An Enterprising Use Case for Named Entity Recognition (NER)

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Abstract   Engineering receives ongoing criticism in publications [1], both digital, and from leading enterprise consultancies. To understand the challenges and complexities, we take on the mantle of Engineering with its focus on `New Product Development (NPD)` and implementing an emerging technology that addresses a business use case for Small and Medium-sized Enterprises (SME) micro-organisations. Specifically, we investigate `Named Entity Recognition (NER)` applied to `Customer Journey Mapping (CJM)`, exploring Employment Journey as a design experiment to distil best practices. Our exploration is deeply rooted in `interconnectedness` that thematises the frontier of systems and technology thinking (Forrester, J., cited by Senge, 2016, 2:45) and in the human context, where systems are both a mental model and an artefact. It is crucial to tackle systems thinking, which is at the heart of the issues faced by engineering and subsequently affects other stakeholders. Logically, placing technology under this lens of a use case helps designers spot **implicit issues that impact implementation**. To address this, we turn to Soft Systems Methodology (SSM), a counterpart to Hard Systems thinking (ST). ST resembles a factory line with resources thrown at it. SSM employs a holistic approach, adapting multiple facets from various viewpoints and constraints. Employment Journeys (EJ) are the atomic journey of the industrial age. It helps frame further exploration with reuse and reiteration. This rehearsal helps uncover best practices and implement new technology, accepting that success comes from it being of the zeitgeist.

"Exploring NER Applied to Mapping the Employment Journey With the Premise of Enriching Job-Seeking"

1 Introduction

Engineering practice receives ongoing attention and public criticism in publications.[1] We premise that this deters investment into new product development (NPD) from Small and medium-sized enterprises (SME)[2] and micro organisations. Given the advent of new technology emerging with free or tiered and low-cost access, plus an abundantly skilled workforce, the opportunity lost is conceivably high. To explore the extent to which engineering is culpable, we empirically explore what is involved in developing *successful* systems.

The study explores themes of ideation and risk around the opportunities that arise due to lowered barriers to access from the engineering practice perspectives on applying emerging technology to a business use case. It emphasises value-adding through iterative development and as a learning process. The focus is on exploring `Named Entity Recognition (NER)` in the context of `New Product Development (NPD)` within the `Customer Journey Mapping (CJM)` knowledge domain.[3]

The project takes on the mantle of Engineering and is characterised as a thought experiment analysing complex problems that benefit from proof of concept and prototyping. It addresses issues when working with opportunities perceived as high strategic value. We aim to support a *worldview in which* Engineers fully engage their skills and abilities by thinking in design terms to address and resolve problems. This view has traction,[4][5][6] celebrating a centenary within the engineering zeitgeist.[7]

Why Employment Journey

In essence, this is the *atomic* Journey. Everyone in the industrial age participates in this. It is, for many, not

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[1](Checkland, 2001)

[2]Define SME

[3]Define Customer Journey Mapping (CJM)

[4](no date)

[5](2019)

[6](2024)

[7](2024)

a rite of passage, and while it may feel mandated, we hope it is an objectively motivating journey for everyone. Customer Journey Mapping (CJM) is a staple and appears on the UK Government website.

> 🔥 Systems Thinking: Reusability is Imperative (not Motivation)
>
> Systems Thinking (ST) can be reapplied or adapted to new topics. Businesses in crisis may limit engineering practices by forging rigid chains of command, resulting in actions that contradict the principles of engineering best practices in challenging times of transition. Figure 1 posits a cautionary interpretation of the Agile Manifesto.
>
> We are uncovering better ways of developing
> software by you showing others how you do it.
> Through this critical period we will value:
>
> **Transitioning processes and tools** above individuals and interactions.
> **Handover documentation and walkthroughs** over working on solutions.
> **Contract [compromise agreements]** quelling Customer Collaboration.
> **Legally enforcing transitions** ensuring compliance with owner plans.
>
> That is, sure, there is value in the items on
> the right, we demand the items on the left.
>
> Figure 1: A cautionary interpretation of the Agile Manifesto

Whereas the path we seek to align on is expressed within the Agile Manifesto (worded below).[8]

We are uncovering better ways of developing
software by doing it and helping others do it.
Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on
the right, we value the items on the left more.

Figure 2: The Agile Manifesto[9]

1.1 On Small and Medium Enterprises (SMEs)

A primary motivation for the engineering enquiry is to underline the extent to which access barriers have dropped with the high availability of powerful, low-cost solutions that run on affordable, high-availability platforms. It seeks to address this question for business practices that fit the `[UK] Small and Medium-sized Enterprises (SME) micro-organisations` classification banner.

"SMEs account for 99% of the total number of businesses. Importantly SMEs employed 61% of the private sector workforce which was 16.3 million employees. They also earned 52% of the turnover of UK plc which is equivalent to £2,300 billion." - UK Gov: BEIS ActionPlan: 2022 to 2025.

1.2 Named Entity Recognition (NER).

As a fundamental part of Natural Language Processing (NLP), the primary goal of NER, in a transformational rather than literal sense, is to locate and classify predefined categories of named entities within unstructured text. A named entity is a "real-world object" assigned a category name, like `Person`, `Organisation`, `Location`, `Date` and `Time`, `Language`, `Event`, and `Monetary` or `numeric` value. The NER engine automatically finds and tags objects and concepts it detects in sentences.

1.2.a Why NER is Important.

NER helps transform unstructured text into structured information. It provides utility to users, enabling tasks incorporating information extraction, content categorisation, enhanced search, and customer Feedback Analysis.

By adapting emerging technology like NER, engineering teams tilt the balance in favour of job seekers (and other employment groups). NER can cut through the noise and pick out key points in a job description (JD). When considering multiple job applications, the seeker can use NER to help measure their best fit for their skills. In summary, the proposed use of NER is to help find the proper role for the job seeker. Helping them _find_ the next role, _fit_ their skills and _form_ strategies that align with the demand for their skill.

1.2.b spaCy

Researched sources propose that SpaCy, a popular open-source library for advanced NLP, be implemented in NER. It presents a good fit for its pre-trained statistical models that predict entities in a document. spaCy features a speedy statistical entity recognition system that assigns labels to contiguous spans of tokens. The default trained pipelines can identify various named and numeric entities, including companies, locations, organisations and products. Designers can add arbitrary classes to the entity recognition system and update the model with new examples.

Contrast this with Enterprise-grade NER solutions businesses deploy for CXM or Voice of Customer programmes. Some vendors offer complete ecosystems for Voice of Customer (VoC) and Customer Experience Management (CXM) that embed NER functionality to deliver functionality around the core practice of Cus-

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[8]beck2001
[9]beck2001

tomer Journey Mapping. Gartner Inc. (2023) stipulates that applications must meet three criteria to be classified as VoC: "Firstly, they must enable Data collection from direct, indirect, and inferred feedback. Secondly, they must allow analysis and derive insight from structured and unstructured feedback. Thirdly, they must offer visualisation and analytical techniques."

However, these solutions sit behind a paywall. In contrast, a proliferation of low-entry-cost NER code libraries and other API-based solutions exists as possible solutions for developer teams comfortable owning and maintaining custom scripts. Broadly the solutions can be divided into 3 groups: SAAS or Cloud-based hosted solutions, tiered access API-based solutions, and third software libraries and scripts from the developer community.

2 Methods

2.1 CATWOE. No CATDOG?!

In the broadest sense, any journey to explore *problemation* is done on the basis of understanding the customer (C) perspective, the population who seeks to buy and acquire use of technology, primarily as it benefits them and helps achieve a goal. Engineers' remit is complex, having to contend with the complex interrelatedness, working with resourcing teams employed to transform a resource and the Owners' (O) vision for the product. This environment (E) is fraught with professional risk. This summarises the CATWOE analysis, a framework that arose from the work of Checkland and Smyth (1976).[10]
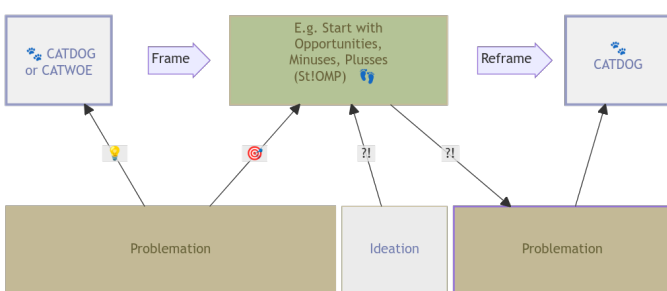

Figure 3: Anchored Thinking Around Worldviews.

This start-point is this anchored view of the world per Figure 3.

2.2 From CATWOE to CATDOG

This paradigm, CATWOE, has withstood time. However, its simplicity remains confusing and invites confusion, so several adaptations and proposals have emerged.[11] We believe it can be adapted or should be to fit circum-

stances. We regard its flexibility as an opportunity; as it is concise, practitioners can reflect on the origins of any adaptation.

2.3 Exploration With CATDOG

Where WOE sounds low, CATDOG has the sounds of energy and warmth, but is there any depth to this other than providing positive psychological uplift? Unlike the former CAT (Customer-Actor-Transformations), the latter is derived, first from the former and then from some personal-professional woes (sic). These concerns stem from observations on the accessibility of `worldviews` and these interrelated struggles to find meaning, fit with purpose and form insights around systems thinking.

2.3.a Customers

The individual(s) who *benefit* from the output. It is also recognised that the transformation output they benefit from may be *negative* for some customers and *positive* for others.[12] For CATDOG, the perspective is on the benefit from the Gestalt (G) viewpoint introduced below. Additionally, we do not allow transformation on the viewpoint, and exclude transformations like," '80%' perceived the workflow as benefitial. We want 90% to perceive it so." These are two system transformations: a system of the 80%, and a system for the 90% (to improve upon the 80%).

2.3.b A is for Actors & Agency

`Actor` specifies who is involved in implementing the transformation proposed.[13] This applies to CATWOE and CATDOG.

> ♡ CATDOG Extends this to Defining Agency
>
> Agency is the ability to initiate and manage the outcomes of actions for which one has communicated responsibility and accepted responsibility for being in charge of one's actions.

Sensitivity to *agency* is separate from *agency*[14]; respectively, a consultant who guides engineering teams versus the project consultant who intervenes to submit a platform change.

Bearing that this perspective is vital for utilisation and workforce optimisation, we can extend the definition to emphasise that this is implicitly a non-deterministic alteration where the agent determines the exact steps to

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[10](cited by Checkland, 2001).
[11]Bergvall-Kåreborn, Mirijamdotter and Basden (2004)

[12]Burge (2015)
[13]('What is CATWOE, and what does it do?', no date)
[14]Agency (psychology), 2024. . Wikipedia.

fulfil the transformation (T), regardless of who owns (O) it.[15]

2.3.c Establishing Perspectives on Job Seeker Agency

A job seeker has sufficient agency to consider perspectives and multiple aspects of a job search. Not all perspectives are equal from their unique viewpoint. However, job seekers have little say and minimal influence and control over the employment outcomes, as they are never the decision-makers. The job and employment decision-making process is owned by someone else (O).[16]

2.3.d Realising Engineering Agency

Similarly, they might spend a lot of time measuring the deterministic aspects of their job-seeking activity.[17] Journeys provide a metaphor ascribing ownership that pairs an agent with their actions. From this vantage, we build narratives around a [strengthened] belief in our abilities (self-efficacy)[18] and the influence of choices, effort, perseverance, and emotional reaction. Consequently, engineering teams can create solutions by applying agency. Realising the service customer's `agency`, [data, analytics, and systems] engineers can freely express `agency` to build narratives around the customer developed, refined and expressed in terms of a `Persona`.

2.3.e Scaffolding: Project Team Agency

In this context, `Personas` support and strengthen project members' self-efficacy through scaffolding. Scaffolding around the abstraction of agency allows teams to design service touchpoints that generate measurable feedback from service users. This helps improve [customer] success and [brand] resilience; meanwhile, these traditional objectives of Customer Journey Mapping (CJM) also empower project team members.

> ♀ The Journey Mapping Construct
>
> Journey mapping helps to frame the endeavour and guide strategic action planning. Crucially, we invite the job-seeker to process emotional information tied to actions and behaviour by supporting their ability to reflect based on noted and, therefore, considered feedback.

We use a diamond to reflect that agency is a superpower in the job-seekers' toolkit. It can be enacted through the cognitive reframing of situations. Feedback is vital as a `sense of agency` is otherwise subjective. If heightened or diminished, it can lead to irrational behaviour or inaction, depression and anxiety per Kaiser *et al.* (2021), who also warns of the higher cognitive demand of too much choice.[19]

2.3.f Transformations

This is the core activity of the system, representing the change that takes place as a reult of participating or interacting with the system. It describes what the system does, transforming input into output. Defining the transformation process is fundamental to understanding the system's purpose. Transformations are often misunderstood in this context so with CATDOG we add some clarity, stipulating that not component of CATDOG is altered by the transformation. C does not become A, D does not transform into a new D, etc. With these systems we are focused on a change of state.

2.3.g Domains (Knowledge and Inheritance)

Domain (of Inheritance, knowledge, or other operational research area). Replacing 'Environment' with a focus on documenting the areas of science or endeavour from which we understand the actions. It can be populist views, peer-reviewed references, or personal beliefs based on a holistic investigation, like self-reflection. For example, the data for the domain might come from observations, surveys, or other techniques like the AEIOU heuristic, which generate observations that change over time.

The Domain captures the broader context of the relationship between Actor and Transformation, enforcing a broader ideology. It sufficiently addresses the 'Worldview' (W) aspect of CATWOE, although it may need frequent revisiting, for example, if the basis of our understanding (model) or data changes.

2.3.h Ownership

This is the individual or group who could instigate or stop the system. They decide that the system is created, changed, or dissolved. Identifying the owner helps to understand who has the power to make decisions about the situation.

For example, Actor A, in this context, engineering, meets Customer C's needs as per the terms of the Owner O. Proximity for A to either may be critical for success. In any process where O is A and C (like this study),

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[15]This is strays from Tayloristic ideals about the 'rabble' workforce and relationship to 'scientific' management.

[16]State-benefit incomes and allowances mandate job-searches.

[17]Monitoring: the volume of applications made by day x, responses received, and job sites used tells us little about landing the right job or the quality of roles we have applied for.

[18](Cherry, 2024)

[19]Kaiser, Buciuman, Gigl, Gentsch and Schütz-Bosbach (2021)

it is critical to be part of the zeitgeist Z. Reflecting on Gestalt G alone will not ensure success. We assert that there must be input from all actors per the principle that agency must be exercised.

2.3.i Introducing Zeitgeist

> **i** Zeitgeist:
>
> A word of German origin (*Zeit* meaning time and *Geist* meaning spirit), is the general intellectual, moral, and cultural climate of an era.[20]

The `zeitgeist` (Z) applies a *framing* anchor for worldviews, as a cursor on shared values. Remember the first tenet, which is that SSM is a tool for the management process. (Figure 5). We find alignment with modern trends in management thinking that promote the management function as a facilitator. Due to this pairing, any practices running counter to the relationship with the `zeitgeist` flags risk.

Zeitgeist offers guardrails to exclude the polarising effects of the owner or external pressure groups. Stakeholders are already covered by analysing Ownership (O). External stakeholders sit within `C-A-T-O` observations, respectively, and their relationship is also expressed within Gestalt (G).

Note: The study emphasises SME micro-organisations; for example, a venture capitalist might relax this rule. They might sit outside the realms of zeitgeist as defined here.

2.3.j Why Extricate Worldview - The Weltanschauung?

Checkland (1989) describes `Weltanschauung` as "the stocks of images in our heads, put there by our origins, upbringing and experience of the world, which we use to make sense of the world and which normally go unquestioned."

It can elicit some visceral responses: first, it raises red flags if we presume to leave bias unchecked. Second, effective ways to achieve better without taking a knee for ideology exist. So, third, why look back if the only action needed is to flush? It is sufficiently clear that individuals will struggle to **find** a productive response.

Additionally, what happens when participant-practitioners cannot access an established worldview? Several factors affect accessibility: cultural, societal bias, and financial barriers to the circles eking out that worldview. This is a gravity problem[21] an immovable circumstance

for job-seekers and career changers. In contrast, worldviews offer a panacea for others, separating the haves from the have-nots in these situations. It is necessary true that `fit` is an issue.

The idea of a universally accepted, communicated `worldview` raises questions. Yes, these exist and serve well as a bias to action that has proven effective in rallying forces. The challenge remains that worldviews stay anchored and remain unchallenged. (E.g. Figure 4). For the Employment Journey, `Finding` and `Fitting` They are essential strategies. We have a third strategy in `Forming`. Where worldviews are invaluable, the Domain of knowledge (D) and domain inheritance are practical viewpoints on `finding` and `fitting`, respectively, in place of the Weltanschauung (W).
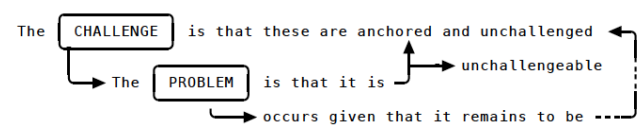

Figure 4: Anchored Thinking Around Worldviews.

> **i** Bias To Action

Notably, the third tenet of SSM Checkland (2000) (Checkland, 2001) emphasises the importance of consciously articulating the process to facilitate understanding and improved outcomes. The second tenet of SSM posits that groups and individuals act autonomously, leading to differing evaluations and actions tailored to unique perspectives. We want to leverage diversity and reframe to capitalise on emerging opportunities.

In the framing context, the concept of 'zeitgeist' is particularly relevant. The accompanying figure Figure 5 illustrates the relationship between zeitgeist (Z) and the first tenet of SSM, highlighting how current societal and cultural dynamics can influence system thinking and decision-making processes.
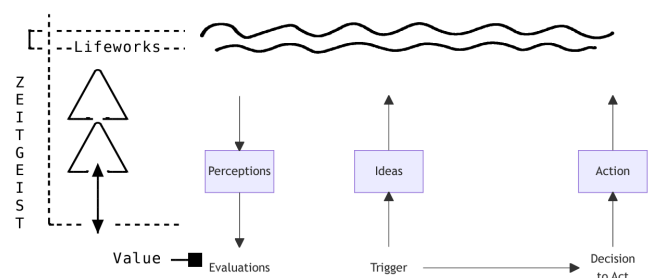

Figure 5: Anchoring Value to the Zeitgeist. (**Source:** A broad concept of 'managing' (Checkland and Casar, 1986) cited in Checkland 1989).

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[20](Definition of ZEITGEIST, 2025)
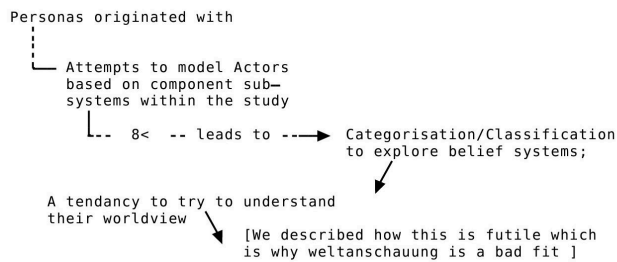
[21](Burnett and Evans, 2016)

```
Personas originated with
  ┆
  └─ Attempts to model Actors
     based on component sub-
     systems within the study
        ├-- 8< -- leads to --→ Categorisation/Classification
                               to explore belief systems;

  A tendency to try to understand
  their worldview
                    ↓ [We described how this is futile which
                       is why weltanschauung is a bad fit ]
```

Figure 6: Anchored Thinking Around Worldviews.

Consider **worldviews** as aspects we ideally respond to well. The idea to use personas to help mask and navigate complexity is borrowed from an existing knowledge domain. Five personas were designed for this exercise: the Jobseeker or `@SEEKER`, `@ENGINEER`, `@PROJECT`, `@PROGRAM`, and `@STAKEHOLDER`.

"A study that sets sail to explore a more traditional Customer Journey Mapping (CJM) with the same focus on New Product Development and Named Entity Recognition (NER) very quickly runs aground. Fortunately, it does so barely out of the harbour."
Figure 7

This narrative says nothing of the chances of success for subsequent journeys. Failures, even early on, have ramifications for the future. We know this empirical evidence through the interactions of the project. Likewise, professional journeys do not just end there, hopefully. However, i*t seems almost fortunate* to be in a position to resume a project after it fails initially. Then again, the adage "LUCK is Labouring Under Controlled Knowledge" applies here. By tracking and measuring journeys, the value is knowing and doing better.

Evidence from this study notes suggests that the risk factors were captured well in earlier iterations as failpoints were identified. This circumstance did occur, and the project experienced the consequences of the risk above. The Figure 8 depicts a fishbone diagram identifying Blockers in the context of Assertions, Context and Deferred items.

Analysing `ABCD`, we expect this general alignment, and so we can enforce quality by establishing tests of correlation (as a stretch goal for future iterations).
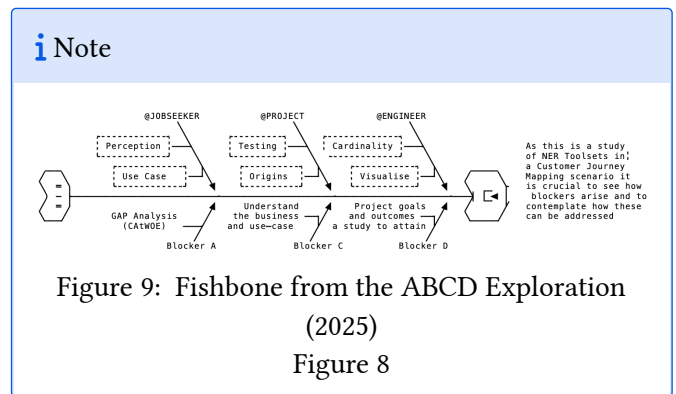
Figure 9: Fishbone from the ABCD Exploration
(2025)
Figure 8

ℹ️ Note: As a stretch goal for future iterations....

However, the probability of *success* does not change because of *what* we do next; this is the sweet spot of Customer Journey Mapping (CJM). We walk away from a *gravity problem* Burnett and Evans (2016) and return when better resourced. **We assume risk based on known principles a priori and walk away a posteriori.** The ability to return indicates that a past attempt accurately captured risk. Doing something twice does not make us more successful, and is expanded upon below.

Consider then our definition of success. CATDOG premises that the target systems do not change any C-A-T-D-O-G dimension. "The system does not make me (succeed)." It can raise the chance of personal or professional success. It can serve to punish (judiciary). Subsequently, systems cannot fail people in the same sense we say, "The *system* failed us!" In this event, CATDOG supports cognitive reframing.

Also, CATDOG trains focus on the *outcomes* of the group's beliefs (in Gestalt) and outer or external constraints (as zeitgeist). Systems exist to support a worldview; are these closed systems with restricted access or closed-looped with open feedback? Journey Mapping leans on the second, asking for feedback, and this feedback is often visible.

CATDOG is an iterative process. It links the '*interconnectedness* of ideation' and the *interconnectedness* of systems *by ideation*. Journey Mapping (JM), we posit, measures the clarity of ideation. JM disregards everything outside the system's periphery and measures a system step in isolation, i.e. excluding other systems in these aspects that call for human attention.

An example of interconnectedness was the `ABCD of Design`, which appeared in 22 documents (notes and project updates). Google's Notebook LM platform helped build a narrative from these. Additionally, the AI built a *near-precise* description of the entire study's key

points with access to just the notes that reference or reflect on ABCD. Audio will be available on the associated website.

2.3.k Doing something twice does not make us any more successful.

We view the rise of AI through the perspective of how database technology became accessible as computing costs decreased, processing power improved, and the gap in training resources narrowed. Small businesses began developing systems in-house, creating new opportunities. Should we anticipate similar developments, considering the high availability and widespread nature of AI, machine learning (ML), and natural language processing (NLP) solutions? If so, why?

2.3.l On Finding, Fitting, and Forming

This heuristic, taken from the context of the employment journey, applies to framing journies. It highlights a problem: these might be 3 distinct steps or stages. Named Entity Recognition (NER) is an excellent fit for the first:

- Finding skill tokens that match our skill set.

- Matching our CV to a job description.

- Improving our search parameters.

NER can help determine the gaps. However, it takes action to fill them and ensure a `Fit`.

Logically, after establishing a match, we might correlate for fit. Similarly, we need a clear picture of our current skills and estimated business needs to `Form` a projection. Data on national and global skills gaps and shortages only relate to Fitting. Consequently, any data on changing course midway is always unreliable. Staying in your lane is the pragmatic approach. So on to building the journey first find, then fit, and last form. Journey mapping should encompass these in turn.

2.3.m The original scoping of the project was complex.

Adopting the ABCD process clarified `near-reach` goals versus `stretch` goals. ABCD also offered insight into interpreting the value of `reproducibility` and `observability` from a design standpoint. **Reproducibility** holds that the past premises hold in the context of the current development cycle.

Key themes and activities within this project include researching and applying NER, exploring journey mapping techniques, developing a business use case, and focusing on concepts like reproducibility, cognitive reframing, tacit knowledge and learning, and systems methodologies like SSM, CATWOE, and CATDOG.

3 Exploration

The @ENGINEERING team identifies three components of the @SEEKER workflow that can benefit from their intervention. *First*, there is a large volume of email subscriptions and automated alerts with relevant jobs. *Second*, a subscription service is used to scrape jobs and track applications, a workflow they will soon replace. *Third*, the system can be automated with application tracking and associated job analytics hosted on a virtual private server.

Here @ENGINEERING proposes an open-sourced solution combining a document server (*Joplin Server*), an on-premises content collaboration platform, *NextCloud* and *RStudio Server*. The first iteration extracts emails from a *Gmail* folder (see Figure 11) and scrapes these for job descriptions. Figure fig-dashboard-1 below depicts a sample dashboard:
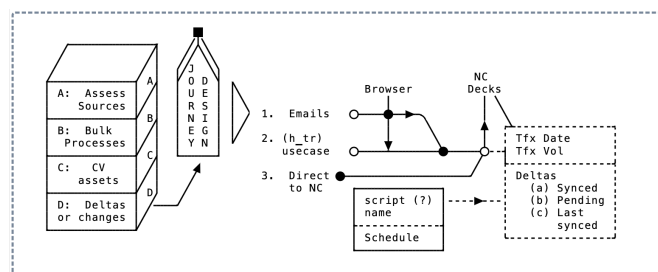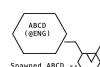

Figure 10: Engineering Perspective on the Job-seekers' Opportunity

They summarised the @SEEKER workflow as: **(A) Assess** Sources, **(B) Batch** Processes, **(C) Communication**, Correspondence & CV, and **(D) Deltas**. Deltas are changes that take time to automate and need manual intervention and frequent checks.

Fundamentally, code-reuse and reusability is at the heart of Engineering. @ENGINEERING expects to repeat the success of applying the ABCD heuristic, applying to their current iteration of the subproject.

The current process picks emails from the @SEEKER Gmail account and tracks these:
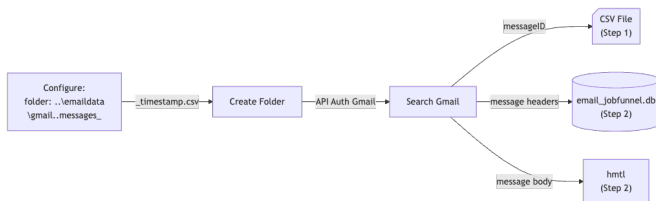

Figure 11: Flowchart of Gmail Sub-process

As this is one of several workflows, it needs to allow less rigid document management. For now, the need is to prototype a flow through experimentation. It should be sufficient to build pipelines and an ETL workflow tracking.

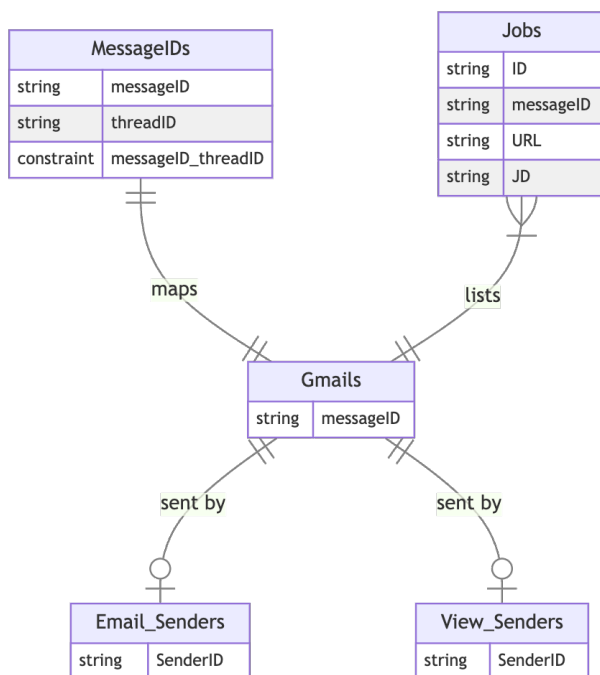The target database configuration for this phase:

Figure 12: Flowchart of Gmail Sub-process

3.1.a spaCy and displaCy

Although spaCy does not ship with `Job Title` or `Skills` referring to the screenshot below, Entity recognition performs exceptionally well at detecting people, organisations, and cardinals. Some of these details are available for this channel in the subject line.

```python
from spacy import display

nlp = spacy.load("en_core_web_sm")
doc = nlp(text_content)
display.render(doc, style="ent", jupyter=True)
```


Figure 13: DisplaCy Visualisation of NER

Meanwhile, the email database alone has 4049 emails; although these are earmarked for analytics, there is a growing backlog of open opportunities. While valuable information and visually aesthetic, the aim is to reduce the effort needed to sort and prioritise. The visuals do not support this goal in themselves.

Note also that although `spaCy` saves the user the complexity of making decisions about the underlying algorithms, it has a lengthy pipeline.
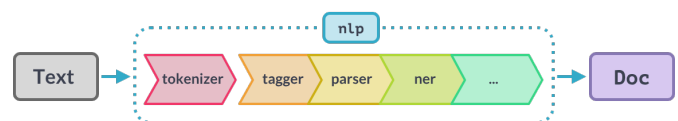
[22]

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[22] 'Trained Models & Pipelines · spaCy Models Documentation'. Trained Models & Pipelines, https://spacy.io/models#design. Accessed 5 May 2025.

3.1.b Notes on The LinkedIn

An ETL script supports the pipeline as a workaround. Testing began with the LinkedIn source, consisting of 1463 messages. LinkedIn is the largest sender and a strategically important source. The subject line for these emails has 3 reliable patterns. These patterns extract either the Job role and Company or the metrics giving the volume of other matched jobs onsite.
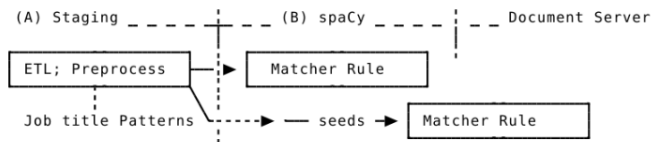

Figure 14: Initially, process emails into a Document Server.

As a result of this ETL, we have 1111 titles. These are fed back into the `spaCy` matcher to allow the tool to identify matches where the pattern was more complicated to identify or match.

While `spaCyr` provides a promising wrapper for Python, enabling its use in `R/RStudio`, but it has not added value for this use case. The setup currently deploys `Jupyter Notebooks`, `RStudio/Server`, `Postgres` (`SQLite` in early stages) database.

The NER processes are summarised below. As spaCy has no `JOB `SKILLS`` detection built in. To be effect the platform needs to be trained. To build some knowledge before puring time into the task, we apply 'protoptyping' in this context the emails are cleaned using SQL (Postgres). There are 3

> 🔥 Caution
>
> Consider the @PERSONAS

3.2 Outline: Exploration Deploying CATDOG

A quick overview of the exploration for this project[23] follows.

> 💡 Tip
>
> Refer to Figure 15, which summarises the exploration, giving context of the activities around project artefacts.
>
> **Important:** The exploration of `CATDOG` in the meta context of modelling is run separately.

Consider the two parts, of the sketch in Figure 15 above the `Transformation` fold, which establishes the Engineering functions relationship to the customer @PROJECT, and the Owner @PROGRAM.
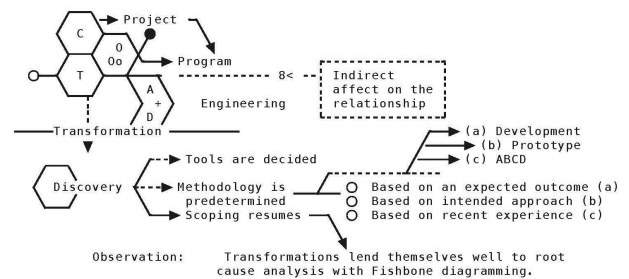

Figure 15: CATDOG Sketch of the Analysis

3.3 Overview: Examining the Exploration Using a CATDOG

Below this fold, observe that a `Discovery` process drives the underlying transformation. We soon establish that the tooling of the transformation is predetermined, with the risk that this creates a dependency or limits idea development. Any subsequent changes in tooling will affect the timelines and quality of the output.

It is imperative to set expectations upfront about the impact of changes. Alternatively, we need to retain the ability to rescope, as the premise was

Additionally, `methodology` was predetermined from earlier exploration and may have `overspill` from ongoing other projects. Overspill refers to *catchall* behavioural phenomena like `inattentive blindness`, which is the human capacity to focus narrowly on stimuli and effectively be blind to other events within the frame.

'CATDOG' can uncover significant risks. For this core discovery exercise, @ENGINEERING works with @PROJECT rather than directly with @PROGRAM. Consequently, a risk that the solutions delivered by this transformation will be over-engineered. The project team must be specific about the nature and timing of deliverables; agile practices may reduce the risk over iterations.

> 💡 Tip
>
> As with any learning activity, this is an ongoing process that engineers will iterate upon over their professional careers. One valuable lesson here is the risk surrounding methodology. The solutions require extra resources or expertise. Hence, there are budgeting and cost management pressures. These are PROJECT costs in this operational model.

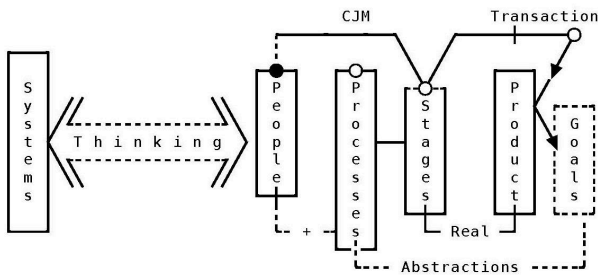[23] Determined through a CATDOG process!

Figure 16: Conceptualised with a CATDOG Analysis.

The study mimics real-world enquiries by presenting a multi-layered investigation into the complex relationships between the components of the problem scenario and the goal-focused client interventions that Engineering teams work on to develop opportunities.

As Figure 16 depicts, we apply systems thinking to the people (e.g., Customers, Actors, Owners), and the underlying transformation processes, and stages. These stages are touchpoints calling for human intervention.

The dashboard depicts the volume of emails processed and observations on the recent batch. See Figure 17.
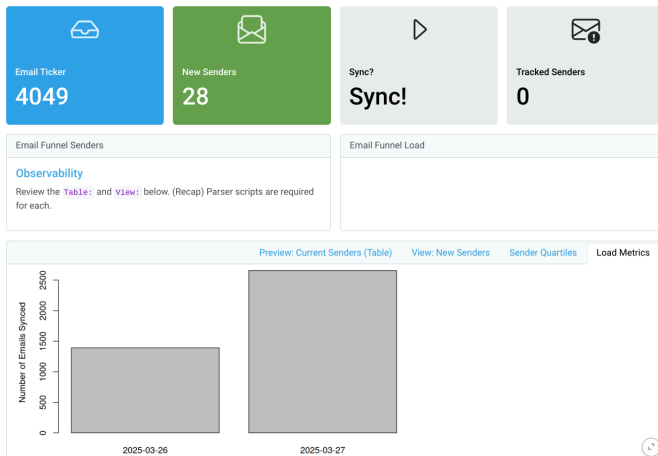

Figure 17: Dashboard With an Indicative Backlog

4 Conclusions

4.1.a CATWOE & CATDOG(Z)

Consider the best practices when applying a framework, like the Soft Systems Methodology (SSM) toolkit. For this study, we look to CATWOE analysis to generate insights into the situation and underlying systems. Before committing to developing any solutions, we hope to work with project team members to agree on the constraints regarding existing systems when building solutions.

However, CATWOE's application can vary from one situation to the next. Teams that interpret the components differently or have different experiences or views grounded in a cultural background will understand its implementation differently. We can expect delayed or stalled projects with stakeholders on separate pages as CATWOE is a general model for purposeful systems.[24] For this study, we abstract CATWOE to CATDOG.

CATDOG we hope reiterates that the best practice is to explicitly define and interpret how any tool supports a practice, establishing agreement on definitions. Project teams can look to shared outcomes, and base this on Domain (knowledge). This 'D' acts for worldview, 'W', as a finite list of topics giving a world view. The idea of Gestalt sits in place of Environmental constraints. This 'G' reflects environmental constraints factored as group goals. We also want to acknowledge the zeitgeist where applicable. This document explores the purpose of these revisions in the study context.
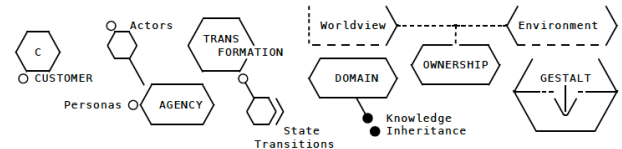

Figure 18: Figure: CATDOG From CATWOE

4.2 Determine an Engineering Focus

Below is a simple model of the challenge overview; please see Figure 19 below. To the left, we plan and focus on **problemation**. To the right, we explore solutions through the lens of **ideation**. We assessed that heuristics and tools like St!OMP and CATDOG are credible and essential for this transformation. Necessary, yes, if not sufficient.

It may just be a limitation of a one-person study. The outcome is that the forms created for CATDOG provide a good way to revisit an idea. External AI tools can help exploration, but the real value can arise from using these as a basis for *plotting* research, informational interviews, and surveying.

The word *transformation* in context is better understood as a journey. This journey maps a priori to a posteriori probability spaces, so it is considered an approach worth building on.

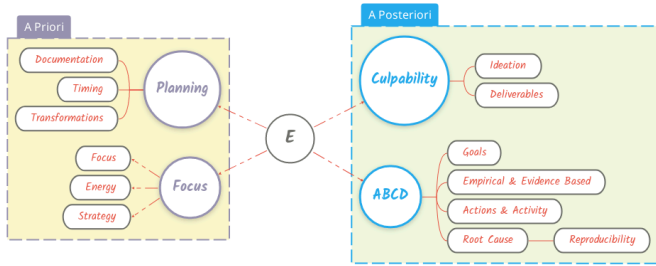[24](S*myth and Checkland, 1976; cited in Checkland, 1989*)

Figure 19: Excerpt from Determining Focus

Although each project may have different *initialising* success factors, it stands to reason that to establish the Engineering focus, we need to understand the risks and opportunities realistically by approaching this through probabilistic means.

In our current invocation of the employment journey, we have formulated three key strategies: Finding, Fitting and Forming.[25] These categories originated through observations made while actively deliberating the @SEEKERs journey. Their genesis is from a conversation with a career coaching expert[26], resulting from *expert* thinking outside my immediate knowledge domain. This idea of genesis extends to any practice in prototyping and proof-of-concept; the goal is to build expertise. Then, applying expert thinking, we have *demonstrative* evidence.

> **i** Engineering on Finding, Fitting, Forming
>
> In this use case, we seek to `find` correlating information about NER, `fit` it in the frame of current thinking, the zeitgeist, and 'form' designs that meet the business capacity and group goals (approximated as Gestalt).

The consequence of this is that the idea has longevity. It suffered many failures. However, in practical terms, we have insights into how to progress with new product development and have better awareness of adjacent opportunities. Each brings value in the form of knowledge of certainty, even if the outlook we determine will be poor. We should celebrate these scrapes as an opportunity to back these up with insights from collected data and evidence.

4.3 ABCDs: Designing Employment Journey Mapping

Where `ABCD` is a placeholder and also identifies as a *metaphor* for the *ideation* process. It proved successful

and has scope for being extended. Reflecting on `ABCD` we have four aspects (spelling **GEAR**, to aid recall):

Goal setting,

Empiricism of research (or Evidence-based),

Action planning,

Root cause analysis.

GEAR - Areas of Transformation.

The transformation for ideation involves grouping a design into focus areas around action points based on research and learning. These four transformations occur through workflows, serving as *sufficient* and *necessary* goals for mapping exercises.

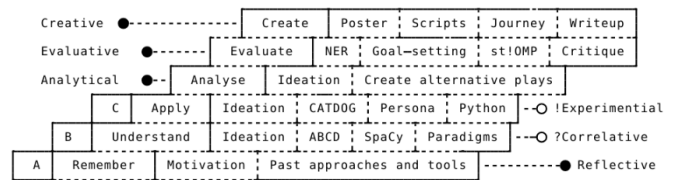ABCD also maps well with and correlates to Bloom's Taxonomy in the context of its use here:

Figure 20: Blooms Taxonomy and ABCDs of Design

> ⬡ **Stretch goal:** This outlook can be extended to make inferences on Employee journey mapping, and reminiscent of the US Fedral Goals-Engagement-Accountability Results (GEAR) framework.

For example, the templates built for CATDOG analysis Figure 21 reside in a Joplin document server. This allows exploration; the form can be filled out as a think-aloud exercise, capturing the essence of the problem. Some additional research is warranted on the nature of transformations as state changes versus fixed steps. The document has been edited to gather more data.
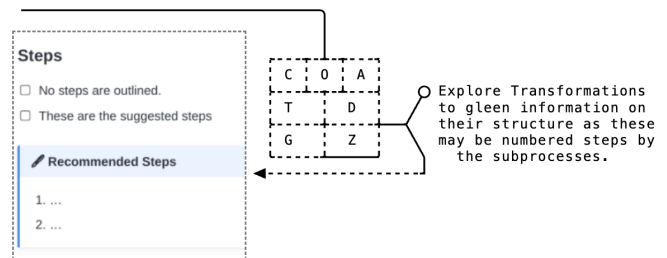

Figure 21: Templating CATDOG - Guided Think Aloud and Vocalisation

4.4 A Note on Systems Modelling

> **ℹ An Existential View of Systems**
>
> We present systems as box-like within a finite physical space. The box scales up as a room with people producing items and processes. The room has hinged windows that, when opened, reveal a static picture of the world. That static picture, in a business sense, is the customer abstraction; in the engineering sense, this abstraction is a persona. This abstraction may be a large language model for machine learning.

Whether a systems intervention is **Hard** or **Soft**, systems coexist outside the imagination. Although engineers mould `design-decisions` around abstraction layers, they still have a tangible impact regarding people-process resources (financial cost) and product-service transformations (opportunity cost). There is an interconnectedness between systems. Senge (2016)

4.4.a Every `transformation or journey` step acknowledges a real-world impact.

Systems design choices have a real impact. Tools like `CATDOG` analysis offer a route to understand, reframe and resume. In the context of an Employment journey, `finding`, `fitting` and `forming` respectively. It helps uncover *why* we participate and where (as `Customer`, `Owner`, `Actor-agent` and combinations) and *how*. Consider the Gestalt; there may be several approaches. Acting on anchored beliefs in the context of our *agency*, and differentiating these from gravity problems.

Systems often present areas for professional learning and achievement, as an aspect of group endeavour. Systems enable a state transition or change within which their underlying transformation occurs. (In soft systems, transformations consider `human interventions`). We stress that `CATDOG` explicitly excludes a transformation on any system's parts. The system transforms neither Customer, Agency, Domain, Owner, nor Gestalt. No assumptions are made about the zeitgeist as this is intangible and without scope.

We conclude that *system change from within* **(Senge, P.,2023), and motivation and successes are contextual to the zeitgeist.**

Customer (C) changes arise from the perceived accessibility of new technology. Actor (A) changes are indirectly affected by many factors, including breakthrough technologies like the pervasive impact of Artificial Intelligence (AI), causing organisational drifts in staffing and governance, and focusing on delivering tangible value beyond the hype. (Gemini, 2025) Transformation

(T) changes occur within resourcing. Domain of knowledge (D) can pull at a business's marketing mix (Product, Platforms, People, Place, Pricing) choice. Ownership changes will affect decisions around resourcing levels. Gestalt suggests that the future success of a system relies on past performance.

4.4.b Thoughts on SSM

Consider each of the 5 tenets of SSM that Checkland (2001) describes:

1. SSM is a process of management and process management.
2. SSM assumes that individuals and groups are autonomous, leading to different evaluations and actions.
3. Consciously articulating the process will be helpful.
4. Any logically linked set of activities constitutes a whole human activity system.
5. SSM learns by comparing pure models of purposeful activity with perceptions of what is going on in a real-world scenario.

This suggests an element of riding storms rather than riding them out. From the engineering perspective to the business, and all seekers alike.

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5 References

AEIOU Observation Framework (no date) Open Practice Library. Available at: https://openpracticelibrary.com/practice/aeiou-observation-framework/ (Accessed: 26 October 2024).

Beck, K., et al. (2001) The Agile Manifesto. Agile Alliance. http://agilemanifesto.org/

"BEIS small and medium enterprises (SMEs) action plan: 2022 to 2025 (accessible webpage)" (2023) GOV.UK. https://www.gov.uk/government/publications/beis-small-and-medium-enterprises-sme-action-plan-2022-to-2025/beis-small-and-medium-enterprises-smes-action-plan-2022-to-2025-accessible-webpage.

Burge, S. (2015) "An overview of the soft systems methodology," System Thinking: Approaches and Methodologies, p. 114.

Burnett, B. and Evans, D. (2016) *Designing Your Life: How to Build a Well-Lived, Joyful Life*. Knopf.

Checkland, P. (2001) 'Soft systems methodology.', Encyclopedia of Operations Research & Management Science, pp. 766–770.

Checkland, P. and Scholes, J., 1999. Soft systems methodology in action. John Wiley & Sons.

Checkland, P. B. (1989). Soft Systems Methodology*. Human Systems Management, 8(4), 273-289. https://doi.org/10.3233/HSM-1989-8405 (Original work published 1989)

Cherry, K., 2024. How Self Efficacy Helps You Achieve Your Goals [WWW Document]. Verywell Mind. URL https://www.verywellmind.com/what-is-self-efficacy-2795954 (accessed 4.13.25).

deBono, E., 1994. PMI lesson plan [WWW Document]. deBono. URL https://www.debono.com/de-bono-thinking-lessons-1/1.-pmi-lesson-plan (accessed 4.14.25).

deBono, E., Teaching Creative Thinking 4 [WWW Document], n.d. deBono URL https://www.debono.com/teaching-creative-thinking-2 (accessed 4.29.25).

deBono, E., Teaching Creative Thinking 4 [WWW Document], n.d. deBono URL https://www.debono.com/teaching-creative-thinking-4 (accessed 4.16.25).

Definition of ZEITGEIST (2025) *Merriam-Webster*. Available at: https://www.merriam-webster.com/dictionary/zeitgeist (Accessed: 15 April 2025).

Ferriss, T., Why you should define your fears instead of your goals, 2017. , TEDx Vancouver. TED.

Harvey, J.B., 1988. The Abilene paradox: The management of agreement. Organizational Dynamics 17, 17–43.

Kaiser, J., Buciuman, M., Gigl, S., Gentsch, A. and Schütz-Bosbach, S. (2021) "The Interplay Between Affective Processing and Sense of Agency During Action Regulation: A Review," Frontiers in Psychology, 12, p. 716220. Available at: https://doi.org/10.3389/fpsyg.2021.716220.

Mack, A. (2003). Inattentional Blindness: Looking Without Seeing. Current Directions in Psychological Science, 12(5), 180-184. https://doi.org/10.1111/1467-8721.01256 (Original work published 2003)

Mair, V., 2009. Crisis Does NOT Equal Danger Plus Opportunity [WWW Document]. URL https://pinyin.info/chinese/crisis.html (accessed 4.16.25).

Order of the Engineer, 2019. URL https://order-of-the-engineer.org/ (accessed 4.16.25).

Senge, P. (2016) "Systems thinking in a digital world." Available at: https://www.youtube.com/watch?v=Zs3ML5ZJ_QY.

'What is CATWOE, and what does it do?' (no date) FutureLearn. Available at: https://www.futurelearn.com/info/blog (Accessed: 21 April 2025).

What is LinkedIn and how can I use it? (no date) LinkedIn Help. Available at: https://www.linkedin.com/help/linkedin/answer/a548441/what-is-linkedin-and-how-can-i-use-itlang=en (Accessed: 26 April 2025).

Wikipedia Contributors (2025). Agency (psychology). Wikipedia.

Wrigley, T. (2020) 'Answer to "Definition of"agent"?"', Philosophy StackExchange.

The Calling of an Engineer, 2024. The Calling of an Engineer. URL https://ironring.ca/home-en/ (accessed 4.16.25).

Sitkin, S., Miller, C., See, K., 2017. The Stretch Goal Paradox. Harvard Business Review Feb 2017.

Stitt, R., 2023. Crisis as Danger and Opportunity | Psychology Today [WWW Document]. Psychology Today. URL https://www.psychologytoday.com/us/blog/walking-in-wisdom/202311/crisis-as-danger-and-opportunity (accessed 4.16.25).

5.1.a References on @J0BSEEKER

Bish, A., Hannett, J. and Irving, F. (2024) 'Fake Jobs: Scammers impersonate firms to target victims', BBC News, 12 March. Available at: https://www.bbc.com/news/uk-england-surrey-68110626 (Accessed: 26 April 2025).

Earl, J., Iskandar, F. and Elizondo, F. (2019), Take a Job, Any Job: Exploring the Importance of Matched Interests to Career Paths and Work Satisfaction. Journal of Employment Counseling, 56: 33-45. https://doi.org/10.1002/joec.12101

McCulloch, A. (2024) 'UK jobs market at its tightest for three years', Personnel Today, 29 September. Available at: https://www.personneltoday.com/hr/uk-jobs-market-at-its-tightest-for-three-years/ (Accessed: 27 April 2025).

Rodriguez, O. (2024) LinkedIn verifications, LinkedIn. Available at: https://www.linkedin.com/posts/orodriguez_im-excited-to-share-a-new-feature-to-help-activity-7239759193556029440-S_qq/?trk=li_namer_FY25JobSeekerH2_linkedin_CommunityManagement (Accessed: 26 April 2025).

Thapa, A. (2024) Ghost jobs: What the rise in fake job listings says about the current job market, CNBC. Available at: https://www.cnbc.com/2024/08/22/ghost-jobs-why-fake-job-listings-are-on-the-rise.html (Accessed: 26 April 2025).

Veiga, S. et al. (2024) 'Contextual and personal resources in unemployed job search: An intra-individual perspective', Applied Psychology, 74, pp. 1–24. Available at: https://doi.org/10.1111/apps.12540.

What is LinkedIn? (and how can I use it) (2023) LinkedIn Help. Available at: https://www.linkedin.com/help/linkedin/answer/a548441/what-is-linkedin-and-how-can-i-use-itlang=en (Accessed: 26 April 2025).

References on Thinking & Ideation

Patel, F. (2022) "Personal reflection. Software engineering with a group project (assessment 2)."

Goffin, K. and Koners, U. (2011) "Tacit Knowledge, Lessons Learnt, and New Product Development," Journal of Product Innovation Management, 28(2), pp. 300–318. Available at: https://doi.org/10.1111/j.1540-5885.2010.00798.x.

Gupta, D. (2023) "6 Levels of Bloom's Taxonomy, Explained (+Examples) - Whatfix," The Whatfix Blog Drive Digital Adoption.

Sternberg, R.J., Berlyne, D.E. and Vinacke, W.E. (2025) Thought - Analytical, Creative, Critical, Britannica. https://www.britannica.com/topic/thought/Types-of-thinking. Available at: https://www.britannica.com/topic/thought/Types-of-thinking (Accessed: February 27, 2025).

Wagner, R.K. and Sternberg, R.J. (1984) "Alternative Conceptions of Intelligence and Their Implications for Education," Review of Educational Research, 54(2), pp. 179–223. Available at: https://doi.org/10.3102/00346543054002179.

What Is Observability? | IBM (2024). https://www.ibm.com/think/topics/observability. Available at: https://www.ibm.com/think/topics/observability (Accessed: April 21, 2025).

5.1.b Bibliography

These tools deploy Artificial Intelligence and were used to document the project.

5.2 Inspirations for `ABCD of Design`

Patel, F. (2022). "IxD Case Study - User Interaction Design". CSC-40078: User Interaction Design; Keele University. Unpublished Assignment.

Wikipedia, Positive psychology. 2022. Wikipedia: Wikipedia.

Wikipedia, 2022. The Magical Number Seven, Plus or Minus Two. Wikipedia: Wikipedia.

Wikipedia, Kanban. (2022, July 24). In Wikipedia. https://en.wikipedia.org/wiki/Kanban

5.3 AI Tools

These tools deploy Artificial Intelligence and were used to document the project.

Google. (2025). Gemini AI (v1.5 Pro Deep Research 2024). [Text-based AI model]. https://gemini.google.com/

Grammarly: free AI writing assistance (2025). https://grammarly.com/

Mindomo (no date) MinDomo - Collaborative Mind Map Software. https://mindomo.com/.

5.4 R Packages

Benoit, Kenneth, Kohei Watanabe, Haiyan Wang, Paul Nulty, Adam Obeng, Stefan Müller, and Akitaka Matsuo. (2018) "quanteda: An R package for the quantitative analysis of textual data". Journal of Open Source Software. 3(30), 774. https://doi.org/10.21105/joss.00774.

Benoi,K., Matsuo A (2023). *spacyr: Wrapper to the 'spaCy' 'NLP' Library*. R package version 1.3.0, https://CRAN.R-project.org/package=spacyr.

5.5 Open Source Software Used

Joplin. (2025). "note taking and to-do application". https://joplinapp.org/

RStudio Team (2025). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL http://www.rstudio.com/.

Zotero. (2020). Zotero [Computer software]. Corporation for Digital Scholarship. https://Zotero.org (Originally published 2006)

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Bibliography

Bergvall-Kåreborn, B., Mirijamdotter, A. and Basden, A. (2004) "Basic Principles of SSM Modeling: An Examination of CATWOE from a Soft Perspective," *Systemic Practice and Action Research*, 17(2), pp. 55–73. Available at: https://doi.org/10.1023/B:SPAA.0000018903.18767.18

Burge, S. (2015) "An overview of the soft systems methodology," *System Thinking: Approaches and Methodologies*, pp. 1–14

Burnett, B. and Evans, D. (2016) *Designing Your Life: How to Build a Well-Lived, Joyful Life.* Knopf

Checkland, P. (2000) "Soft Systems Methodology: A Thirty Year Retrospective: Soft Systems Methodology," *Systems Research and Behavioral Science*, 17, p. S11–S58. Available at: https://doi.org/10.1002/1099-1743(200011)17:1

Kaiser, J., Buciuman, M., Gigl, S., Gentsch, A. and Schütz-Bosbach, S. (2021) "The Interplay Between Affective Processing and Sense of Agency During Action Regulation: A Review," *Frontiers in Psychology*, 12, p. 716220–716221. Available at: https://doi.org/10.3389/fpsyg.2021.716220

Order of the Engineer (2019). Available at: https://order-of-the-engineer.org/

Senge, P. (2016) "Systems Thinking in a Digital World". Available at: https://www.youtube.com/watch?v=Zs3ML5ZJ_QY

The Calling of an Engineer (2024). Available at: https://ironring.ca/home-en/

"Manifesto for Agile Software Development" (no date)