has been established but are not monitored	Policies and procedures are started to be implemented to manage core data through its lifecycle	Full set of policies are communicated and enforced, and the governance is prioritized based on business needs.	Fully functioning	1
Data management organization	Does not exist	Understanding of data and establishing ownership is emerging. Data owners are assumed.	Policies are monitored through information stewards with limited authority	Data governance organization exists.	Data stewards are acting as information advocates focusing on value generation	1
Veho's overall score						1,8

It was discovered during the current state analysis that a customer data governance model has been created a few years ago, but not implemented fully. To gain level three, Veho needs to update the governance model and expand it to cover other master and metadata. The issues at hand have to be covered in data policies and proce-

dures to be able to manage data through its life cycle. Data stewards are monitoring the policies in business.

In 2021 Veho is targeting to reach stage four. This means a fully functioning data governance organization. The policies are communicated and enforced, and the prioritization is done based on business needs. Now data quality monitoring is a manual task and in 2021 the target is to get it automated in the same way as the activities needed for data life cycle management.

5.6 Summary

When the assessments are combined, Veho is at level two. When looking at the dimensions separately (Figure 22), the most immature by the assessment is technology and most mature are strategy and vision and organization and people. This does not indicate the efforts needed to be made for the changes, but more that there is a lot to be done in all of them. Level two can feel as a low number, but like presented earlier through the study done by Forbes Insights, most of the companies are beginning their journey and especially the automotive industry is not mature on Data and Analytics. Only few are leaders or on level four or five, but the ones that are there are seeing the benefits.

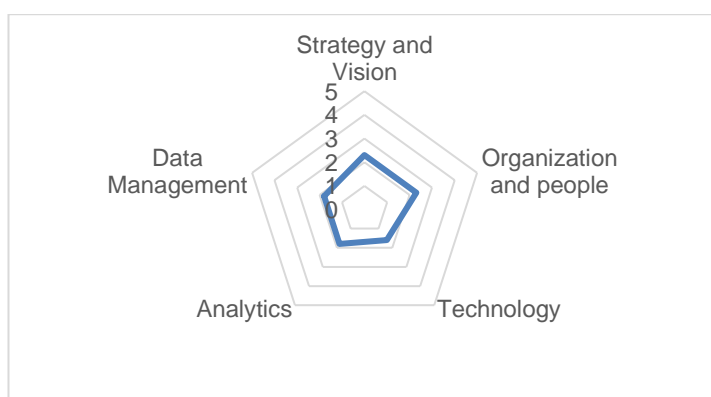


Figure 22. Maturity assessment done for Veho

The proposed maturity framework was built based on the assessment and combined maturity indicators for each dimension (Appendix 4). The current stage is highlighted with red lining and the target stage with green lining.

6 Validation of the proposal

This section introduces the validation process and the final outcome of the thesis. It addresses the issues of what has been done and what should be done next.

6.1 Validation overview

The purpose of a maturity framework is to be able to assess the current state of Data and Analytics compared to other organizations and best practises. After defining the target state, it works as a framework for building a road map and helping in prioritizing decisions and actions. Veho's maturity framework has gone through a three-level validation.

6.1.1 Project team validation

The first level of validation was done together with the project team involved and the executive level sponsors. There were some minor modifications done mostly to the conclusions of the current state assessment and to some indicators that needed to be highlighted.

6.1.2 Practical validation

The second level validation was done in practise by using the framework for strategic action planning for 2019-2021 and creating a short-term road map for 8/2018-6/2019.

Veho carried out the strategic planning for 2019-2021 during summer 2018. The Data and Analytics framework was used to create a strategic action plan to reach the strategic target for Data and Analytics.

The strategic targets were assessed against the maturity stages, and a schedule was drawn. The maturity framework works as metrics for the upcoming transformation program. Figure 23 shows the target schedule for increasing maturity level for each dimension.

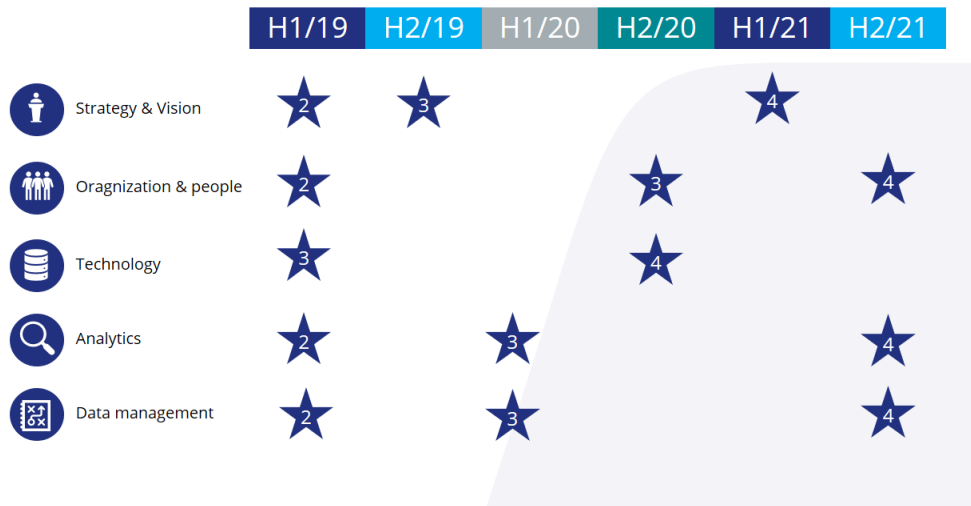


Figure 23. Target schedule for gaining maturity (Veho, 2018)

A short-term plan for autumn 2018 and spring 2019 were drawn from the strategic plan and aligned with the framework and target state 2021 (Figure 24).

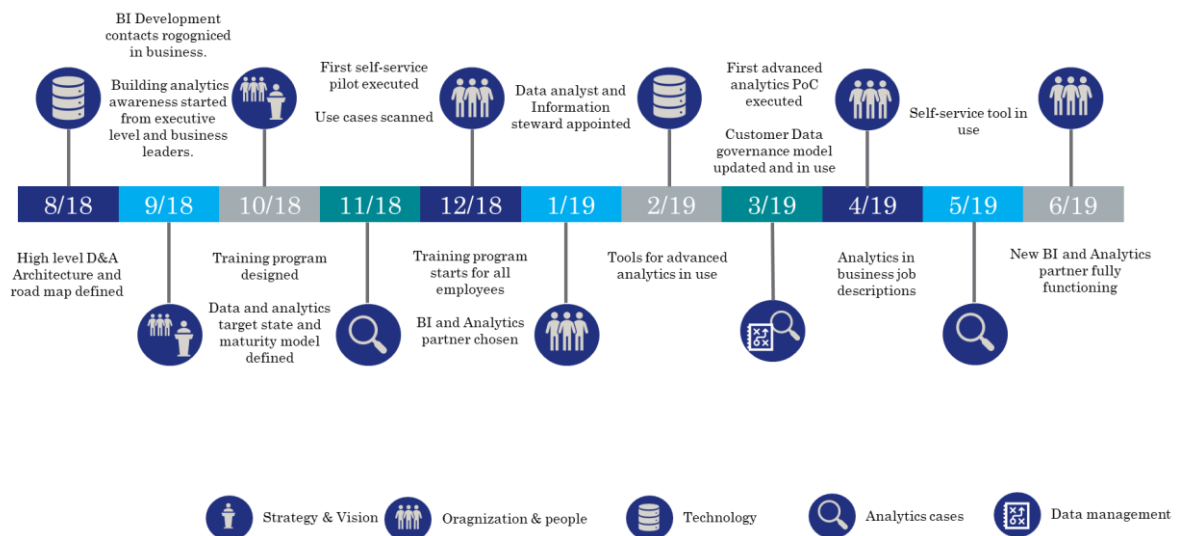


Figure 24. Next steps for H2/2018-H1/2019. (Veho, 2018)

The framework suited the purpose and supported the planning. Organizing and prioritizing actions was fairly easy and the drawn schedule more realistic than without the framework. From validation perspective the framework did work in practical use in long- and short-term action planning.

6.1.3 Executive level validation

The target state summary (Figure 25) was presented to the management team and they gave their approval for the transformation program aiming to achieve the targets.

TARGET STATE 2021

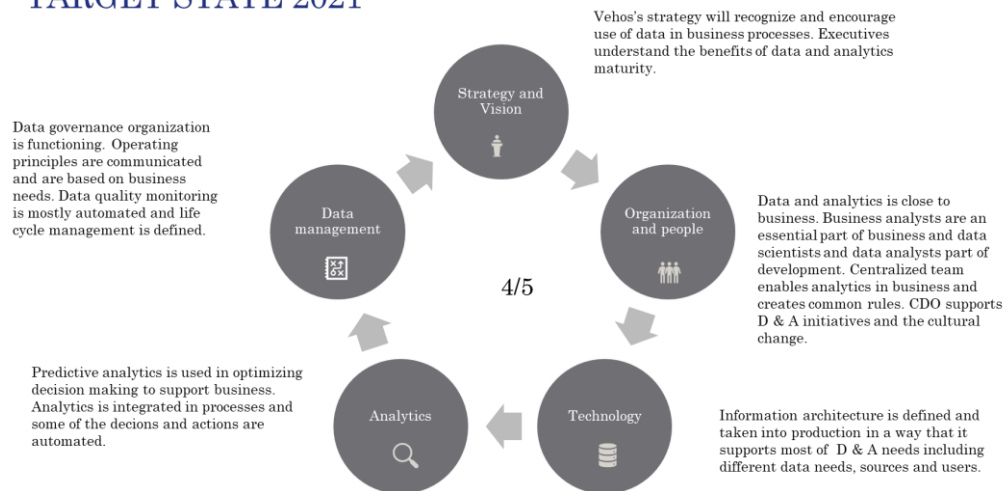


Figure 25. Target state summary

6.2 Final proposal: Maturity framework for Veho

Previously presented maturity indicators from existing knowledge for chosen dimensions have been combined with current state analysis and a desired target state. As a result, a maturity framework suitable for Veho's business culture has been created (Table 8).

Table 8. The Maturity framework for Veho

Veho Maturity Assessment	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Strategy and Vision	Data and analytics is discussed but not visual in business strategy. The organization does not see a reason why and don't recognize what it means to be data driven. No Data and analytics vision exists nor is there leadership sponsorship.	Digital strategy recognizes the importance of data and analytics. Progress of data and analytics initiatives is hampered by culture, organizational barriers and lack of leadership. Main focus is on technology. High-level sponsor from ICT is named.	Business strategy recognizes and encourages the use of analytics within business processes. Strategy definition is shifting from a static, annual process toward more of a dynamic one. High-level sponsor from business is named and other leaders understand the benefits of data and analytics maturity.	Business strategy realizes competitive advantage from customer-centric analytics and well managed data. Data is seen as valuable asset. Vision for data and analytics exist for coming years.	Data drives continuous business model innovation. Business strategies highlight this importance. Data is a recognized corporate asset, competitive differentiator, source of transformation, and a product itself.
Organization and people	Data and analytics related responsibilities are resourced based on applications and business people manage their own data. The organization does not have any devoted people handling data and analytics or have a leader to manage it.	ICT based data related roles exist and are handling data administrative and modelling related tasks. Business is involved in resolving data related issues but not in development or planning. ICT leader is sponsoring data activities. Business leaders are involved but not fully committed.	Data and analytics organization exists. Business unit-based analysts and central data analysts and data scientists start to emerge. Implementation of data and analytics related projects is difficult due to finding needed resources from business side. Executive level sponsorship exists. POCs are helping to gain more interest and engagement from business.	Data and analytics moves away from IT as a separate unit closer to Business. Data scientists, coordinators and analysts are important part of business. Former data team is turned into a competency center which is doing less but enabling more of what business is doing. CDO is leading and supporting data and analytics initiatives and cultural change. Training is on-going.	CDO leads the data and analytics organization that supports the data and analytics lifecycle. Data and analytics initiatives are business driven. Business executives see data and analytics as an essential part of their operations. Collaboration between centralized team and business functions is part of the culture.
Technology	There is no coherent information architecture. It is not understood how big data masses should be handled.	Data and analytics architecture exist but does not support advanced analytics or variety of data sources. Some experiments are done with cloud-based solutions regarding big data. Tradition BI-tools are in use, but modern data discovery is missing.	Best-practice data and analytics -architecture including data discovery tools is defined and applied in certain areas. Various data technologies are in use but may not be well managed or used in analytics.	Information architecture is defined and applied and cover most of the data and analytics needs using structured and unstructured data.	Information architecture fully support all data and analytics initiatives and business strategy related projects and on-going activities.
Analytics	Analytics is used to understand what has happened. Traditional BI and reporting solutions exist for e.g. financial and other regulatory purposes.	Analytics is used to understand why something has happened. Data is mostly still used for reporting purposes. Interest in analytics has grown inside the organization and some outside partners are used to do some experiments even with advanced analytics.	Analytics is used to predict the likelihood of what will happen. A company might be able to manage large data masses but not able to utilize it through predictive models or other advanced ways in all business needs.	Predictive analytics is used to optimize decision making to enable optimal actions for better business value. Analytics supporting the organization by integrating it into business processes and automating some decision making and actions.	Analytics is used in optimizing business processes and is automated where possible. All kind of data is used in integrated way for analytics.
Data Management	Manual information governance for regulatory purposes is done based on few policies. Lack of data definitions and handling quality ad-hoc can be seen as data not being trusted or used. No overall data strategy or plan for lifecycle management.	Understanding of data and establishing ownership is emerging. Some reactive policies for data management have been established but are not monitored. Data owners are assumed, and upstream data quality is performing well enough. No data lifecycle management. End state data architecture such as semantic layer might exist.	A company is aware of data issues and therefore policies and procedures are started to be implemented to manage core data through its lifecycle. Policies are monitored by information stewards with limited authority. MDM programs are started but focus is on subsets of data.	Data governance organization exists. Full set of policies are communicated and enforced, and the governance is prioritized based on business needs. Data quality monitoring is mostly automated and data life cycle management exists.	Data quality monitoring is automated and part of business culture. Data stewards are acting as information advocates focusing on value generation.

When adding all the scores for different dimensions together Veho is at stage 2.

Veho's strategic statement from digital strategy (2018) is: 'Veho will have a competitive advantage from its advanced internal analytics services and high-quality, up to date customer and product information. We will have the needed competencies and resources for it.' To be able to realize this statement maturity needs to grow year by year. Target is set and validated by the management team to gain stage four maturity in 2021.

6.3 Implementation

The maturity framework has been presented throughout the organization and implemented for action planning during autumn 2018. Data and Analytics transformation program will start in early 2019 and the framework will be used as a compass for the program members and the project manager. It will be used in ongoing action planning, prioritization and measuring the progress. Now that the target stage has received the approval of the executive level, the programme can start with full speed.

7 Discussion and conclusions

This section will summarize the thesis from objective to outcome and evaluate the work from research and personal perspectives.

7.1 Summary

Veho is storing huge amounts of data related to customers, products and transactions. The data is currently used in backward-looking reporting purposes. New digital strategy for 2018 states that ‘Veho will have a competitive advantage from its advanced internal analytics services and high-quality, up to date customer and product information. We will have the needed competencies and resources for it“. In a way this could be seen as the vision for Data and Analytics. It is recognized that Veho is not mature in data driven business and is missing some key elements for gaining more maturity such as roles, technologies and use cases.

The objective of the study was to create a Data and Analytics maturity framework to help management to achieve the vision. There are several maturity models out in the market. Their purpose is to evaluate organization’s current state against other organizations. When a target level is set, it is easier for organizations to build their road map to achieve the target. The existing models are generic and don’t apply in all levels to Veho business. This study combines the chosen dimensions from existing models, best practices found from existing knowledge and current state analysis to create a framework suitable for Veho’s business.

The maturity dimensions chosen and combined with existing models are strategy and vision, organization and people, technology, analytics, and data management. It is seen that without any one of these, the increase in maturity is not possible. If the strategy does not support the transformation project and use of data, there will be significant obstacles in getting the needed resources and actions in place. If the skills and roles are lacking, the analytics solutions are impossible to be built and trusted. A few people in IT can’t do this by themselves since the need of analytics must come from business and the result must benefit business. Technology is an important enabler but not the main focus. Technology without appropriate data, correct cases or right users is useless. Analytics use cases have an important role in the upcoming transformation

program. One stream of the program will lay the basis of maturity by setting up the architecture or getting right people involved, and the other is about executing analytics projects in all levels; descriptive, diagnostic, predictive and prescriptive. With successful outcomes, the pace of the program will increase. The last dimension chosen was data management. Without data being managed, the trust in analytics is hard to achieve. Data management includes data quality monitoring and security policies, functioning governance organization and common procedures. There have to be rules set for inserting, handling and transforming data and an organization to support it.

When analysing the current state by interviews done with different types of data users, it was quite clear from the start that the maturity level is not very high. This is common in all industries and automotive industry especially. Even though the digital strategy highlights Data and Analytics, it is not seen clearly enough in business strategy or in strategic actions. The CDO and CFO support the change, but it seems that the business leaders are not yet fully committed to the efforts needed.

The organization is interested in Data and Analytics but is still missing the needed skills and roles for it. A centralized team operates from digital services and includes IT-minded specialists. The team is not cooperating with business in a way the best practices describe. In business side there are no analysts, which is a key role when driving data driven culture. People analysing data are looking at it from historical perspective from static reports and using lots of time for analysis and data massaging.

The current technology landscape is built to suit the needs of traditional BI. The architecture is not documented and a road map to get to the next level does not exist. There is a need of data discovery tools for super users to enable them an easier access to data and visualizations. New data sources, such as open data or IoT(Internet of Things) -data and advanced analytics need new architectural components such as a cloud-based data lake and tools.

Veho is mainly doing descriptive analytics which is backward looking and needs a lot of human input to generate decisions and actions. To gain maturity in analytics there needs to be data discovery and advance analytics implemented.

Data management activities have been ongoing at Veho for several years. There was a data governance project done in 2014 including mainly customer data. The results of that project need updating and spreading throughout all data components.

Maturity framework combining the best practices from existing knowledge and current state analysis was built. A target maturity stage for all the five dimensions was set to grow from two to four by 2021.

The proposed framework was validated first together with the project team involved and with the CDO. After minor changes were done, the framework was tested in practice during the strategic action planning period in summer 2018. It needed minor alterations but at the end the final framework was built, and it is presented in section 6.2. The final validation was done to the target state by getting it accepted by the Veho management team.

7.2 Practical implications

The framework is designed to support leaders and management when making decisions regarding future development projects, resource planning, tool selection and strategy work regarding Data and Analytics. There will be a Data and Analytics transformation program started in the beginning of 2019 and this framework will help in setting the action plan and prioritizing the tasks.

Here are recommendations that should be taken into consideration when Veho starts the program:

1. Integrate Data and Analytics into business strategy during next strategy period
2. Increase understanding in Data and Analytics throughout the organization
3. Find key users and add analytics in their job description
4. Hire a data analyst who has skills and understanding of advanced analytics
5. Start building an architecture that enables advanced analytics and data discovery
6. Start searching for use cases and business problems that could be solved with advanced analytics. Start implementing solutions first through PoCs and then gradually start implementing solutions to all business units
7. Refresh the data governance model done previously concerning customer data and expand to other master and meta data

8. Appoint needed roles for data management

It is important to carry out the transformation program and to involve all relevant stakeholders. The change will take time and it will affect the whole business. It is especially important to have support from the highest level.

7.3 Evaluation of the thesis

The thesis is evaluated by assessing whether the outcome meets the objective. A personal reflection on the thesis is the final part with learnings, successes and challenges.

7.3.1 Outcome vs objective

The objective was to create a framework for management to increase Data and Analytics maturity. The outcome of the thesis met the objective. With the framework Veho will be able to address the challenge they have with data and utilizing it. Managers have a tool to make needed decisions and take action to fulfil the digital strategy statement 'Veho will have a competitive advantage from its advanced internal analytics services and high-quality, up to date customer and product information. We will have the needed competencies and resources for it'. The framework can be used for measuring the progress and steering along the way.

7.3.2 Reflection & Afterword

Final section of the thesis is my own reflection on the study and the process. The challenge addressed in this study seems to be very common in companies: everyone has heard of analytics but is not sure how to address the matter and Veho is no exception.

The research method of using the gate model worked well to the case company's schedule and the subject. There was a need to have a strategic action plan ready right after summer and the gates made it possible to have the first proposal ready to be validated in practise. The model also gave enough time for a wide assessment done with 42 employee interviews.

The maturity model thinking to address the business challenge was a clear path from the start. There are several different models out in the market and the ones chosen all represent different types of providers. As a Data and Analytics professional I have encountered challenges regarding all chosen dimensions in my career and this was a good opportunity for me to study these more thoroughly.

One of the hardest things when doing the research was to find reliable and up to date information about the best practises of Data and Analytics. Since the industry is constantly evolving, the books written can be outdated in a very short period of time. This is the reason why I used a lot of papers from Gartner analysts. Among analytics professionals Gartner is the main consulting company giving guidance on Data and Analytics from managerial perspective.

I learned a lot from the interviews done in the case company. They gave me a wide perspective on the matter, the pain points and the successes. With those I was able to draft a holistic view on the status in the organization and to find the current stage of maturity from existing models. When building the proposal for Veho's framework some dimensions needed more attention. The organization and people dimension was seen internally and by me the hardest one and needed most work in defining the target. It was great to see the support the organization was giving to this thesis and especially the project team, CDO and CFO were supporting it along the way. Like presented in the validation, the framework has already proven to be useful in action planning and I have fully adapted it to my work as the development manager of Data and Analytics.

The built framework has already benefitted the case company, and at the same time it has also been a great learning experience for myself. I have got a strategic perspective for Data and Analytics instead of doing daily operations regarding traditional BI. I have had the opportunity to widen my network and to be acquainted with business directors and management. I believe that this framework will change the way I do my work and it will form the steps that Veho will take to reach the target state that it is now committed to.

References

Becker, J., Knackstedt, R. & Pöppelbuß, J. (2009) Developing maturity models for IT management – a procedure model and its applications. *Business & Information Systems engineering*. 7(3), 213-222.

Buytendijk, F., Rollings, M., Judah, S. & Moran, M. (2017) *No Data and Analytics Vision? No Business Impact!* Gartner. Report number: G00313740.

Cook, H. (2017). Modern Data and Analytics Architecture for digital transformation. In: Gartner (ed.) *Gartner catalyst conference 2017*, 25-29 Sept 2017, London, UK. pp. 9, 30.

Deloitte. (2018) *Modern Business Intelligence - The Path to Big Data Analytics*. Available from: <https://www2.deloitte.com/content/dam/Deloitte/tr/Documents/deloitte-analytics/Modern%20Business%20Intelligence.pdf> [Accessed 15th June 2018].

Fisher, T. (2009) *The Data Asset. How Smart Companies Govern their Data for Business Success*. New Jersey, John Wiley and Sons.

Forbes insights, (2017) Data and advanced analytics: High stakes, high rewards. Forbes.

Fritsch, J. (2017) Data Governance: from on-premises to cloud. In: Gartner (ed.) *Data and Analytics summit 2017*, Gartner 22-23 March 2017, London, UK. pp. 6-16.

Gartner. (2017a) *Leadership Vision for 2018: Data and Analytics Leader*. Gartner. Report number: 333902.

Gartner. (2018) Gartner IT score. Available from: <https://www.gartner.com/en/research/methodologies/itscore> [Accessed 12th Jan 2018].

Gregory, A. (2011) Data governance -- Protecting and unleashing the value of your customer data assets: Stage 1: Understanding data governance and your current data management capability. *Journal of Direct, Data and Digital Marketing Practice*. 12 (3). 230-248.

Halper, F. & Krishnan, K. (2013-2014) *Big data maturity model guide – interpreting your Assessment score*. TDWI Research.

Howdy, C. & Duncan, A. (2015) *IT score overview for BI and Analytics*. Available from: <https://www.gartner.com/doc/3136418/itscore-overview-bi-analytics> [Accessed 21st Jan 2018].

Howson, C (2017) Moving your Data and Analytics maturity from laggard to leader. In: Gartner (ed.) *Gartner data & analytics summit 2017, 22-22 March 2017*, London, UK. pp. 3, 13.

Laney, D. (2016) Enterprise Information management maturity Model. Gartner. Report number: G00289832.

Nott, C. (2015a) *Big Data and Analytics Maturity Model*. Available from <http://www.ibmbigdatahub.com/blog/maturity-model-big-data-and-analytics> [Accessed 3rd Feb 2018].

Nott, C. (2015b) *Applying the big Data and Analytics maturity model for a competitive advantage*. Available from: https://www.ibm.com/developerworks/community/blogs/bigdataanalytics/entry/Applying_the_big_data_and_analytics_maturity_model_for_a_competitive_advantage?lang=en [Accessed 5th Feb 2018].

Oestreich & Buytendijk, 2016. Gartner Why you need to rethink your Data and Analytics roles now. Gartner 2016

Oestreich, W. & White, A. (2016) *Must have roles for Data and Analytics 2017*. Gartner. Report number: G00309273.

McKinsey Global Institute. (2016) *The age of analytics: competing in a data driven world*. McKinsey.

White, A. & Beyer, M. A. (2017) *Design an effective data information governance strategy*. Gartner. Report number: G00338329.

Veho Oy Ab. (2016) *Veho Oy Ab Vuosikatsaus 2016*. Available from:
https://www.veho.fi/globalassets/veho/veho_vk2016_fin_low.pdf [Accessed 26th December 2017].

Veho Oy Ab. (2017) *Veho yrityksenä*. Available from:
<https://www.veho.fi/autoliikkeet/veho-yrityksena/> [Accessed 26th December 2017].

Veho Oy Ab. (2018) *Konserni- ja digistrategia*.

Veho Oy Ab. (2014) *Loppuraportti: Liiketoimintakriittisen tiedon hallintamalli, Vaihe 1*.

Appendix 1: Data collection plan

Data round	Data type	Data Source	Date	Recording	Purpose focus	
Data 1 Current state analysis	Face to face interview	Business Controller	25.1.2018	Yes	Root level experience	
		Field manager	29.1.2018	Yes	Mid level experience	
		Manager, spare parts	29.1.2018	Yes	Mid level experience	
		Manager, spare parts	29.1.2018	Yes	Mid level experience	
		Development manager	29.1.2018	Yes	Root level experience	
		CFO	29.1.2018	Yes	High level experience	
		Business Controller	30.1.2018	Yes	Root level experience	
		Development manager	5.2.2018	Yes	Root level experience	
		Head of Development	5.2.2018	Yes	High level experience	
		Business Controller	6.2.2018	Yes	Root level experience	
		Quality manager	13.2.2018	Yes	Root level experience	
		Pricing manager	14.2.2018	Yes	Mid level experience	
		Ledger manager	21.2.2018	Yes	Root level experience	
		CDO	20.2.2018	Yes	High level experience	
		Maintenance manager	22.2.2018	Yes	Mid level experience	
		Head of Development	23.2.2018	Yes	High level experience	
		Sales manager	23.2.2018	Yes	Mid level experience	
		Director, commercial vehicles	28.2.2018	Yes	High level experience	
		Customer service manager	7.3.2018	Yes	Mid level experience	
		Field manager	7.3.2018	Yes	Mid level experience	
		Product manager	15.3.2018	Yes	Mid level experience	
		Sales manager	16.3.2018	Yes	Mid level experience	
		Warranty manager	16.3.2018	Yes	Mid level experience	
		Business Controller	19.3.2018	Yes	Root level experience	
		Business Controller	19.3.2018	Yes	Root level experience	
		BI Specialist	27.3.2018	Yes	Root level experience	
		Head of financial services	28.3.2018	Yes	High level experience	
		Marketing manager	12.4.2018	Yes	Mid level experience	
		Maintenance manager	16.4.2018	Yes	Mid level experience	
		Business Controller	16.4.2018	Yes	Root level experience	
		Marketing manager	19.4.2018	Yes	Mid level experience	
		Head of maintenance	23.4.2018	Yes	High level experience	
		Director, passenger cars	2.5.2018	Yes	High level experience	
		IT Manager	8.5.2018	Yes	Mid level experience	
		Head of Sales	8.5.2018	Yes	High level experience	
		Integration architect	9.5.2018	Yes	Root level experience	
Integration architect	15.5.2018	Yes	Root level experience			
Datawarehouse specialist	16.5.2018	Yes	Root level experience			
Development manager	30.5.2018	Yes	Mid level experience			
Data specialist	4.6.2018	Yes	Root level experience			
Director, IT and information security	12.6.2018	Yes	High level experience			
Development manager	20.6.2018	Yes	Root level experience			
	Internal documentation	Strategy, corner stones, organization chart, Company presentations	May-October, collection of documents		To gather knowledge about the current state of organizational hierarchies and strategy.	
Data 2 Building the proposal	Group interview	Project team	May 2018	Notes	To go through the findings from current state and build an approach for target state creation.	
		CDO	June 2018	Notes	To validate the current state analysis. To define target state for strategy and vision	
		Data team	June 2018	Notes	To define target state for technologies, analytics and data management	
			Project team, business members	June 2018	Notes	To define target state for organization and people
			Project team	August 2018	Notes	To validate the proposed model
Data 3 Validation	Group interview	Board of executives	August 2018	Notes	To validate the target state	

Appendix 2. Base questions for current state interviews

Base questions for stakeholder interviews	High-level experience	Mid-level experience	Root-level experience
Basic questions	<ul style="list-style-type: none"> - Name - Title - Data user time - Domain - Work experience - Organization's responsibilities - Personal responsibilities 	<ul style="list-style-type: none"> - Name - Title - Data user time - Domain - Work experience - Organization's responsibilities - Personal responsibilities 	<ul style="list-style-type: none"> - Name - Title - Data user time - Domain - Work experience - Organization's responsibilities - Personal responsibilities
Strategy and vision	<ul style="list-style-type: none"> - What is the business strategy? - What are the strategic actions? - Is data and analytics part of strategy? - How do you see the role of Data and analytics in Veho? 	<ul style="list-style-type: none"> - Is Data and analytics part of your action planning? - What is the meaning of data and analytics? - What is data used for? - Why is data important? 	<ul style="list-style-type: none"> - Is there a clear data and analytics strategy? - What is data used for? - Why is data important?
Organization and people	<ul style="list-style-type: none"> - How is your organization organized? - Are there people doing analytics? - Are there data owners? - How does the co-operation between It and business work? 	<ul style="list-style-type: none"> - Do you have analysts in your organization? - Has there been any training organized related to data and analytics? - How are key contacts related to data and analytics? - How does the co-operation between It and business work? 	<ul style="list-style-type: none"> - Has there been any training organized related to data and analytics? - How are key contacts related to data and analytics? - How does the co-operation between It and business work? - How much time do you use for data and analytics related tasks?
Technology	<ul style="list-style-type: none"> - How do you see the current situation of data and analytics tools? 	<ul style="list-style-type: none"> - What kind of tools are you using? - How are the tools performing? - For what purpose are the tools used for? 	<ul style="list-style-type: none"> - What kind of tools are you using? - How are the tools performing? - For what purpose are the tools used for? - What kind of architecture exists? - What kind of development is done related to tools? - What is missing? - What data sources are used? - Other data sources available?
Analytics	<ul style="list-style-type: none"> - What kind of analytics happen in your organization? - What kind of decisions are made? - Is analytics utilized in decision making and action planning 	<ul style="list-style-type: none"> - What kind of analytics happen in your organization? - What kind of decisions are made? - Is analytics utilized in decision making and action planning - What kind of analysis do you make based on the data available? - What is missing? 	<ul style="list-style-type: none"> - What kind of analytics applications are available? - What kind of development has been done related to data and analytics? - Is there a road map for further development? - What kind of analysis do you make based the data available? - What is missing?
Data management	<ul style="list-style-type: none"> - What are the biggest problems with data management? - What do you think causes the problems? - How important is data in your organization? - Are there people responsible for data? 	<ul style="list-style-type: none"> - What are the biggest problems with data management? - What do you think causes the problems? - How important is data in your organization? - Do you trust the data? 	<ul style="list-style-type: none"> - How is data management done currently? - How is the housekeeping and quality monitoring operated? - What are the biggest problems with data management? - What do you think causes the problems? - Are there existing policies, best practises or standards defined?

Appendix 3: Maturity dimensions from Gartner Enterprise Information Model, TDWI Big Data maturity model and IBM Big Data and Analytics maturity model

Dimension	1	2	3	4	5	Source
Organization and people	Information-related responsibilities are resourced on an application-by-application and project-by-project basis. Business people typically are resigned to source and manage their own data or must join the IT backlog.	Pooled or centralized database administrators, data administrators and data modeling resources emerge, all of whom are strictly part of the IT department. IT also houses business intelligence analysts and data integration specialists. Business users are engaged in information-related activities mostly to resolve issues, rather than in upfront design and planning	Formal information and content management organizations materialize within IT and governance councils and stewardship bodies in the business. At least one data scientist is hired by a business unit. Projects are set up and staffed one at a time but tend to lack a plan for organizational continuity or intraenterprise synergy.	EIM and analytics move outside of IT as a CDO is installed to lead a separate enterprise information services organization. Specialty roles — such as big data infrastructure/architecture specialists, data scientists, information strategists, information architects, information product managers, and data curators — become prevalent. Information-related competency centers emerge under the CDO for core analytics, data modeling, metadata and master data.	The CDO oversees and has authority and budget for most aspects of the information life cycle. This information services organization supports the entire LOB-customer-partner-supplier information ecosystem. Data-related meetings have become business-centric. An information product management function develops and facilitates new revenue stream	Gartner EIM (Laney, 2016:p.11)
Organization and people		In this stage, the organization is just beginning its big data journey. In traditional companies, typically, one executive sponsor is on board, but companywide support can be spotty. Often the sponsor is in the CIO organization and not in the business. The mindset is generally around experimentation. The team charged with exploring big data is trying to determine the top business problems to solve and may have brought in some business partners to help with this. They realize that identifying the right business problem is critical for success. The company typically utilizes analytics as part of its decision-making process in various departments, but the company itself isn't necessarily analytics driven. In some companies at this stage, there may even be scepticism around big Data and Analytics. In Internet-based companies, where the mindset might be to get it done as quickly as possible, the goal might be to get the first application up and running and worry about the rest later. Typically, the CIO team might be working with a business sponsor who is the driver behind the effort, but who may not yet be totally engaged.	At this point, there is generally at least one executive sponsor involved. However, it is also at this stage when more executives might start to become interested in the program as companies show some wins in the POCs. As the organization gets excited about the prospects of big data, more people start to come on board. This often means that a team is established to start to plan and strategize for a wider big data scope. This also means that politics may start to kick in, especially in cases where the goal of the big data project is cost containment rather than competitive advantage.	At this stage, the company has usually come to realize that analytics is a competitive differentiator. Innovation in data and data analysis is a core value, and an analytics culture prevails. The business strategy is generally top-down and bottom-up, with a data infrastructure that can support this. The funding process is secured, and an ROI is in place for big data analytics.	The visionary company exhibits several characteristics. First, executives have bought into analytics and big data analytics and view it as critical, de facto standard for how to do business. Analytics is seen as a competitive weapon and the mindset is creative. Second, analytics is not simply used to drive strategy or insight; instead, the business is always looking for opportunities to use analytics in new ways. In fact, a key characteristic of a visionary company is that it is continuously determining new ways to use and create value from analytics. Finally, collaboration is a big part of the culture.	TDWI (Halper & Krishnan, 2013-2014:p.7-14)

Strategy and Vision	Big Data is discussed but not reflected in business strategy in which use of data extends financial and regulatory reporting	The business strategy recognizes that data can be used to generate business value and return on investment (ROI) through realization that is largely experimental	The business strategy encourages the use of insight from data within business processes	The business strategy realizes competitive advantage in client-centric insight	Data drives continuous business model innovation	IBM (Nott, 2015a:p.1).
Vision	Information is a source of power but managed in silos. People spend time arguing about whose data is correct and who owns it instead of seeking uniform availability. There is general acknowledgment that information management (or lack thereof) is a serious problem.	Reactive IT attempts to formalize objectives for information availability to achieve targeted operational needs. Progress is hampered by culture, contradictory incentives, organizational barriers and lack of leadership.	Proactive Business management encourages cross-functional information accessibility to improve responsiveness to the business, customers and marketplace. Different content types still are treated and managed separately. Data fiefdoms begin to disband. Exogenous data sources begin to be integrated for enhanced analytics.	Managed Senior business executives champion and communicate information-related best practices. Information is viewed as an indispensable fuel for enterprise performance and innovation to be shared seamlessly. Customers and partners influence information vision. Information assets are linked and leveraged across several programs.	Information is a central component of business strategy and architecture. Information is a recognized corporate asset, competitive differentiator, source of transformation, and even as a product itself. Necessary, valued and prioritized information is leveraged across all programs and investments.	Gartner EIM (Laney, 2016:p.6)
Strategy	Information is hoarded by departments and individuals as a source of power and influence or is unknown altogether. Information is seen merely as application-specific. An information management organization may be in formative stages, but sponsorship is nonexistent.	Business units recognize the broader value of information and begrudgingly share it on cross-functional projects. An EIM organization emerges to establish and control standards, and improve information availability while reducing expenses, but the main focus is on technology.	A high-level sponsor (e.g., CDO) is named to define an enterprise wide information strategy and coordinate a broad agenda, including funding and roadmap. Information management resources and technologies start to become pooled and shared across projects. Strategy definition is shifting from a static, annual process toward more of a dynamic "living document."	A well-funded and well-led information program addresses most enterprise needs (current and planned). Business units are committed and involved. Most components and resources are in place and functioning. The office of the CDO is empowered to drive EIM vision in support of the business needs.	Data and Analytics leadership has a say in corporate strategy as information is deemed an actual corporate asset. Information is defined primarily by the value it brings, not by its structure or other characteristics. Business informational needs and risks are met proactively. The information strategy considers the organization's extended ecosystem of partners, suppliers and customers. Information strategy is no longer a separate work task but is embodied in how the business operates.	Gartner, EIM (Laney, 2016:p.7)

Strategy and Vision	Nascent organizations are also often not that far along in terms of an overall unified data strategy, nor do they see a reason to have one. These organizations may not yet have thought about what it means to be data driven.					TDWI (Halper & Krishnan, 2013-2014:p.7-14)
Technology	The organization does not have single, coherent information architecture	An information architecture framework exists but does not extend to new data sources or advanced analytics capabilities	Best-practice information architectural patterns for big Data and Analytics are defined and have been applied in certain areas	Information architecture and associated standards are well defined and cover most of the volume, variety, velocity and veracity capabilities and structured and unstructured data consumption needed for differentiation	Information architecture fully underpins business strategies to enable complete market disruption with volume, variety, velocity and veracity specifications applied.	IBM (Nott, 2015a:p.1)
Technology	A key piece of the enterprise and its information management standards lies with the infrastructure of the corporation. Big data management requires an in-depth understanding of the new infrastructure to support critical big data components such as data types, data volume, user and data security, access to information, processing requirements, and information storage. The nascent organization often misunderstands the need to differentiate between infra-	In this stage of maturity, the company may be trying out Hadoop or some other big data technologies as part of the experimentation phase leading to a proof of concept. The installation, configuration, and maintenance are defined, and there is a level of compliance to an enterprise standard, although the class of infrastructure may not be close to production ready or may utilize a basic use case. For example, some companies may stand up a Hadoop cluster or invest in a NoSQL database, but this is likely only supporting one kind of workload to support a single initiative or department.	During the early adoption stage, there may be various kinds of big data technology in place. This might include an appliance or a Hadoop cluster. NoSQL databases might be in place. However, the notion of a unified architecture or ecosystem is not yet widespread, and these technologies are not operationalized. A typical infrastructure is a tier 2 production-class cluster that is installed and maintained in the company's data center or even in the cloud. The installation, configuration, and maintenance are defined per enterprise standard. If a NoSQL database is in place, its use is generally offline and not part of the operational infrastructure. In some companies where cost savings are paramount, Hadoop may be used to take advantage of growing data volumes without expanding the data warehouse. Although this is	In this stage of maturity, the typical company infrastructure is a tier 1 production class cluster that is installed and maintained in the data center, which might include the cloud. A range of technologies might be used, including enterprise NoSQL databases, Hadoop, and appliances or a data warehouse, but the information architecture is unified in a way that underpins the analytics. A Hadoop cluster might include 50 to 100 nodes at this phase (although cluster size is not always tied to maturity). This might also be a commercial distribution because as the company moves out of early adoption, it is actually concerned about managing the clusters. Another sign of operational maturity is that the company can perform multiple workloads on a cluster. The installation, configuration, and maintenance of the infrastructure are defined per enterprise standards. The deployment is driven at an enterprise level in the organization with the	The way you manage complexity is key to big data maturity. The visionary company has deployed a coherent analytics infrastructure that is fully operational and can be used in the mission-critical aspects of the business. Part of the infrastructure includes the ability to integrate new sources of data for analytics, whether they are internal or external to the company. The infrastructure leverages commercial Hadoop and enterprise NoSQL databases and there is security, disaster recovery, backup and recovery, performance management, and proactive infrastructure monitoring in place—even if the public cloud is used. The program is	TDWI (Halper & Krishnan, 2013-2014:p.7-14)

	structure and data, leading to short-lived success in their big data journey.		a valid hybrid approach, it may not be well managed, and the data may not be used yet for meaningful analysis.	complete support of IT teams and line-of-business participation. The infrastructure and architecture of the big data ecosystem comply with backup and recovery or disaster recovery procedures, which are in place. A unified architecture that takes an ecosystem approach is also in place.	treated as mission critical and given the right amount of staffing and skills. Data is shared across the organization.	
Analytics	Analytics has limited to describing what has happened	Analytics is used to inform decision makers why something in the business has happened	Analytical insight is used to predict the likely hood of what will happen to some current business activity	Predictive analytics is used to help optimize an organization's decision making so that the best actions are taken to maximize business value	Analytical insight optimizes business processes and is automated where possible	IBM (Nott, 2015a:p.1)
Analytics	A key piece of the enterprise and its information management standards lies with the infrastructure of the corporation. Big data management requires an in-depth understanding of the new infrastructure to support critical big data components such as data types, data volume, user and data security, access to information, processing requirements, and information storage. The nascent organization often misunderstands the need to differentiate between infrastructure and data, leading to short-lived success in their big data journey.	Typically, the organization has explored some kind of advanced analytics. There may be some groups of individuals, especially at traditional companies, who are adept at predictive modeling or example, but they may be aligned at the department or line-of-business level. These statisticians or business analysts may be part of the overall voice of the organization that sees the need for a big data implementation because they see the value. There may also be some outside organizations helping to set the analytics strategy or involved with performing some kind of advanced analytics.	The organization may be utilizing descriptive or even predictive analytics in its projects. In early adoption, the kind of analytics tools will depend on the problem that the company is trying to solve. Typically, organizations are still using one kind of data, although that may vary among organizations in this phase. For example, some companies in early adoption are utilizing large volumes (i.e., more than 10 TB) of structured data that is stored in an appliance. The company may be running some sort of predictive model on this data. This is an established and production-ready implementation, but it still may be departmental in scope and has not moved on to other forms of data. Alternately, a company (e.g., a publisher) might be mature in managing and utilizing large amounts of content but not strong analytically. Some companies might be utilizing different kinds of data but not in an integrated fashion. For instance, some organizations may be primarily utilizing internal structured data but making use of unstructured social media data in another part of the company. In addition, sometimes one department in a company has a specific use for big data analytics.	Any company might collect a lot of data but not make use of it. It's a sign of maturity when new data coming into the organization can be analyzed quickly and made part of the logical infrastructure. In this stage, analytics supports the organization. Typically, a company at this stage also has a center of excellence (COE) in place that serves different parts of the organization. The COE includes the data science team, which might even train other groups in the use of analytics in different forms. The COE is generally also tasked with evangelizing big data, and its members might also be looking for commonalities in analytic needs to determine what might be reusable in other parts of the company. At this point, analytics might be operationalized as part of a business process. In other words, analytics might be automated or integrated with the business process. An example of this might be using machine-generated data together with other data about customers to determine a next best offer. These companies are typically using new capabilities and not just existing BI infrastructure.	In the visionary company, the mindset is to continually develop analytics. Typically, this kind of company makes use of all kinds of data, including real-time data, and uses this as part of its decision making and incorporates into business processes. The visionary company can connect the dots between new data and existing assets. The business can tap into this to enhance product offerings and bring new products to market. The infrastructure, data, and analytics are completely intertwined. There are COEs in place, and teams are working to deliver new and exciting forms of analytics. Some visionary organizations build an innovation team consisting of business and IT that innovates on the technologies, brings them back to the business, and takes them into production.	TDWI (Halper & Krishnan, 2013-2014:p.7-14)

			This might be the network monitoring department in the case of a wireless carrier. That department might be advanced in using location data as well as other kinds of data for its analysis, but the deployment is isolated to that department.			
Data Management	Information governance is largely manual sufficient to stand up to legal, audit and other regulatory scrutiny.	Understanding of data and its ownership defined and managed in a piecemeal fashion	Policies and procedures are implemented to manage and protect core information through its life in the organization	The degree of confidence in information and resulting insights is reflected in making decisions	Information governance is integrated into all aspects of the business processes	IBM (Nott, 2015a:p.1)

Appendix 4: Proposed maturity framework for Veho

Veho Maturity Assessment	Stage 1	Stage 2 - Current state	Stage 3	Stage 4 - Target state	Stage 5
Strategy and Vision	Data and analytics is discussed but not reflected in business strategy. The organization does not see a reason why and does not recognize what it means to be data driven. No Data and analytics vision exists nor is there leadership sponsorship.	Business strategy recognizes the importance of data and analytics. Progress of data and analytics initiatives is hampered by culture, contradictory incentives, organizational barriers and lack of leadership. Main focus is on technology	The business strategy encourages the use of insight from data within business processes. Strategy definition is shifting from a static, annual process toward more of a dynamic one. High-level sponsor is named.	The business strategy realizes competitive advantage from customer-centric analytics and well managed data. Data is seen as valuable asset. Vision for data and analytics exist for coming years.	Data drives continuous business model innovation. Business strategies high-light this importance. Data is a recognized corporate asset, competitive differentiator, source of transformation, and a product itself.
Organization and people	Data and analytics related responsibilities are resourced based on applications and business people manage their own data. The organization does not have any devoted people handling data and analytics or have a leader to manage it.	IT based data related roles exist and are handling data administrative and modelling related tasks. Business is involved in resolving data related issues but not in development or planning. IT leader is sponsoring data activities. Business leaders are involved but not fully committed.	Data and analytics organization is established. Business unit-based data analyst and data scientists start to emerge. Implementation of data and analytics related projects is difficult due to finding needed resources from business side. Executive level sponsorship exists. POCs are helping to gain more interest and engagement from business.	Data and analytics moves away from IT as a separate unit closer to Business. Data scientists, coordinators and analysts are prevalent part of business. Former data team is turned into a competency center which is doing less but enabling more of what business is doing. CDO is leading and supporting data and analytics initiatives and cultural change.	CDO leads the data and analytics organization that supports the data and analytics lifecycle. Data and analytics initiatives are more business centric and driven. Business executives see data and analytics as an essential part of their operations. Collaboration between centralized team and business functions is part of the culture.
Technology	There is no coherent information architecture. It is not understood how big data masses should be handled.	Data and analytics architecture exists but does not support adding new data sources or advanced analytics. Some experiments are done with cloud-based solutions regarding big data.	Best-practice data and analytics -architecture is defined and applied in certain areas. Various data technologies are in use but may not be well managed or used in analytics.	Information architecture is defined and applied and covers most of the data and analytics needs using structured and unstructured data.	Information architecture fully support all data and analytics initiatives and business strategy related projects and on-going activities.
Analytics	Analytics is used to understand what has happened. Traditional BI and reporting solutions exist for e.g. financial and other regulatory purposes.	Analytics is used to understand why something has happened. Data is mostly still used for reporting purposes. Interest in analytics has grown inside the organization and some outside partners are used to do some experiments even with advanced analytics.	Analytics is used to predict the likelihood of what will happen to some business-related questions. A company might be able to manage large data masses but not able to utilize it through predictive models or other advanced ways.	Predictive analytics is used to optimize decision making to enable optimal actions for better business value. Analytics supporting the organization by integrating it into business processes and automating some decision making and actions.	Analytics is used in optimizing business processes and is automated where possible. All kinds of data is used in integrated way for analytics.
Data Management	Manual information governance for regulatory purposes is done based on few policies. Lack of data definitions and handling quality ad-hoc can be seen as data not being trusted or used. No overall data strategy or plan for lifecycle management.	Understanding of data and establishing ownership is emerging. Some reactive policies for data management have been established but are not monitored. Data owners are assumed, and upstream data quality is performing well enough. No data lifecycle management. End state data architecture such as semantic layer might exist.	A company is aware of data issues and therefore policies and procedures are started to be implemented to manage core data through its lifecycle. Policies are monitored by information stewards with limited authority. MDM programs are started but focus is on subsets of data.	Data governance organization exists. Full set of policies are communicated and enforced, and the governance is prioritized based on business needs. Data quality monitoring is mostly automated and data life cycle management exists.	Data quality monitoring is automated and part of business culture. Data stewards are acting as information advocates focusing on value generation.