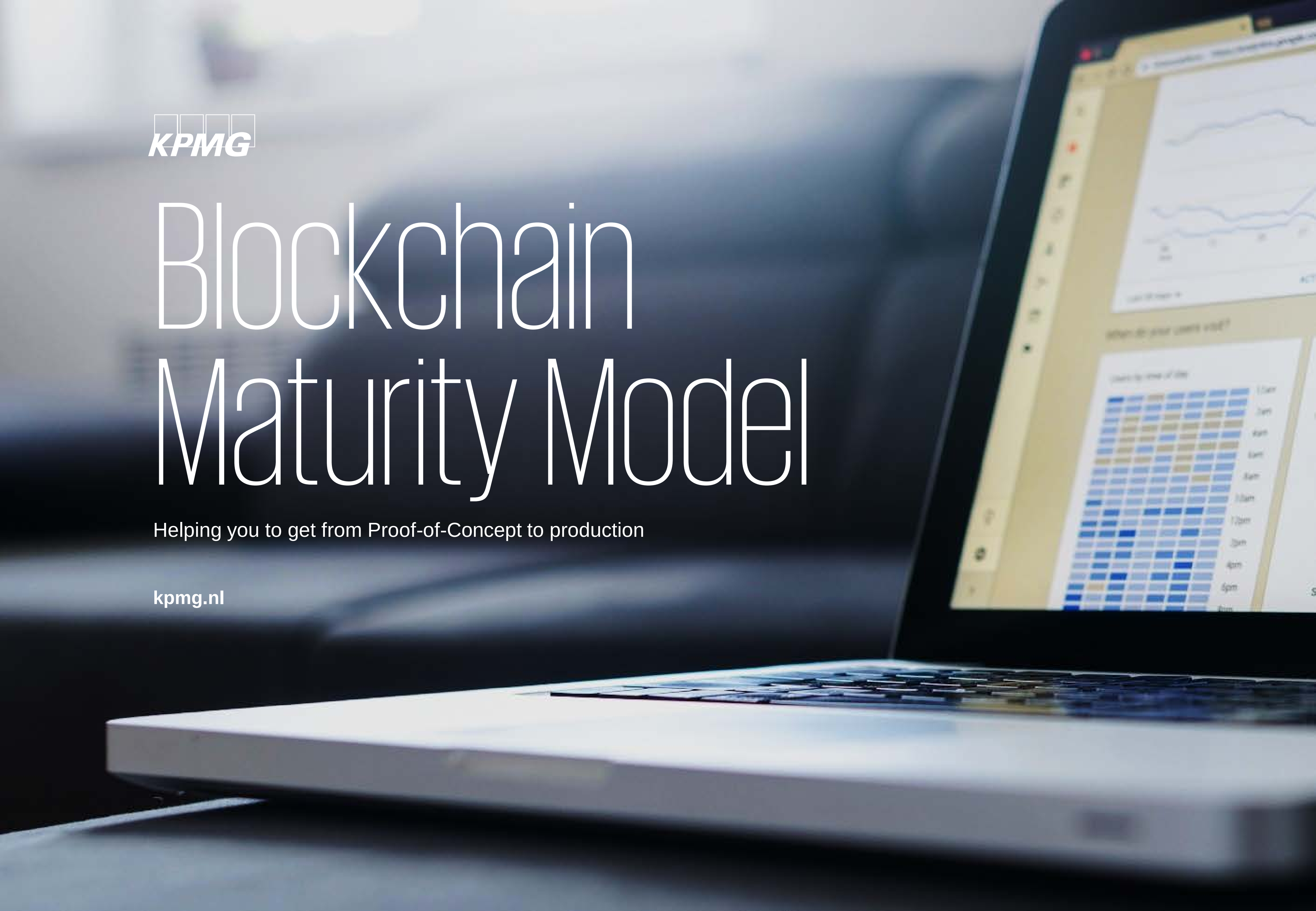
KPMG

Blockchain Maturity Model

Helping you to get from Proof-of-Concept to production

kpmg.nl



What is the blockchain maturity model?

Introduction

— Blockchain or Distributed Ledger Technology (DLT) is seen as a revolutionary new technology that might enable potentially significant cost savings and efficiency gains.

— Blockchain enables multiple parties in a value chain to efficiently work together based on a single source of truth. This facilitates sharing data between multiple parties, transferring value in a digital way and eliminating the need for costly reconciliations.

New risks

— Due to the nature of blockchain, implementing distributed ledger technology also introduces new and specific risks that do not exist in more traditional centralized systems.

— This raises the question whether new blockchain implementations will be sufficiently in control when moving from proof-of-concept phase to production.

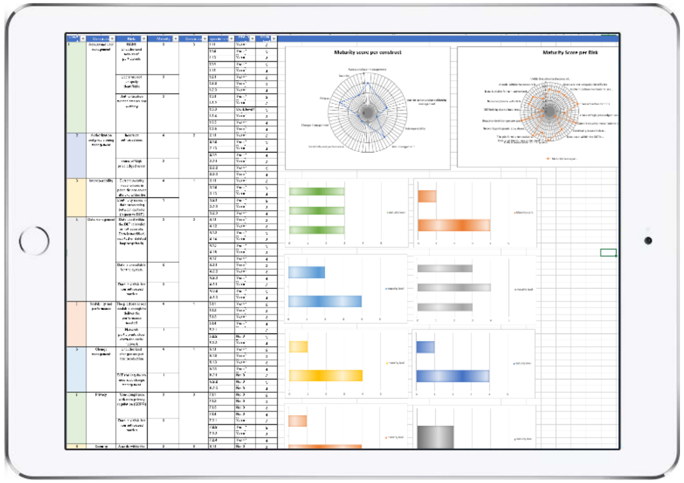
— KPMG has identified eight specific blockchain risk areas including interoperability, security, access management, privacy and scalability.

Quick scan

— KPMG has developed a blockchain maturity model which helps to get a grip on the specific risks associated with blockchain implementations.

— This framework helps you to get an understanding of the IT risk maturity of the blockchain implementation in all eight risk areas.

— The assessment enables you to identify weak points and to spot opportunities for improvement. The overall report provides you with concrete pointers as to how to improve and raise your blockchain maturity level.



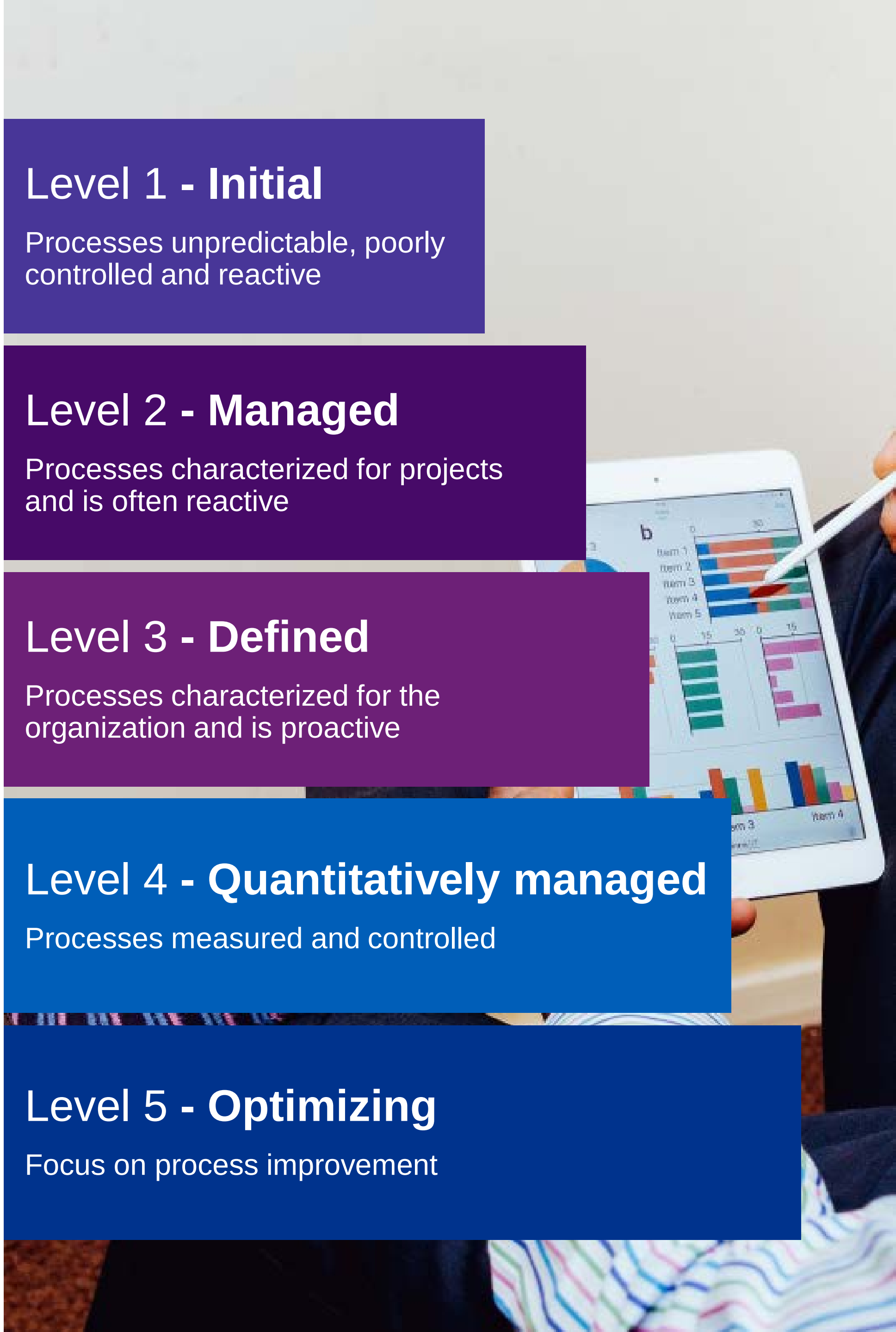
Which levels does the maturity model contain?

Maturity levels

The KPMG Blockchain Maturity model is based upon the Capability Maturity Model (CMMI) for IT maturity. CMMI is a model owned by ISACA, the international professional body for IT governance. The CMMI uses five maturity levels to measure maturity, ranging from 1 (processes unpredictable, poorly controlled; lowest level) to 5 (focus on process improvement; highest level). The scale is further explained in the figure on the right. Based on the CMMI scale you can easily define your ambition level for blockchain maturity.

Scoring

KPMG scores each blockchain risk area against the CMMI maturity model resulting in a maturity score per risk area. This helps you to identify which risk areas are below your desired maturity level. KPMG provides specific recommendations to improve the maturity level and help you get your blockchain Proof-of-Concept to production level from an IT governance perspective.



Level 1 - **Initial**

Processes unpredictable, poorly controlled and reactive

Level 2 - **Managed**

Processes characterized for projects and is often reactive

Level 3 - **Defined**

Processes characterized for the organization and is proactive

Level 4 - **Quantitatively managed**

Processes measured and controlled

Level 5 - **Optimizing**

Focus on process improvement

What are the risk areas of the blockchain maturity model?

1. Access and user management

- Management of cryptographic keys
- Unauthorized access of participants
- Uniquely identifiable users.
- …

2. Authorization and provisioning management

- Segregation of duties
- Incorrect authorizations
- Abuse of high privileged or over authorized users
- …

3. Data management

- Data confidentiality
- Data integrity
- Data availability
- …

4. Interoperability

- Integrating with legacy systems
- Monitoring of interconnections
- Integrating legacy IT and blockchain internal control mechanisms
- …

5. Scalability and performance

- Scalability
- System failure or downtime
- Adding extra nodes
- …

6. Change management

- Agreement by all participants
- Slow adoption
- Forking
- …

7. Privacy

- Append-only data structure
- The ‘right to be forgotten’
- GDPR regulation
- …

8. Security

- The consensus mechanism
- The number of nodes
- Location of nodes
- …

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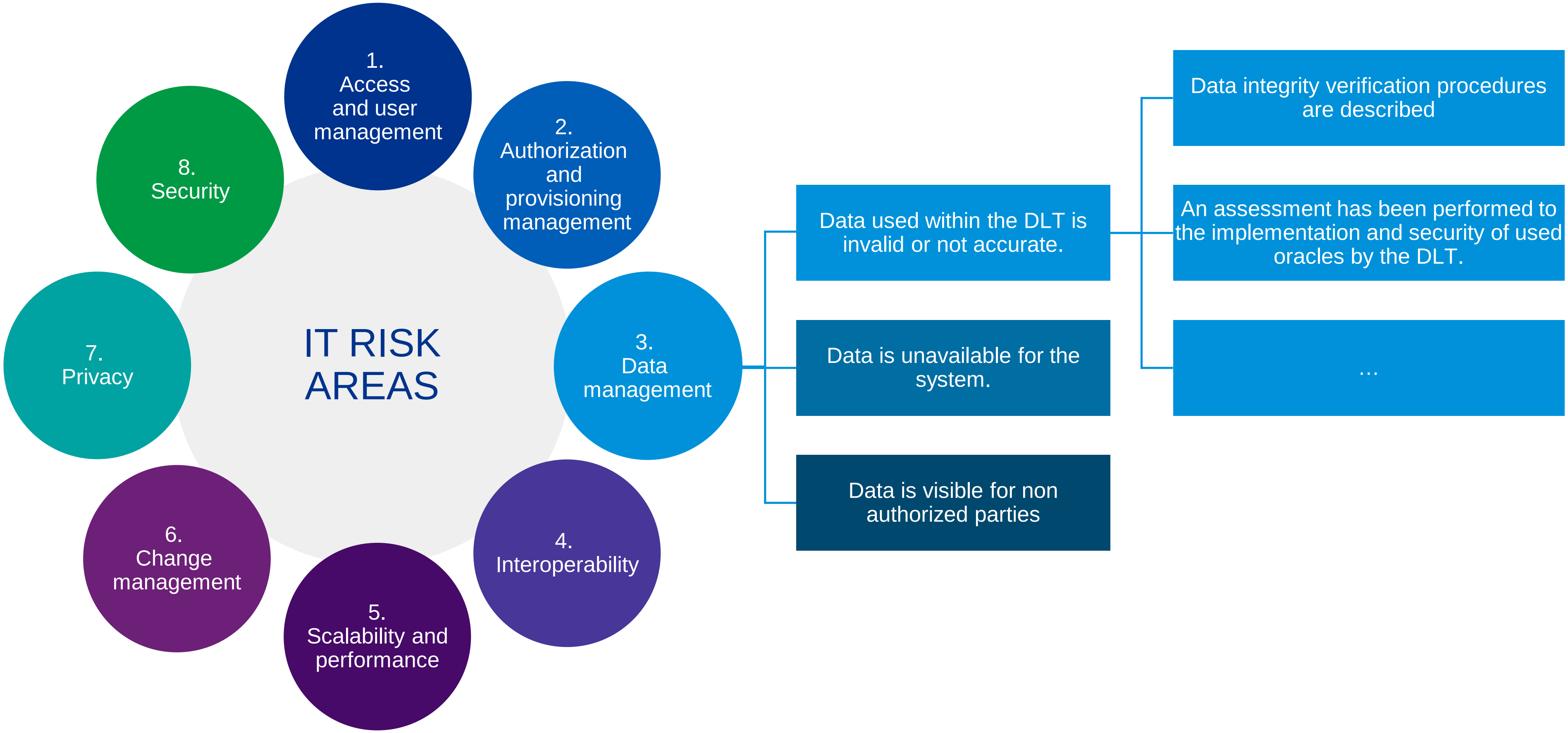
How does the maturity model scoring work?

The model contains blockchain specific risks grouped in eight IT risk areas.

Each of these risk areas contains multiple risks.

For each risk a number of controls have been defined to allow KPMG to assess the maturity on the specific risk.



IT RISK AREAS

1. Access and user management

2. Authorization and provisioning management

3. Data management

4. Interoperability

5. Scalability and performance

6. Change management

7. Privacy

8. Security

Data used within the DLT is invalid or not accurate.

Data is unavailable for the system.

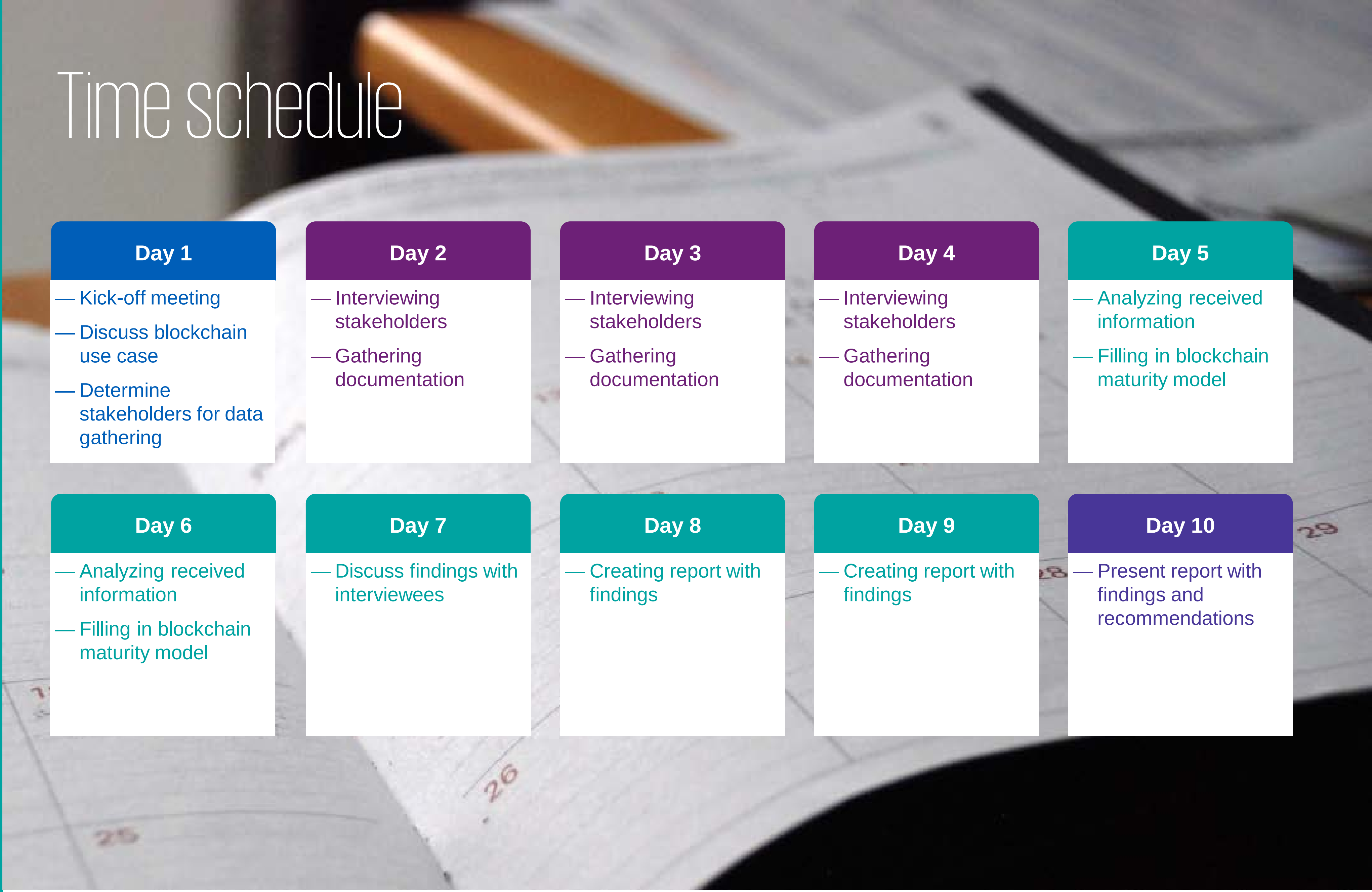
Data is visible for non authorized parties

Data integrity verification procedures are described

An assessment has been performed to the implementation and security of used oracles by the DLT.

…

Time schedule



Day 1

- Kick-off meeting
- Discuss blockchain use case
- Determine stakeholders for data gathering

Day 2

- Interviewing stakeholders
- Gathering documentation

Day 3

- Interviewing stakeholders
- Gathering documentation

Day 4

- Interviewing stakeholders
- Gathering documentation

Day 5

- Analyzing received information
- Filling in blockchain maturity model

Day 6

- Analyzing received information
- Filling in blockchain maturity model

Day 7

- Discuss findings with interviewees

Day 8

- Creating report with findings

Day 9

- Creating report with findings

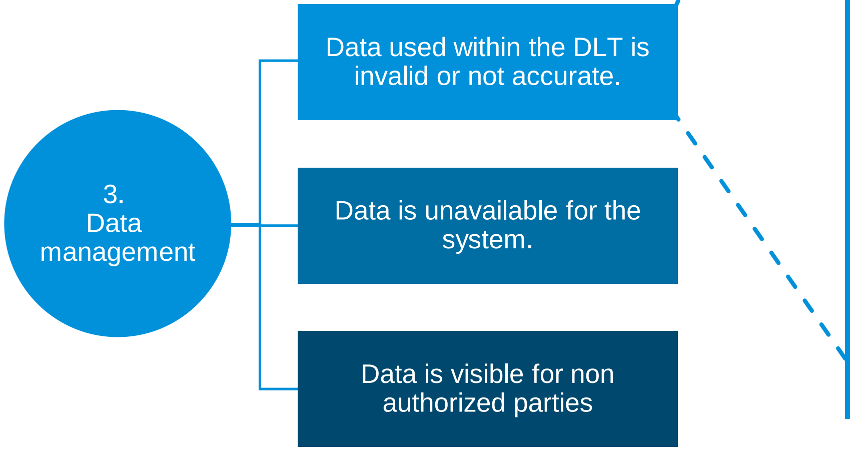
Day 10

- Present report with findings and recommendations

Maturity assessment in detail

Assessment questions

- The full model consists of 8 risk areas, each risk area has several risks and for each risk there is a set of maturity questions.
- To give an example we have taken one risk from the 'Data management' category and the table on the right shows the associated maturity assessment questions.



3. Data management

Data used within the DLT is invalid or not accurate.

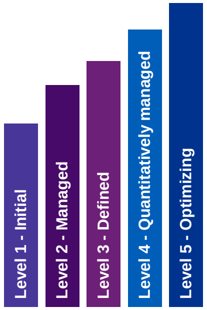
Data is unavailable for the system.

Data is visible for non authorized parties

Construct: Data management				
Risk	ID	Maturity self-assessment questionnaire	Maturity level	Literature
Date used within the DLT is invalid or not accurate. Data is modified, inserted or deleted inappropriately	4.1.1	Integrity verification procedures are described;	If yes: maturity level 2	(Robeco: Jeroen van Oerle & Lemmens, 2016); (Tas ca et al., n.d.) (Morabito, 2017; Trautman, 2016) (Rights, 2017 (Hard y et al., 2008; ISACA, 2017; ITIL, 2013; NIST, 2016; OWASP, 2008))
	4.1.2	History of data in the DLT is immutable.	If yes: maturity level 3	
	4.1.3	Error checking mechanisms are in place to check entered data, such as input validation (completeness checks) to preclude the entering of invalid data, erro detection/data validation to identify errors in data	If yes: maturity level 3	
	4.1.4	Controls are in place, as conditions to be verified before data is updated.	If yes: maturity level 3	
	4.1.5	An assessment has been performed to the implementaton and security of used oracles by the DLT.	If yes: maturity level 3	
	4.1.6	Real world objects tracked in the DLT are on boarded by trusted party.	If yes: maturity level 3	
	4.1.7	A checkpointing system is implemented in the DLT to ensure data availability.	If yes: maturity level 3	
	4.1.8	A monitoring system is in place to verify the data integrity of underlying data sources connected to the DLT.	If yes: maturity level 4	

Blockchain maturity model assessment findings

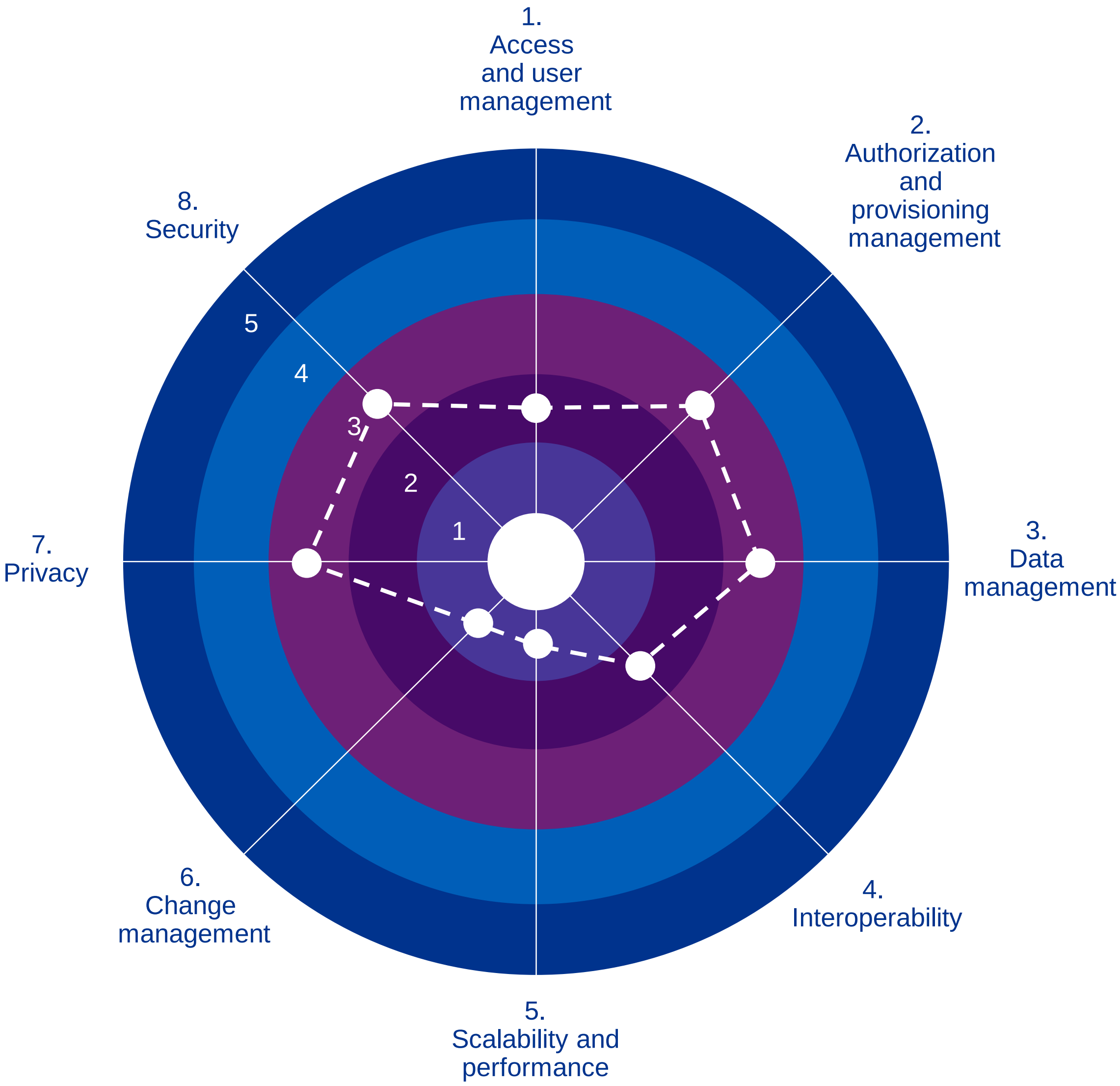
Maturity scores



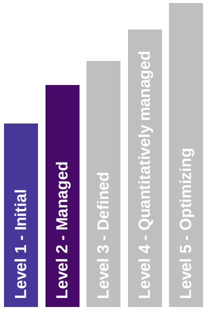
Overall score

— After the assessment has been completed, all the scores for each risk area are visualized in a spider graph.

— Each risk area has obtained an overall score, ranging from level 1 to level 5, depicted in the graph on the right. The scores are elaborated in the details slides.



Access and user management



Score

Level 2 - Managed

Detailed score overview

- This risk area has obtained an overall score of level two as depicted on the right.
- The overall risk area score is always the lowest scoring sub-risk. In this case the lowest sub-risk score was a two, leading to an overall risk area level two score.

MATURITY LEVELS

5

4

3

2

1

Risk: authentication mechanisms are not working

Procedures regarding certificate generation, distribution, storage, use and destruction exist on a technical level. Business procedures are yet to be written. The platform uses standard login methods, however in the first phase the system will use dedicated login system. Due to regulation that differs per country the authentication mechanisms used to interface with the DLT can be different for each participant. Digital certificates can be stored both on a hardware device and in software, however periodic checks to confirm the correct working of certificate storage are not performed. Periodic re-issuing/ revocation of certificates is not implemented.

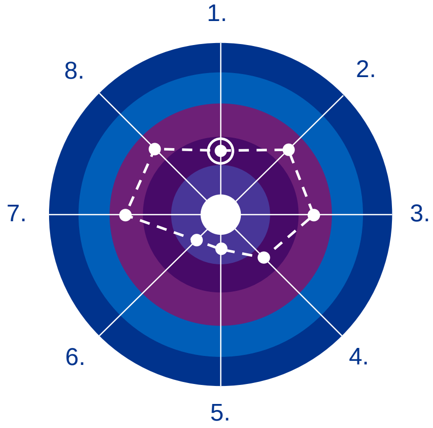
Risk: XYZ

Analysis here

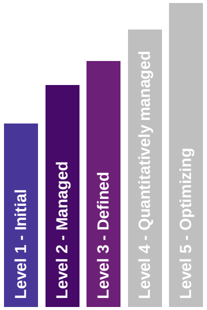
Risk: ABC

Analysis here

MATURITY SCORES

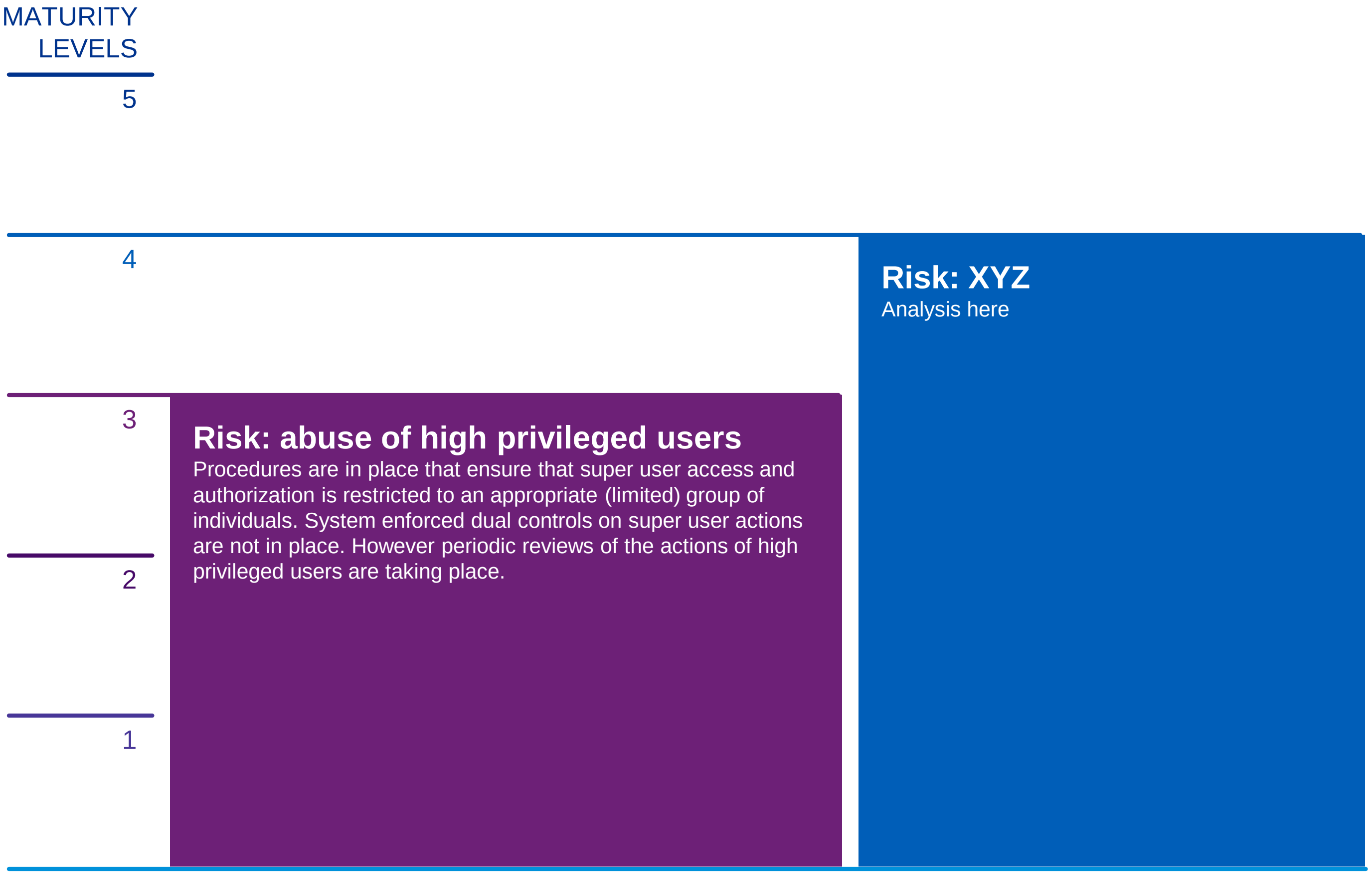


Authorization and provisioning management



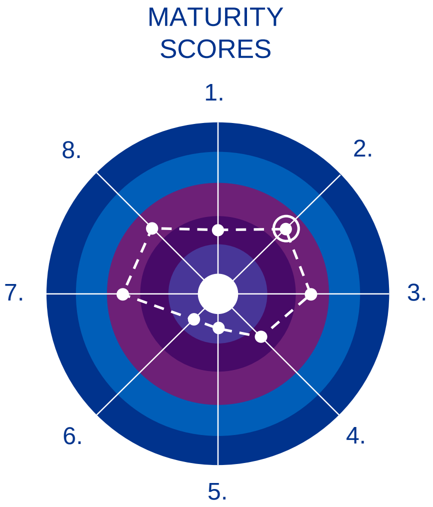
Score

Level 3 - Defined

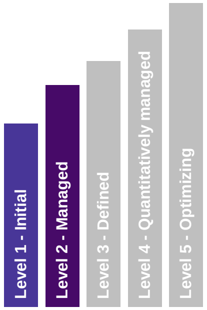


Risk: abuse of high privileged users
Procedures are in place that ensure that super user access and authorization is restricted to an appropriate (limited) group of individuals. System enforced dual controls on super user actions are not in place. However periodic reviews of the actions of high privileged users are taking place.

Risk: XYZ
Analysis here

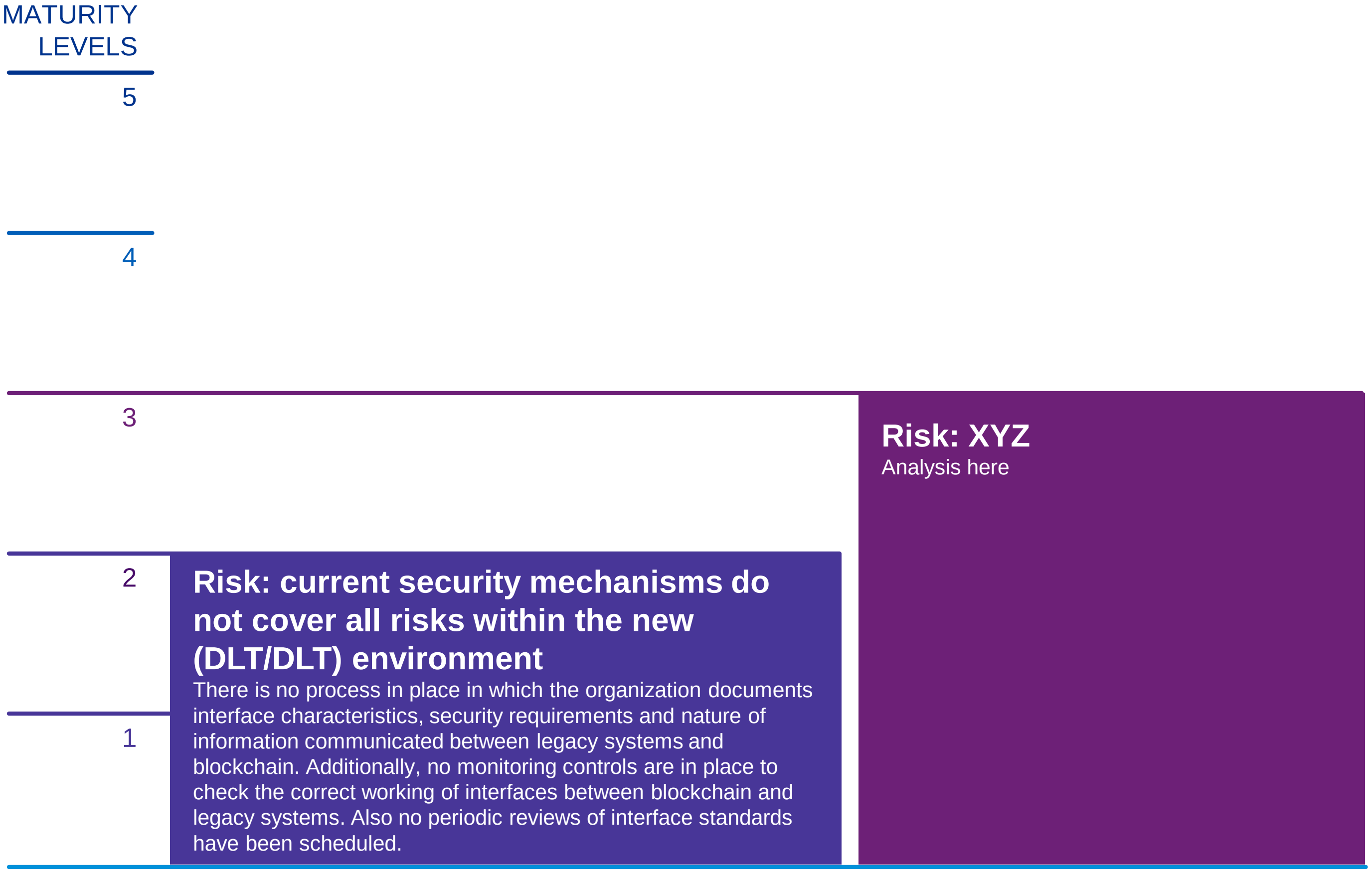


Interoperability



Score

Level 2 - Managed



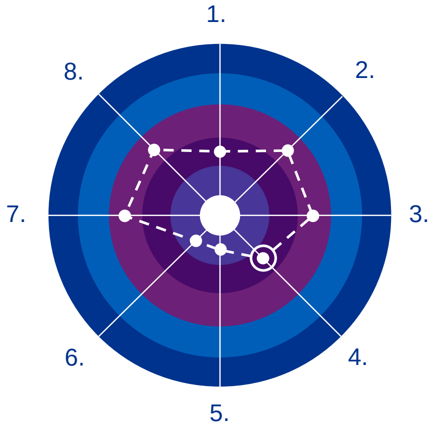
Risk: current security mechanisms do not cover all risks within the new (DLT/DLT) environment

There is no process in place in which the organization documents interface characteristics, security requirements and nature of information communicated between legacy systems and blockchain. Additionally, no monitoring controls are in place to check the correct working of interfaces between blockchain and legacy systems. Also no periodic reviews of interface standards have been scheduled.

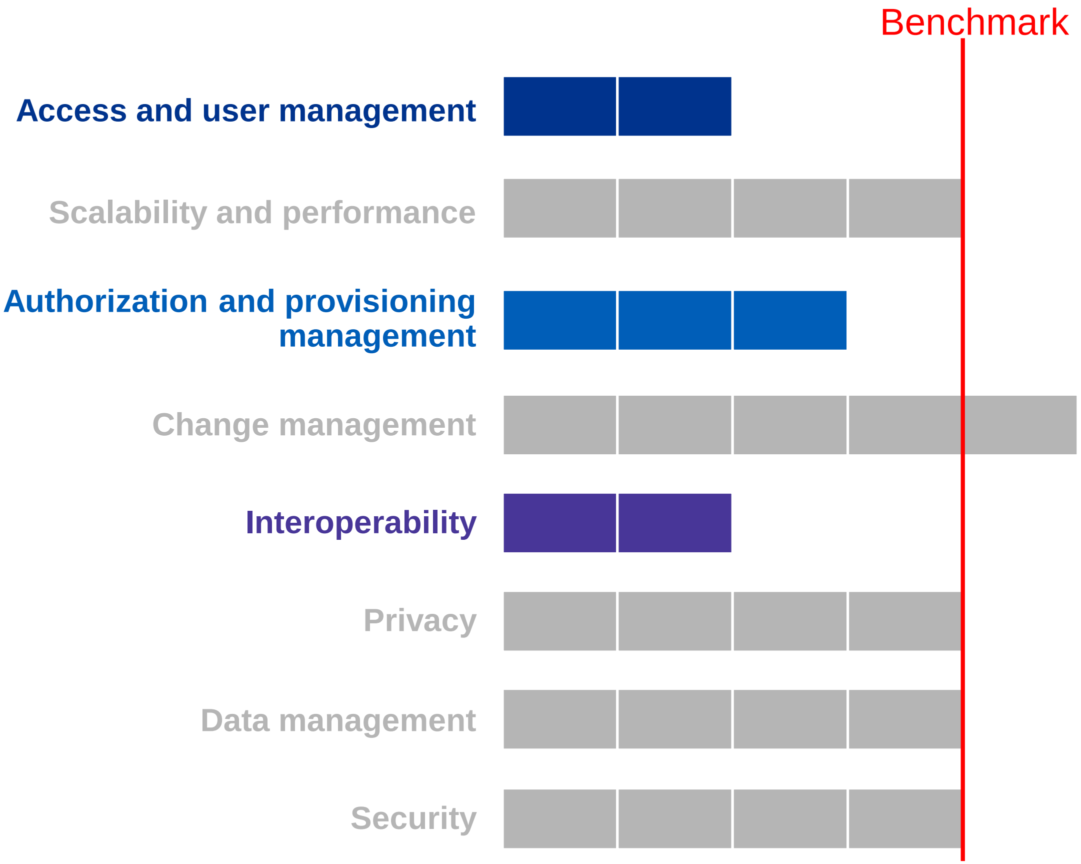
Risk: XYZ

Analysis here

MATURITY SCORES



Blockchain maturity model assessment recommendations



Recommendation Access and user Management
While the preventative controls are implemented, we do see room for improvement on implementing more detective controls such as periodic checks on access rights and associated digital identities. Another suggestion would be to perform monitoring to be able to spot when malicious actors are trying to obtain access to the system.

Recommendation Authorization and provisioning management
While authorizations for regular users are thoroughly managed, the access of high privileged users is inadequately supervised and dual control is lacking. Implementing dual control on super user actions is recommended.

Recommendation Interoperability
It is recommended to implement monitoring on all connections from the blockchain implementation to legacy systems. Additionally it is recommended to perform periodic reviews of interface standards.

The benefits of the maturity model

CLEAR INSIGHT INTO BLOCKCHAIN RISKS

This framework helps you to get an understanding of the IT risk maturity of the DLT implementation from eight risk areas.

FROM PROOF-OF-CONCEPT TO PRODUCTION

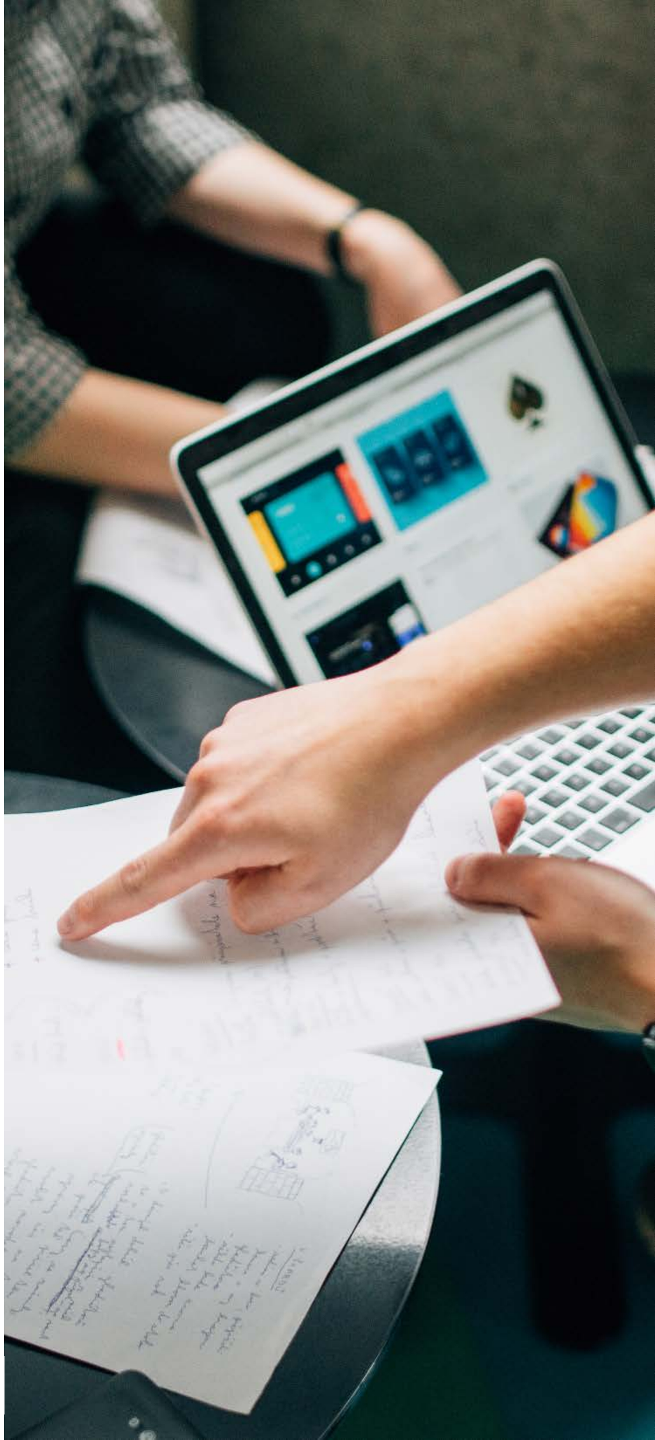
Going from proof-of-concept to a production ready system requires a good view on IT risks. The maturity model identifies weaknesses in your existing blockchain solution.

CONCRETE ACTION PLAN

The assessment gives concrete pointers to risk areas for improvement and concrete recommendations how to improve and raise to the next blockchain maturity level.

UNIQUE AND VALIDATED MODEL

This assessment with its specific blockchain focus is unique in the current market and is based upon solid research, IT risk standards and years of experience and was validated with clients.



Credentials

Blockchain maturity assessment

- Rabobank is a multinational cooperative bank and the second largest financial service provider in the Netherlands, serving over 10 million customers worldwide.
- Rabobank is very active in developing blockchain use cases. They have run many projects on various topics such as: KYC, payments, trade finance and the food value chain. These projects vary from proof-of-concept stage to production-ready systems.
- KPMG assisted Rabobank in their blockchain journey by applying the blockchain maturity model to one of their blockchain projects.

Rabobank

Chris Huls
Teamlead Blockchain
at Rabobank

“The blockchain maturity model enabled us to get a clear grip on our IT risks when investigating a new blockchain solution”

Thank you

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