





Evaluating design science research artefacts: A case of augmented AI

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Abstract. Design science research (DSR) is a methodology that supports problem-solving and enhances human knowledge through the creation of innovative artefacts. The problems that organisations will face in the future are uncertain; therefore, the exact requirements of artefacts are complex to predict. DSR artefacts come in many forms, such as constructs, models, methods or frameworks and are intended to solve organisational problems. We propose, build and evaluate an augmented AI solution to help continuously improve DSR artefacts. The prototype enables the communication of an artefact to people in practice. Furthermore, it allows for practitioners to evaluate and provide feedback to the artefact owner. The improvement process is supported by an AI agent called Ailea. The concept of Ailea can also be used to communicate and facilitate feedback on other DSR artefacts, for example an organisation can make use of Ailea to communicate an operations manual and enable multiple people in the organisation to provide feedback to the creator.

Keywords: Future-ready design research · Augmented AI · emancipatory agent

1 Introduction

Design science research (DSR) is a methodology that supports problem-solving and enhances human knowledge through the creation of innovative artefacts [9]. The problems that organisations will face in the future are uncertain; therefore, the exact requirements of artefacts are complex to predict [17]. The use of recurrent design science cycles [21] is a method that allows a feedback loop to enhance artefacts. Additionally, a future-ready design research (FRDR) approach prompts researchers to be more aware of future requirements, with vigilance to avoid undesirable outcomes and foresight to pursue the preferred future [13]. Even though the evaluation and improvement of artefacts are part of DSR cycles [9], there is limited guidance on how unexpected futures should be accounted for [13]. In order to cater for unexpected futures and allow for an adaptable and continuous improvement approach, this paper describes an augmented AI agent that: (1) supports the communication of an artefact; (2) allows people to provide feedback on the artefact; and (3) enables a researcher or artefact owner to enhance the artefact based on the feedback.

DSR artefacts come in many forms, such as constructs, models, methods or frameworks and are intended to solve organisational problems [7]. For the purpose of this study, an artificial intelligence adoption framework (AIAF) is used as an example of an artefact. The AIAF was created as part of a larger study [18,19], of which this paper is part of. People within organisations that are responsible for AI adoption interventions can use AIAFs to assist with their artificial intelligence adoption interventions [8,5]. As AI comprises of ever-evolving technologies [4,2], AI can be classified as a continuum [11]. The organisational adoption of AI represents a “moving target” [4] and therefore, an AIAF should be adaptable and continuously improve as more knowledge and experience becomes available. Furthermore, to avoid a potentially oppressive environment as a result of implementing AI in organisations, the augmented AI agent acts as an emancipatory assistant (EA) as proposed by [10]. An EA, in this context, is a machine learning system that engages with humans to help them understand and enact emancipatory outcomes [10].

2 Design of the artifact: Ailea

The augmented AI solution has two main functions; the first function is to utilise augmented **AI** to support the continuous improvement of an AIAF by utilising machine learning. The second function is to act as an **EA**, where the EA engages with humans to help them prevent a potentially oppressive outcome as a result of implementing AI in organisations. We will call the agent, **Ailea**.

2.1 Intended user groups

The AIAF that Ailea helps improve is based on a framework [18,19] that was designed by combining the innovation adoption decision stages [15] and the technological, organisation and environmental framework [20]. In short, the framework contains enabling factors that organisations can consider to support their interventions to increase AI adoption [18]. Ailea has two main intended user groups: *change managers* and *AIAF owners*.

The AIAF is intended to be used by organisations to assist with their AI adoption initiatives. In this example, within organisations, *change managers* are responsible for adoption interventions. Within this prototype, they will be allowed to sign in to the website, where the AIAF is presented and explained. The AIAF will provide the change manager with information on the enabling factors that the change manager needs to consider when embarking on an AI adoption intervention. As AI and the adoption thereof is a moving target, the website will follow a community-based approach which allows change managers to provide feedback on the framework; this forms part of the “*evaluation*” stage of Vaishnavi et al.’s design science research process model [21]. Moreover, to avoid a potentially oppressive environment due to the implementation of AI, the request for feedback prompts the change manager to provide comments in this regard. Ailea facilitates the whole communication and feedback process.

In an organisational setting, the person responsible for updating and maintaining the AIAF is the *AIAF owner*. The AIAF is updated and maintained to ensure it is still valid and relevant. In a research setting, the content driver and owner of the framework is the researcher who is designing and improving the AIAF. Given this understanding, the AIAF owner is likely interested in reviewing feedback from the change managers and subsequently updating the AIAF. The review is covered in the “*evaluation*” of stage of Vaishnavi et al.’s design science research process model [21] and subsequently kicks off a new design cycle. Ailea facilitates gathering the feedback from the managers and presents it to the AIAF owner.

2.2 Use case and features

The AI adoption EA use case allows for four main features. Figure 1 graphically depicts the interaction between the framework owner, the change manager and Ailea. The first feature allows the AIAF owner to communicate the created artefact (AIAF) content via Ailea. The second feature allows Ailea to enable change managers to view the AIAF. Third, the change managers can provide feedback on the artefact via Ailea. The feedback regarding the framework results in unstructured text. In order to structure the feedback and allow for an augmented AI solution, Ailea utilises topic modelling. Topic modelling is a natural language processing (NLP) technique that groups similar themes and topics. A topic is a probability distribution over words, and the words with the highest probabilities describe the topic [6]. Lastly, Ailea presents the results of the topic modelling to the AIAF owner. This information, together with the AIAF owner’s knowledge is used to further enhance the AIAF.

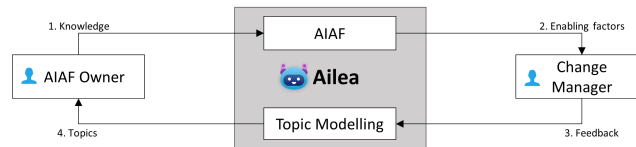


Fig. 1: AI adoption emancipatory assistant (EA) use cases cycle

2.3 Description of features

Ailea acts as an augmented AI facilitator who manages the communication and reviewing of the AIAF. The first feature that she covers is the navigation of the process. The chatbot functionality was built using the Chatterbot [1] python package. Figure 2 shows the basic chatbot functionality of Ailea. From this chatbot function, Ailea allows the user to view the framework that was built by using python and Flask. A snippet of the framework can be seen in Figure 3.

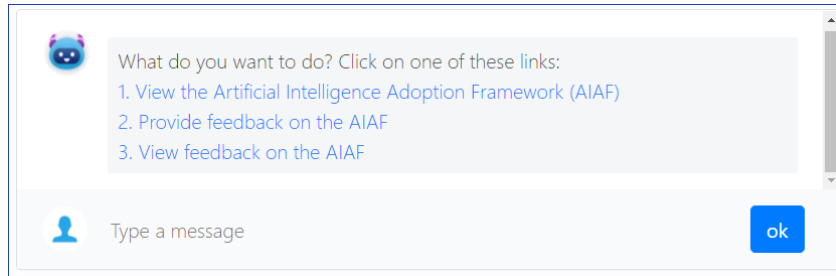


Fig. 2: Ailea chatbot facilitating the communication and review of an AIAF

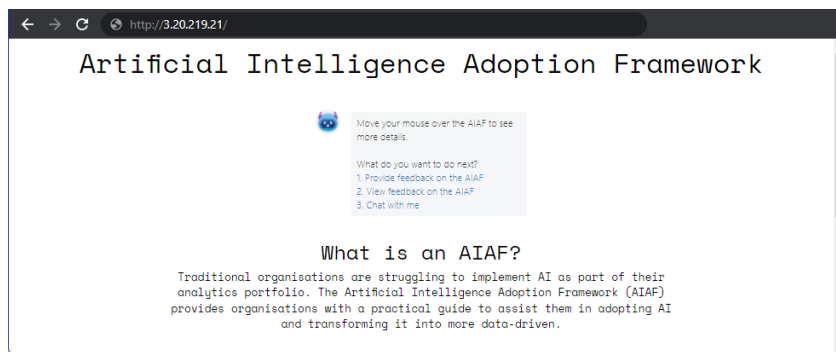


Fig. 3: A snippet of the AIAF as supported by Ailea

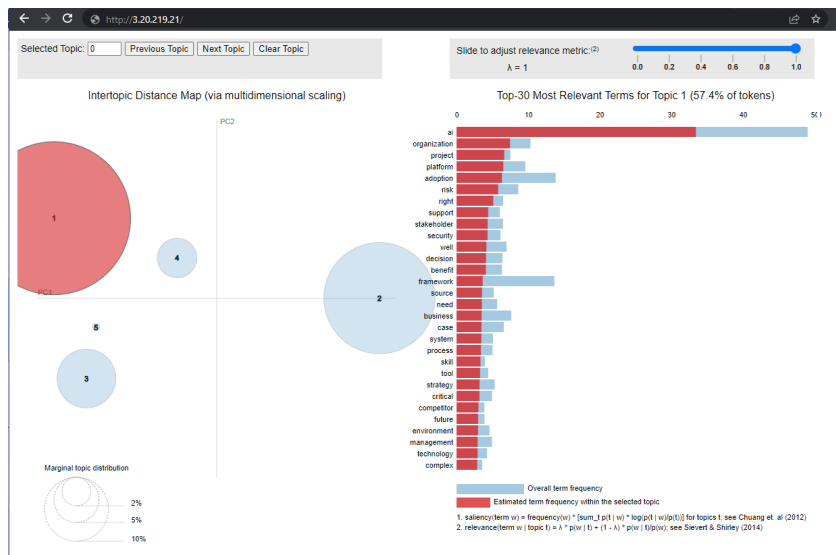


Fig. 4: Ailea making use of topic modelling to present the feedback

Ailea enables the change managers to submit feedback on the framework and specifically prompts the change managers to comment on how to prevent a potentially oppressive environment as a result of implementing AI in organisations. The feedback's unstructured text data are stored in an SQLite database. Ailea reads the data and makes use of Gensim [14], an open-source Python library to apply topic modelling [12], a machine learning technique. The AIAF owner can then use the topics that emerges from the data to update and improve the framework. The topic modelling screenshot can be seen in Figure 4. The dominant topic for each feedback is shown next to the feedback title. The prototype can be found at the url: <http://3.20.219.21/>.

3 Significance to research

Design science research is a methodology that focuses on creating artefacts, but there is limited guidance on how to design for unexpected futures [13]. To support the continuous improvement of an artefact, in this case an artificial intelligence adoption framework (AIAF) and allow for designing for a future that cannot be foreseen, an augmented AI emancipatory assistant was created. This prototype allows the researchers to explore using augmented AI to allow for evaluation and improvement of design science research artefacts.

4 Significance to practice

The prototype enables the effective communication of an AIAF to people in practice as required in design science research [9]. Furthermore, it allows for practitioners to evaluate and provide feedback to the AIAF owner. The improvement process is supported by Ailea. The concept of Ailea can also be used to communicate and facilitate feedback on other DSR artefacts, for example an organisation can make use of Ailea to communicate an operations manual and enable multiple people in the organisation to provide feedback to the creator.

5 Evaluation of the artifact

To evaluate the use of Ailea, a small but knowledgeable group of managers from a global digital transformation industry leader were interviewed [3]. They were asked if, in their opinion, Ailea could help evaluate and improve artefacts in general. To this, they all responded 'yes'. As motivation, their responses included: 'Ailea provides wider inputs to the designer, with different views and interpretations.' This allows for continuous improvement' and 'the topic modelling provides a holistic overview of all the opinions in a structured way'. Because Ailea prompts the person giving the feedback to consider the ethical impact of implementing AI, Ailea supports the prevention of an oppressive future.

6 Conclusion

From a design perspective, this study shows that augmented AI can support the evaluation and enhancement of DSR artefacts. Furthermore, given the potential that AI can have on human society [16], this paper also shows that the concept where AI can act as an EA to support humans in preventing an oppressive future is possible. Future studies can build on this simple concept and develop a more sophisticated solution to both support DSR and expand the possibilities of how AI can support humans against some of the dangers of implementing AI and also in the use of FRDR.

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