

From Documents to Model Based Systems Engineering with (the help of) AI

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Semmttech & Arcadis

Semmttech is a consultancy firm specialised in information management & software development. We help our clients share information easily across organisations, departments, and software applications.

Arcadis is a global design, engineering and management consulting company delivering solutions for natural and built assets.

With more than 36,000 people in over 30 countries, we are committed to improving environments around the world.

Exercise: Prepare a Tender

- You are preparing a tender in South Africa to build a new section of road. One of the relevant documents is in front of you
- With markers, extract the most relevant ideas from this (part of a) document (5 minutes)
- Discuss in pairs (5 minutes)

From Documents to MBSE

Agenda

1. Document- versus Model based working: Why and What's the difference?
2. The necessary transition
3. How AI Can Help
4. Stories from the field
5. Open discussion

Model Based System Engineering

Documents versus MBSE: What's the difference?

WHY



Get what the client wants

“By starting with your goals and desired functions, the solution meets your needs exactly. All design can be traced back to the client requirements”



Reduce errors and inconsistencies

“All team members can access all analysed and related information, per asset, in a structured format and in one place as soon as it is available.”



Be in control

Transparent and accurate view in your supply chain. Status of your requirements, design decisions process whenever and wherever you are.”



Reuse and share information and knowledge easily

Reuse and share explicit requirements with all the relevant parties

We get a contract (the box) and we want to deliver (the taj mahal)



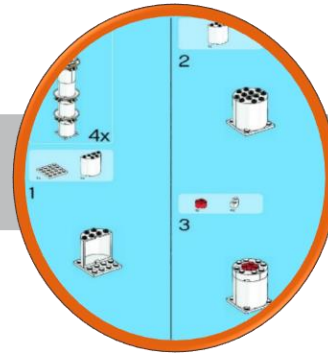
What is the first thing everyone does (and immediately regrets) when opening the box?



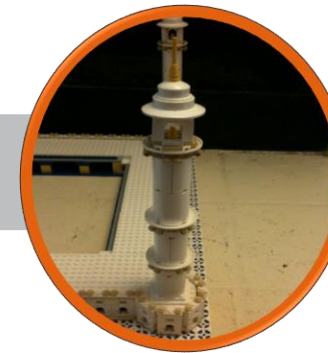
We need a method that helps us achieve the desired result



Sort blocks



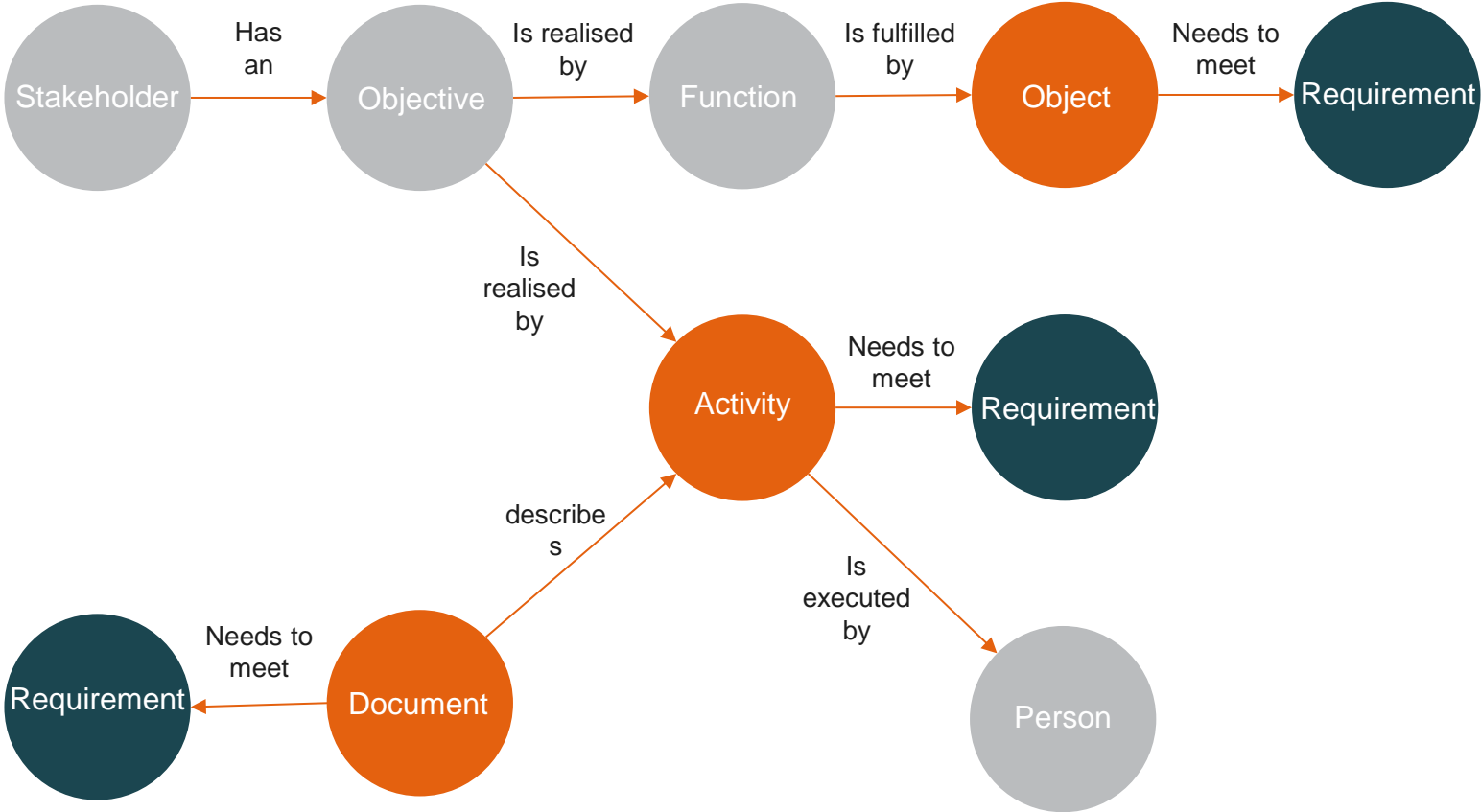
Follow guidelines



Build structures



What does sorted (structured) information look like?



Process model - Information model - Software

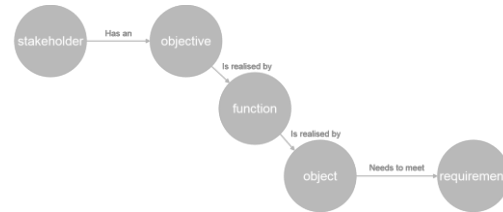
1



Design & project management processes

Based on ISO 15288, e.g., used in IT, aerospace engineering and telecommunications.

2



Future proof semantic model

Prepared for use of Object Type Libraries OTL's, reuse information multiple times.

3



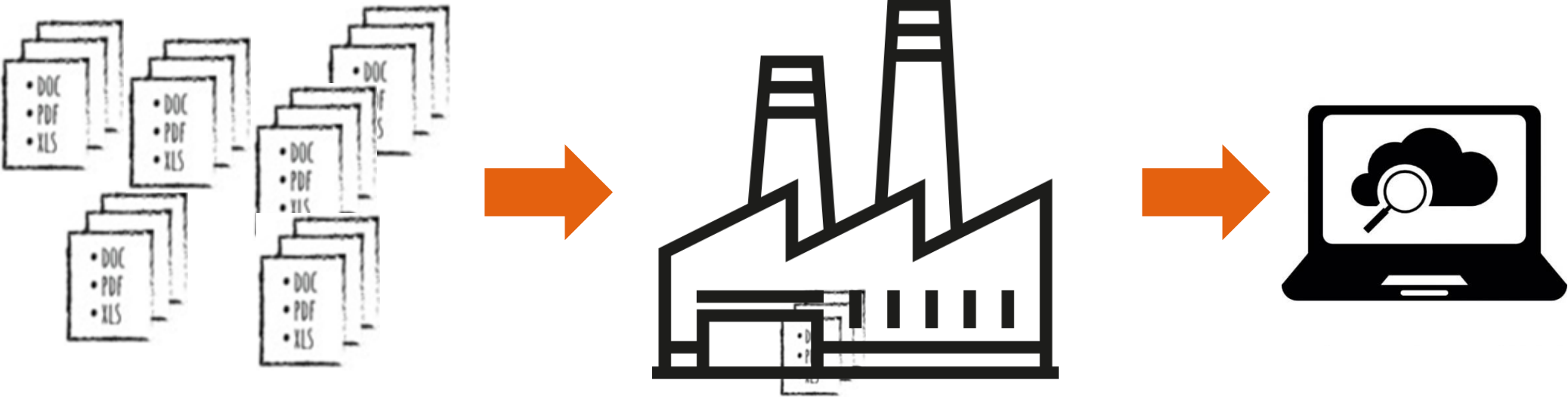
Collaboration through an online platform

Work together with the whole project team, transparent, internationally, simultaneously.

Transition from Documents

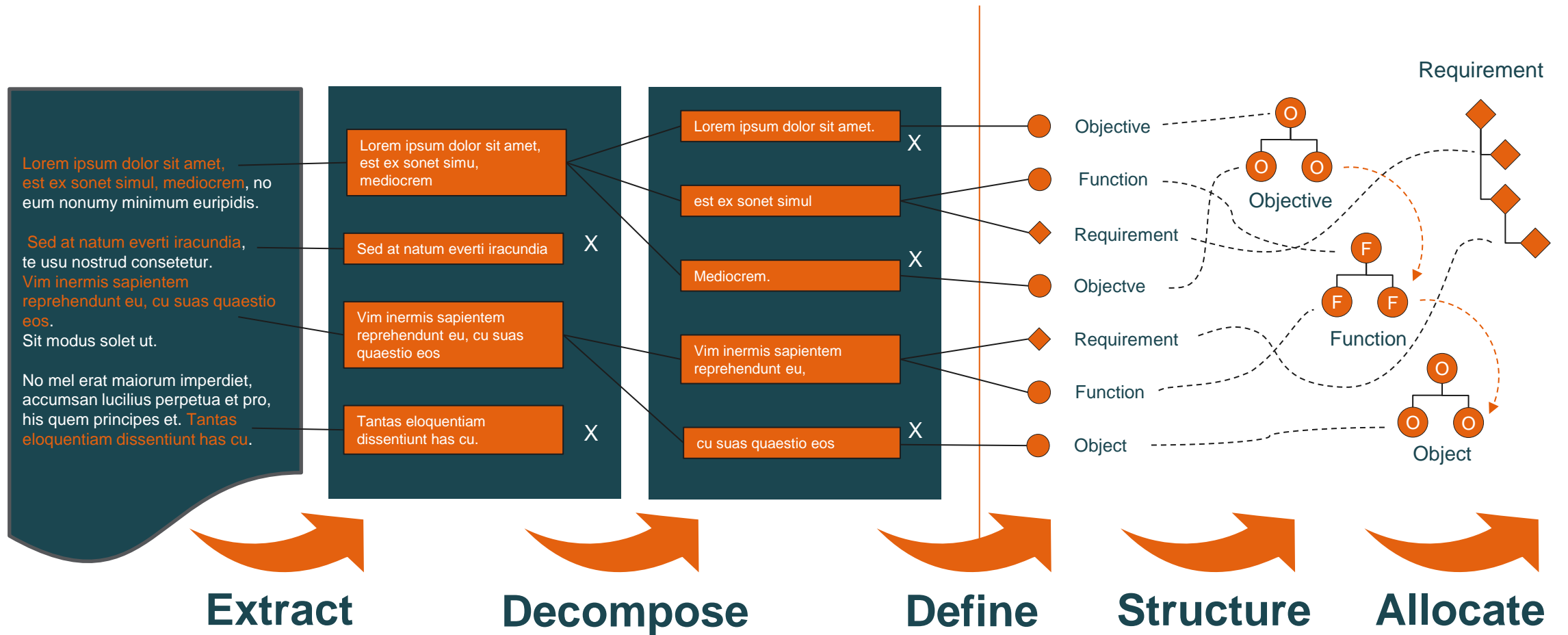
A step-by-step guide

Document Based to Model Based

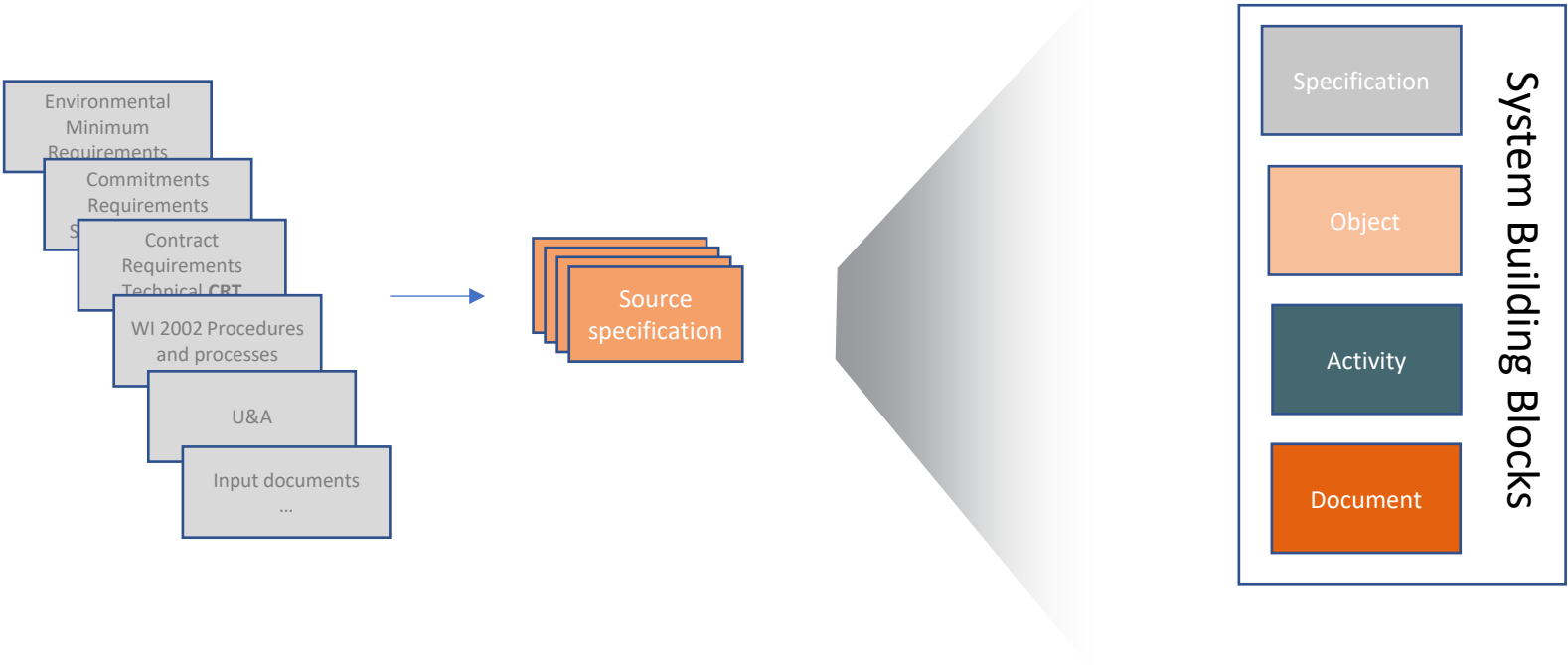


Extraction process

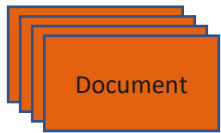
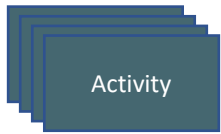
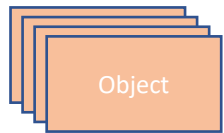
Extraction process



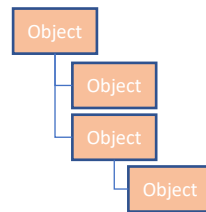
Step 1: Extract contract documents



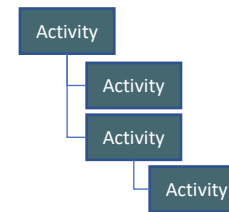
Step 2a: Structure Content



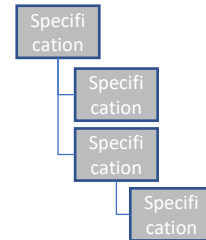
**Object
breakdown structure**



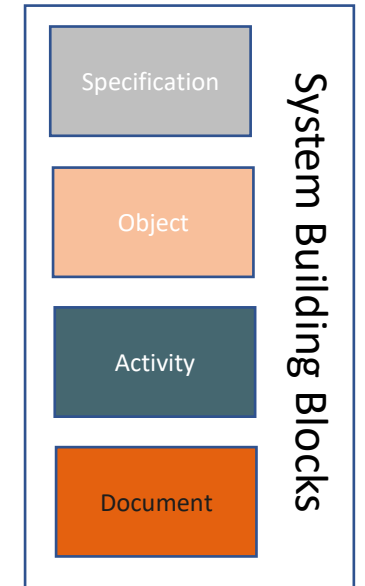
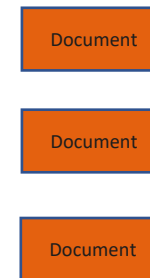
**Activity
breakdown structure**



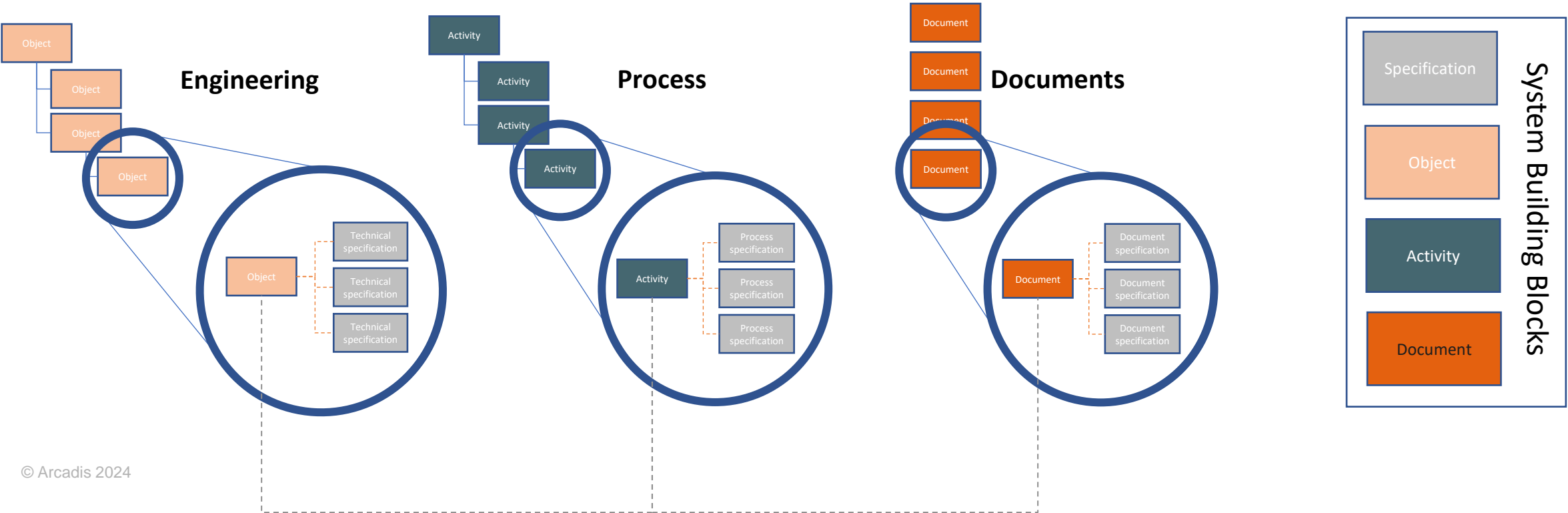
**Requirement
breakdown structure**



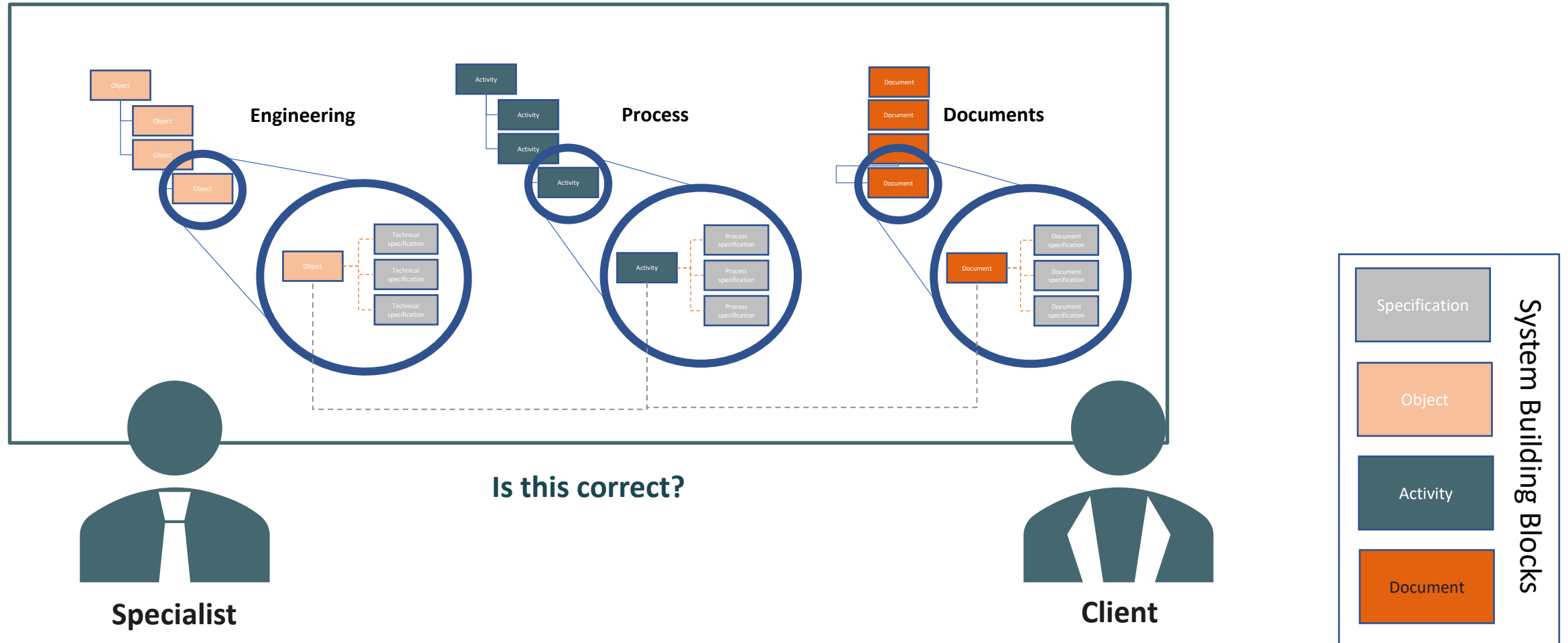
Documents



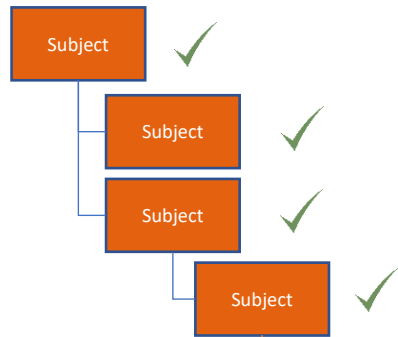
Step 2b: Structure Content



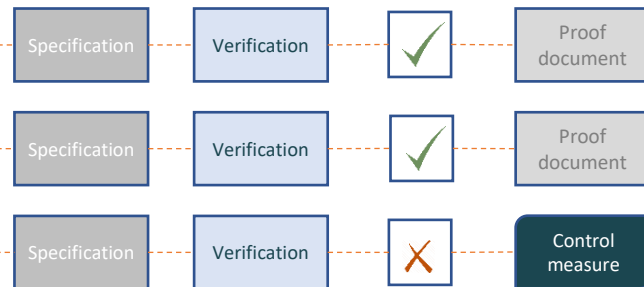
Step 3 & 4: Validate Work package



Step 5: Execute and verify contract

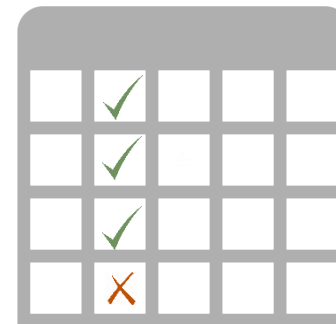


Verification plan



Verification of design

Verification report



Documentation design

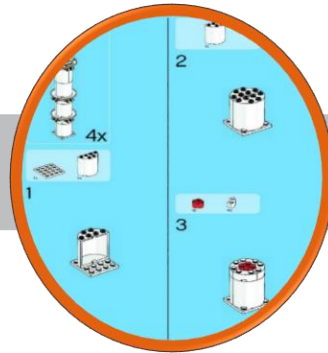
Questions to ask yourself:

- Are the activities executed?
- Are the products delivered?
- Do the activities meet the requirements?
- Do the products meet the requirements?
- Does the design meet the requirements?

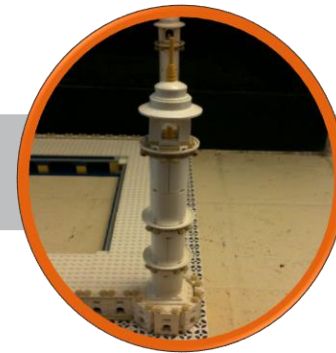
We need a method, that helps us achieve the desired result



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Exercise: Extract information in Laces

Same document, but now we extract specifications in Laces. (10 minutes)

Also, see if you can connect requirements to some subjects.

You should have received an invitation for Laces in your email

Current state

Challenges & needs

The use of data evolves



Data ecosystems are growing: more data and more cooperation.

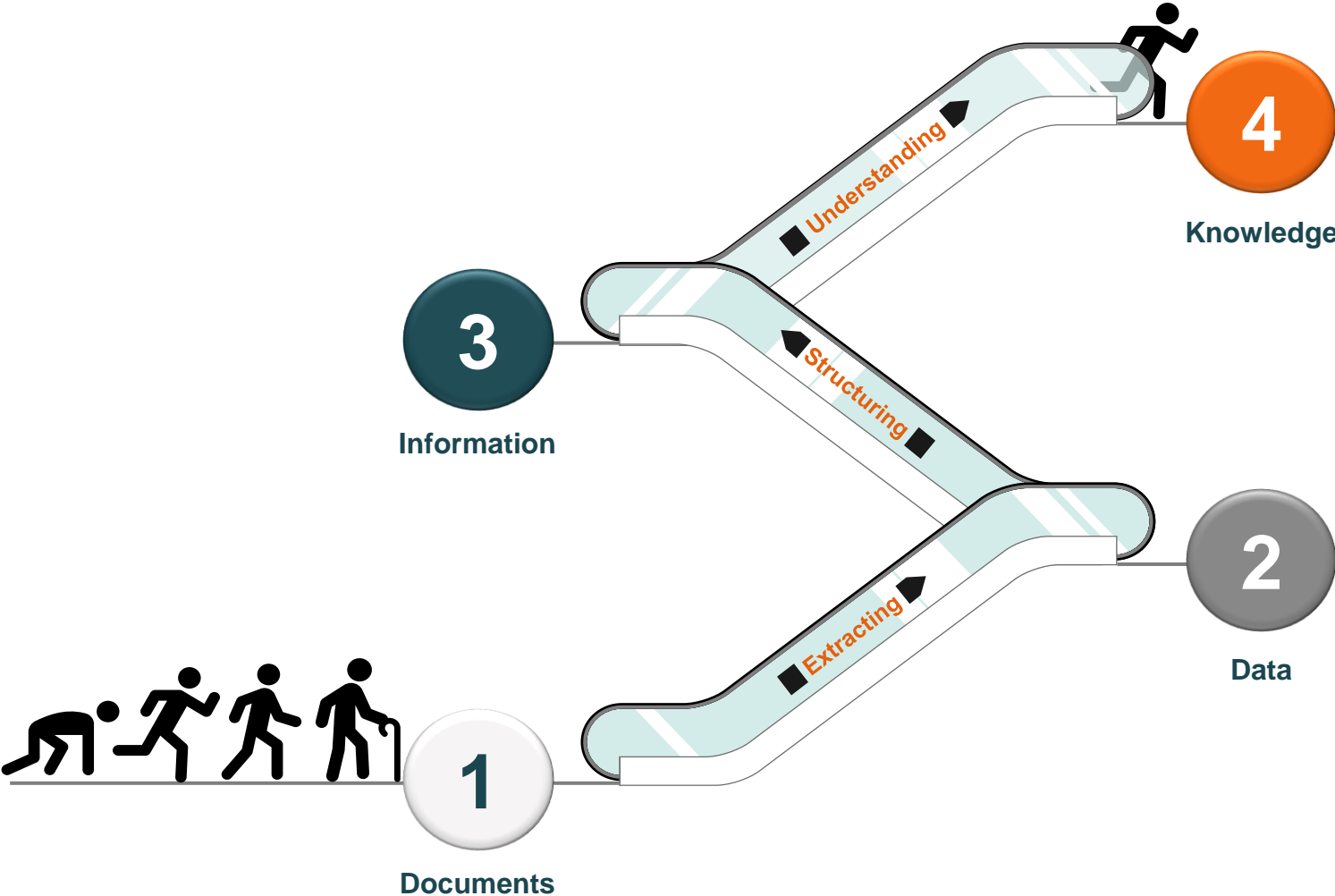


Explosion of data formats, ranging from text documents, to spreadsheets to structured databases.



Growing importance of data. We expect software to adapt faster and with more ease. AI, machine learning, IoT etc.

Staircases to knowledge?



Current state



Manual searching.

Tender managers must manually search through text documents to find relevant requirements time and time again.



Marking and annotating.

If tender managers come across requirements that are relevant to the project, they highlight them within the document.



Manual copying and pasting.

Once all requirements are found in the document, they need to be transferred to software or spreadsheets individually.

42%

unnecessary time is spent by contractors to process requirements from tender documents.

Source: Semmtech Internal Research

But Artificial Intelligence can help

1

AI/NLP-support to speed up processing.

2

AI/NLP-support to avoid human errors.

3

Single overview of all verifications.

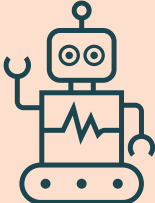
AI: Support the Transition

From documents to MBSE

LAlcy Pipeline

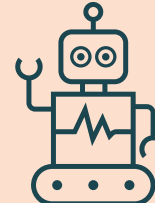
1

Extraction



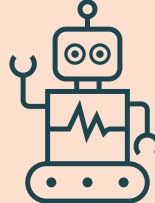
2

Classification



3

Linking



4 Wanneer verlichten (in- en uitschakelen van verlichting)

Met het oog op reductie van kosten, energieverbruik en de daaraan gekoppelde CO2 uitstoot is het van belang de schakeltijden van openbare verlichting kritisch te bezien. Hierdoor wordt openbare verlichting een flexibel systeem dat verkeersdoorstroming en verkeersveiligheid optimaal ondersteunt op het moment dat verlichting gewenst en/of noodzakelijk is.

Onderstaande teksten gaan voornamelijk over de (schakel)tijden waarop de openbare verlichting in- en uitgeschakeld wordt en de wijze waarop dit schakelcommando bepaald en gegeven wordt.

4.1 Wanneer in- en uitschakelen

Het minimale lichtniveau op de weg mag niet onder de ontwerpwaaarde van de openbare verlichting uitkomen. Daarom moet de inschakeling van de openbare verlichting plaatsvinden voordat het minimaal vereiste luminantenniveau van de rijbaan door afnemend daglicht bereikt wordt. Er moet rekening gehouden worden met de opstarttijd van de diverse aanwezige lichtbronnen.

4.2 Wijze van in- en uitschakelen

4.2.1 TF-sigitaal

Tot nu toe worden veel verlichtinginstallaties in- en uitgeschakeld op basis van een op het energienet aanwezig TF-sigitaal. Dit TF-sigitaal wordt steeds minder door het energieleverend bedrijf geleverd.

4.2.2 Astronomische klok

Een ander veel voorkomende manier om verlichting in- en uit te schakelen is het schakelen door middel van een astronomische klok. In deze schakelklok kan op basis van de geografische locatie per dag vastgesteld worden wanneer de 'zon op' en 'zon onder' gaat. Op basis van deze tijden kan de in- en uitschakeling van de verlichting ingesteld worden.

4.2.3 Radiosturing

Minder aanwezig in Nederland maar zeer veel toegepast in het buitenland is het in- en uitschakelen van verlichting op basis van een radiosignaal. Dit radiosignaal wordt verzonden door een radiozender zoals bijvoorbeeld aanwezig in Frankfurt (D). Het is mogelijk om een eigen 'RWS' schakel signaal in te kopen.



How to use AI?

Use State-of-the-art

By using *State-of-the-art* models, you don't re-invent the wheel

Finetune your model

By training State-of-the-art is adjusted to your use case

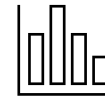
Set a scope

It is better to set a small scope and achieve high precision, than the other way around

Integrate in software

By *integrating* the results in software we keep *a human in the loop*.

AI for requirements



AI = Statistical model



Requirements are very precise



Keep a *human-in-the-loop*, to prevent *hallucination*

Stories from the field

2 example cases

Success example: HDSR Tender



HOOGHEEMRAADSCHAP
DE STICHTSE
RIJNLANDEN

- + **Project:** Hoogheemraadschap de Stichtse Rijnlanden tender: 'framework agreement major maintenance water system works
- + **Ambition:** Save time reading, analyzing, and understanding tender documents by extracting requirements automatically.
- + **Result:** Find important information faster by presenting and using it wherever you want: Laces SPL, Relatics, Excel.

Pilot BDO Oost Tender

- + **Project:** Province South-Holland tender BDO: Daily Management and Maintenance (DBO) of the assets around the road network
- + **Ambition:** Save time reading, analyzing, and understanding tender documents by extracting requirements automatically.
- + **Result:** Find important information faster. Extracting subjects automatically will add value.

Demo

AI in our software

Conclusion

Challenges & needs

Takeaways



Power of **Models**

The usage of models improves the collaboration across the value chain



A **helping hand**

LAlcy eases the transition from documents to model-based working



Human in the Loop

The end-user stays in control of the results

How to capitalize?

The future for you with Artificial Intelligence

Open Discussion

Have you worked with AI, (and how)?

Which tasks would you rather delegate?

How will AI change your work, specifically?



Thank you for your time

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