Summary of research findings

1. Research aims and objectives

This study aims to reduce the Technological Risk Perception (TRP) gap to increase the adoption of disruptive technologies by answering the following research questions -

a) How does one's technological competency relate with technological risk perceptions?
b) How can the technological risk perception gaps be reduced to increase the adoption of disruptive technologies and to maximize the potential of these technologies to improve the performance of industries?

To answer the research questions, this research aims to answer the following research objectives:

(i) To identify the factors that impact the technological risk perception of an individual in the context of managing disruptive technologies;
(ii) To identify the factors that impact the technological competency of an individual;
(iii) To develop an assessment tool to assess technological risk perceptions in the context of managing disruptive technologies;
(iv) To develop an assessment tool to assess an individual's technological competency;
(v) To assess the relationship between technological competency and technological risk perception, and subsequently the technological risk perception gap;
(vi) To explore the reasons for technological risk perception gap based on the various technological competency levels; and
(vii) To develop risk communication strategies tailored for the various technological competency levels to reduce the technological risk perception gap.

The scope of IPUR seed fund covers objectives (i) and (ii).

2. Significance of study

The findings from this study are expected to contribute to knowledge and practice in the following ways:

- Lay the foundation to understand the underlying factors that determine one's TRP and TC, which can further drive the adoption of disruptive technologies
- Proposed risk communication strategies can help to provide a better understanding of how TRP gap can be reduced
- Guide governments, industries and organizations in transitioning towards new technologies beyond the Fourth Industrial Revolution
- The proposed KBTTAS can operationalize the assessment of one's TRP and TC to provide tailored risk communication strategies that can be undertaken by governments, industries or organizations to align individual perceived risks associated with technology adoption with experts' perceived risks, reducing the resistance of end-users toward adopting disruptive technologies and encourage adoption of new technologies

3. Literature review

The study identified the factors influencing Project Manager's (PM) TRP (refer to Table 1 in Annex) and TC (refer to Table 2 in Annex) and developed a conceptual model of TRP and TC as shown in Figure 1.

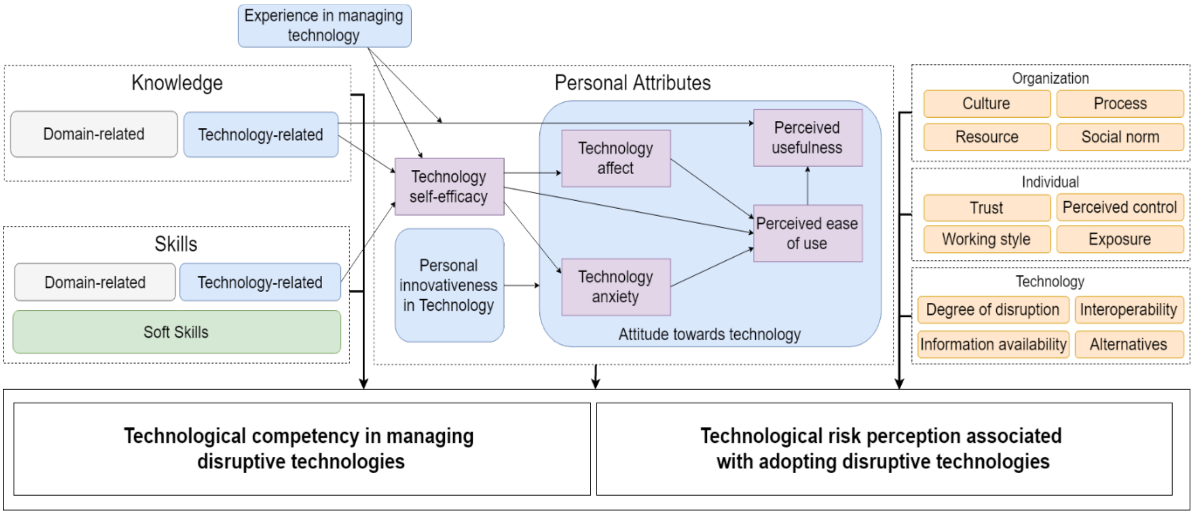

Figure 1. Conceptual model of TRP and TC

4. Research methods and data presentation

The study adopted the research approach as shown in Figure A in Annex. To analyse the data collected from the survey questionnaire, the following data analysis methods were conducted:

- Frequency analysis – understand profile of respondents, organisations and projects
- Shapiro-wilk test – test for normality to determine if parametric or non-parametric tests should be conducted
- One-sample Wilcoxon signed-rank test – test for significance of factors contributing to TRP and TC
- Kruskal-Wallis test – test for differences among three or more groups
- Mann-Whitney U test – test for differences among two groups
- Spearman Rank Correlation Coefficient (SRCC) – test for statistical dependence of relationship between two sets of data
- Factor analysis – group factors that determine one's TRP
- PLS-SEM – analyze structural relationships among variables

A total of 48 valid responses were received and the profile of the respondents, organisations and projects are presented in Table 3 in Annex.

5. Data analysis and discussion

The study analyzed the following:

- Experience and level of familiarity of respondents in disruptive technologies
  It was found that:
  - Practitioners have little experience in the disruptive technologies
  - Practitioners have low level of familiarity with the technologies except for familiarity with VR

  The relatively higher level of familiarity with VR may be due to the mandated use of Building Information Modeling (BIM).
- Factors influencing Technological Risk Perception
  Applicability, impact and overall significance of all factors were found to be significant, except for:
  - Applicability of perceived learning opportunities
  - Impact of autonomy of decision making in applying technology in the workplace
  - Applicability and impact of organizational red tapes, peer influence, existing organizational communications system, need for improvements in project quality, availability of alternatives
  - Applicability, impact and overall significance of traditional media exposure and social media exposure

  This finding is expected as project managers are required to work with specified technologies in the contract and typically do not have the autonomy to decide for the use of specific technologies in projects in the Singapore construction industry.
- Preliminary PLS-SEM model for TRP (based on overall significance)
  The preliminary PLS-SEM model for TRP based on the overall significance was developed according to the results of the factor analysis conducted. The preliminary PLS-SEM model for TRP is shown in Figure 2.

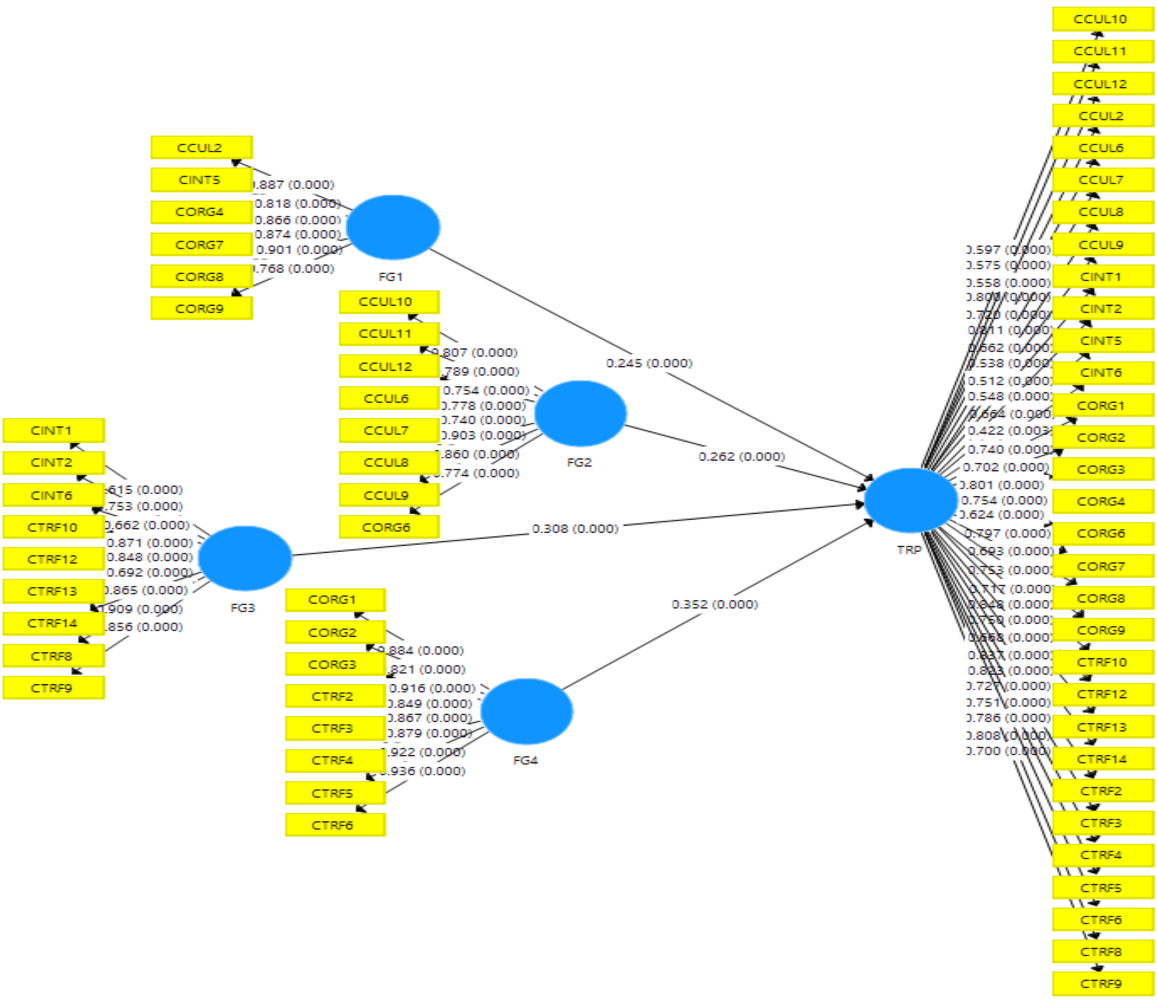

Figure 2. Preliminary PLS-SEM model for TRP

- Factors influencing Technological Competency
  - Knowledge
    - All project management knowledge areas were found to be significant in manaing both conventional projects and in projects with disruptive technologies
    - Knowledge in each project management knowledge areas were perceived to be equally important in managing conventional projects and projects with disruptive technologies
  - Skills
    - All skills were found to be significant in manging both conventional projects and projects with disruptive technologies
    - Top three skills required to manage conventional projects were found to be:
      - Project management skills
      - Planning and organization skills
      - Communication skills
    - Top three skills required to manage projects with disruptive technologies were found to be:

        - Leadership
        - Problem solving skills
        - Active learning skills
    - Importance of several skills were found to be statistically more important in managing projects with disruptive technologies
        - Technological skills – PMs are required to have the ability to utilize the technology to complete a task
        - Information management skills – PMs are required to manage the inputs and outputs from the technologies so that data input are of good quality and to be able to understand and utilise the information outputs to achieve project objectives
        - Active learning – PMs need to constantly learn how to utilize the technologies to manage changes and complexities in projects through experimentation
        - Creativity – PMs need to be creative in utilising the technologies to achieve project objectives as the use of the technologies are still in its infancy
        - Flexibility – PMs need to be flexible and adapt according to the situations arising from the use of the disruptive technologies as there is no existing standards or guidelines overarching the implementation of the technologies
        - Strategic planning – PMs need to both inspire followers and be able to strategically plan for the use of the technologies to achieve project objectives
        - Ethical awareness – The technologies can collect information bound to individuals, hence PMs need to be aware of the ethical and legal aspects from utilising the technologies
- Attitude towards technology
    - Applicability, impact and overall significance of all factors were found to be significant in contributing to one's attitude towards technology except for:
        - Applicability of afraid to become dependent on disruptive technologies and lose some reasoning skills

      The finding demonstrates that reasoning skills may instead be used to interpret the outputs from the technologies.
- Preliminary PLS-SEM Model (based on overall significance)

  The preliminary PLS-SEM model for TC based on the overall significance was developed and is shown in Figure 3.

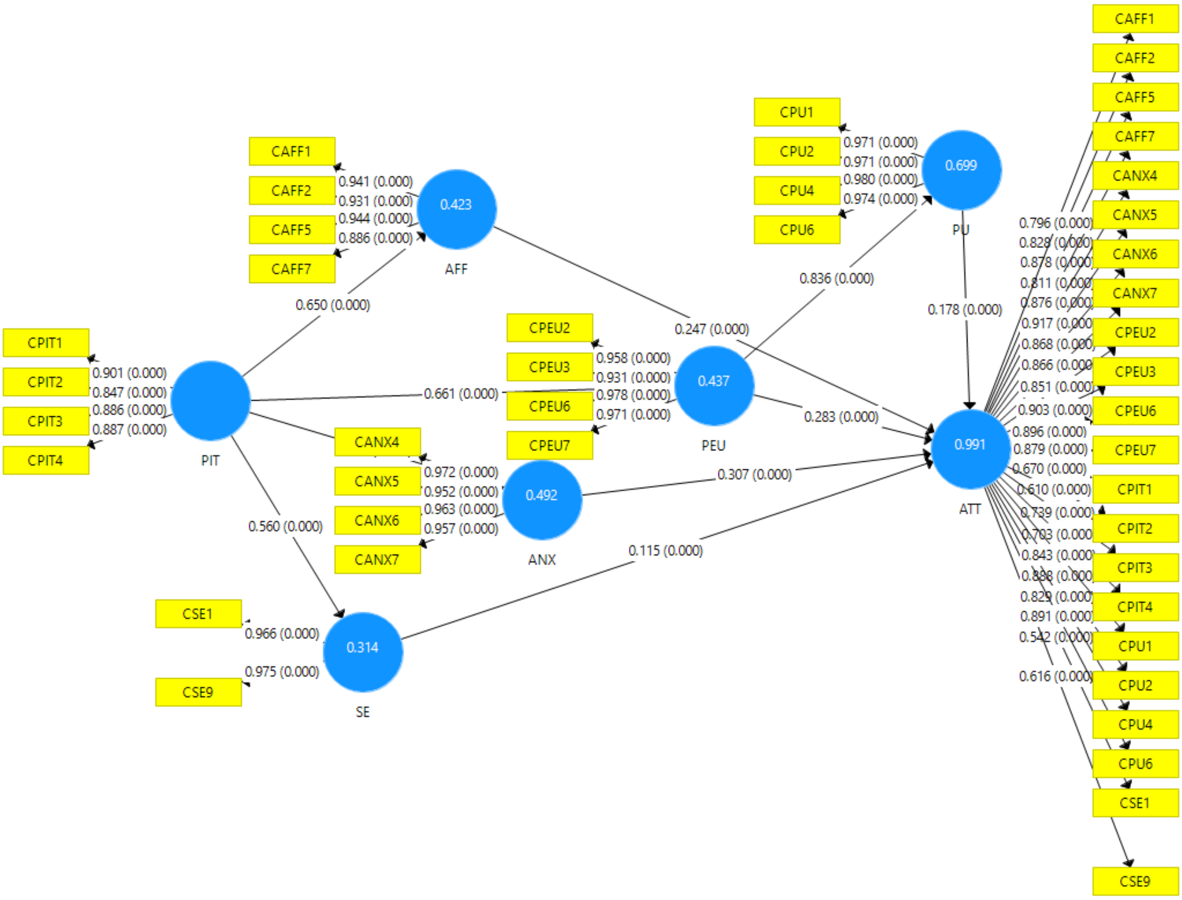

Figure 3. Preliminary PLS-SEM

- TRP-TC relationships
  It was found that:
  - Respondents had moderate self-assessed TC level and are moderately risk neutral
  - No statistically significant relationships between respondents' risk attitude and level of self-assessed TC level
- Perceived differences among respondents of different risk attitude and self-assessed level of TC
  - Several statistically significant differences for perceived importance of knowledge, skills and applicability, impact and overall significance factors contributing to attitude towards technologies and TRP were found among respondents of different risk attitude
  - Several statistically significant dependency for perceived importance of knowledge, skills and applicability, impact and overall significance factors contributing to attitude towards technologies and TRP were found among respondents of different risk attitude
  - Several statistically significant differences for perceived importance of skills and applicability, impact and overall significance factors contributing to attitude towards technologies and TRP were found among respondents of different self-assessed TC levels

- Several statistically significant dependency for perceived importance of knowledge, skills and applicability, impact and overall significance factors contributing to attitude towards technologies and TRP were found among respondents of different self-assessed TC levels
- Further studies warranted due to limited responses per level of risk attitude and TC

6. Development of tool

The proposed architecture for KBTTAS is shown in Figure 4. The wireframes for the proposed KBTTAS are provided in Figures B to E in the Annex. The wireframes will be used as a reference to develop the front end of the web-based KBTTAS.

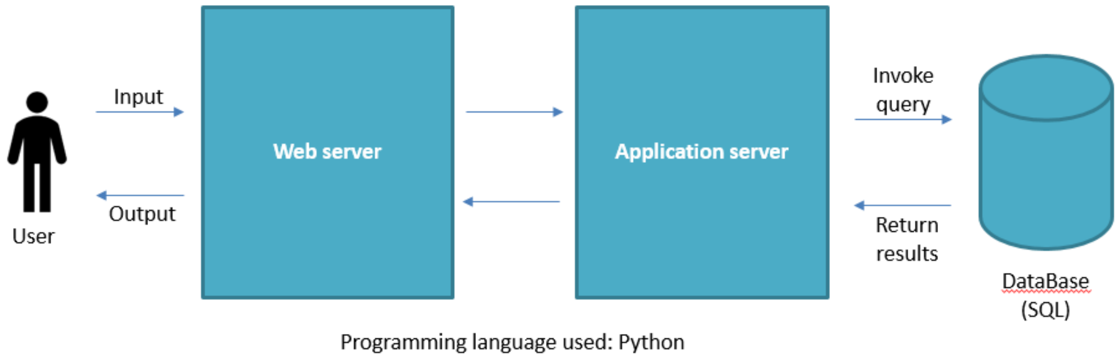

Figure 4. Proposed architecture for KBTTAS

Annex: Tables, Figures & References

Table 1. Factors influencing Project Manager's Technological Risk Perception

Factor	References
Perceived value of technology	(Addae et al., 2019; AlHogail, 2018; Byrne et al., 2016; Choi & Ji, 2015; de Groot et al., 2020; Dixon et al., 2018; El-Haddadeh, 2020; Fox-Glassman & Weber, 2016; Gupta et al., 2012; Hsu & Lin, 2018; Huang et al., 2011; Kim & Jung, 2019; Larsson et al., 2019; Mathews et al., 2018; Peters et al., 2004; Renn & Benighaus, 2013; Roper & Tapinos, 2016; Siegrist et al., 2007; Sokolowska & Tyszka, 1995; Tosun, 2017; van Schaik et al., 2017; Weisenfeld & Ott, 2011; Weller et al., 2015)
Autonomy of decision making in applying technology	(AlHogail, 2018; Choi & Ji, 2015; Digmayer & Jakobs, 2016; Dixon et al., 2018; Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Hall et al., 2014; Ho & Watanabe, 2018; Huang et al., 2011; Kim & Jung, 2019; Mathews et al., 2018; Nelkin, 1989; Roper & Tapinos, 2016; Savage, 1993; Siegrist et al., 2007; Tosun, 2017; van Schaik et al., 2017; Weller et al., 2015)
Economic considerations	(Digmayer & Jakobs, 2016; El-Haddadeh, 2020; Hsu & Lin, 2018; Jacquet & Stedman, 2014; Kim & Jung, 2019; Larsson et al., 2019; Mathews et al., 2018; Nelkin, 1989; Paluch & Wunderlich, 2016; Renn & Benighaus, 2013; Roper & Tapinos, 2016; Sadeh & Dvir, 2020; Sokolowska & Tyszka, 1995)
Logistical considerations	(Digmayer & Jakobs, 2016; El-Haddadeh, 2020; Mathews et al., 2018; Renn & Benighaus, 2013; Sadeh & Dvir, 2020)
Operational considerations	(Addae et al., 2019; Digmayer & Jakobs, 2016; El-Haddadeh, 2020; Mathews et al., 2018; Paluch & Wunderlich, 2016; Renn & Benighaus, 2013; Sadeh & Dvir, 2020)
Enhancements in risk communications among team	(El-Haddadeh, 2020; Hsu & Lin, 2018; Kim & Jung, 2019)
Interoperability of technology	(El-Haddadeh, 2020; Hall et al., 2014; Larsson et al., 2019; Mathews et al., 2018)
Monetary cost	(Digmayer & Jakobs, 2016; Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Hall et al., 2014; Hsu & Lin, 2018; Kim & Jung, 2019; Mathews et al., 2018; Paluch & Wunderlich, 2016; Renn & Benighaus, 2013; Roper & Tapinos, 2016; Sadeh & Dvir, 2020; Stoutenborough & Vedlitz, 2016)

Time investment	(Addae et al., 2019; Drottz-Sjöberg & Sjöberg, 2010; Hall et al., 2014; Mathews et al., 2018; Renn & Benighaus, 2013; Roper & Tapinos, 2016)
Labour investment	(Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Hall et al., 2014; Mathews et al., 2018; Renn & Benighaus, 2013; Sadeh & Dvir, 2020)
Stakeholder heterogeneity	(de Groot et al., 2020; Hall et al., 2014; Larsson et al., 2019)
Prior knowledge of the technology	(Byrne et al., 2016; Choi & Ji, 2015; Digmayer & Jakobs, 2016; Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Gupta et al., 2012; Ho & Watanabe, 2018; Huang et al., 2011; Larsson et al., 2019; X. Lu et al., 2015; Mathews et al., 2018; Nelkin, 1989; Peters et al., 2004; Raue et al., 2019; Renn & Benighaus, 2013; Siegrist et al., 2007; van Schaik et al., 2017; Weisenfeld & Ott, 2011; Xie et al., 2011)
Innovation radicalness	(Choi & Ji, 2015; de Groot et al., 2020; Digmayer & Jakobs, 2016; Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Huang et al., 2011; Larsson et al., 2019; Roper & Tapinos, 2016; Sadeh & Dvir, 2020; Weisenfeld & Ott, 2011)
Degree of trust in technology deliverables	(AlHogail, 2018; de Groot et al., 2020; Dixon et al., 2018; Hall et al., 2014; Larsson et al., 2019; Mathews et al., 2018; Paluch & Wunderlich, 2016; Renn & Benighaus, 2013; Siegrist et al., 2007; Wang & Zhao, 2019)
Knowledge gap in use of technology	(Addae et al., 2019; de Groot et al., 2020; El-Haddadeh, 2020; Hall et al., 2014; Ho & Watanabe, 2018; Hsu & Lin, 2018; León-Pérez et al., 2020; Mathews et al., 2018; Raue et al., 2019; Renn & Benighaus, 2013; Sadeh & Dvir, 2020; Stoutenborough & Vedlitz, 2016; Wang & Zhao, 2019)
Usability of the technology	(Addae et al., 2019; AlHogail, 2018; Choi & Ji, 2015; El-Haddadeh, 2020; Hsu & Lin, 2018; Huang et al., 2011; Paluch & Wunderlich, 2016; Roper & Tapinos, 2016; Tosun, 2017; van Schaik et al., 2017)
Product lifetime of the technology	(de Groot et al., 2020; Digmayer & Jakobs, 2016; Drottz-Sjöberg & Sjöberg, 2010; Hall et al., 2014; Roper & Tapinos, 2016; Sadeh & Dvir, 2020; Wang & Zhao, 2019; Weisenfeld & Ott, 2011; Xie et al., 2011)
Supervisory control	(Huang et al., 2011; Kim & Jung, 2019; Mathews et al., 2018; Paluch & Wunderlich, 2016)
Technological stigma	(Byrne et al., 2016; El-Haddadeh, 2020; Garrick, 1998; Peters et al., 2004; Renn & Benighaus,

	2013; Wang & Zhao, 2019; Weisenfeld & Ott, 2011; Weller et al., 2015)
Technological hazard	(Digmayer & Jakobs, 2016; Dixon et al., 2018; Drottz-Sjöberg & Sjöberg, 2010; Hall et al., 2014; Huang et al., 2011; Hung & Wang, 2011; Kim & Jung, 2019; Paluch & Wunderlich, 2016; Sadeh & Dvir, 2020; Savage, 1993; Siegrist et al., 2007; Slovic, 2016; Sokolowska & Tyszka, 1995; Tosun, 2017; van Schaik et al., 2017; Wang & Zhao, 2019; Xie et al., 2011)
Degree of disruption brought by the technology	(Byrne et al., 2016; Choi & Ji, 2015; de Groot et al., 2020; Digmayer & Jakobs, 2016; Drottz-Sjöberg & Sjöberg, 2010; Huang et al., 2011; Larsson et al., 2019; Roper & Tapinos, 2016; Sadeh & Dvir, 2020; Stoutenborough & Vedlitz, 2016; van Schaik et al., 2017; Xie et al., 2011)
Availability of alternatives	(Drottz-Sjöberg & Sjöberg, 2010; Garrick, 1998; Tosun, 2017)
Perceived learning opportunities	(Mathews et al., 2018; Roper & Tapinos, 2016; Weller et al., 2015)
Perceived ease of use	(Addae et al., 2019; AlHogail, 2018; Biucky et al., 2017; Choi & Ji, 2015; El-Haddadeh, 2020; Hsu & Lin, 2018; Huang et al., 2011)
Peer influences	(Addae et al., 2019; AlHogail, 2018; Choi & Ji, 2015; de Groot et al., 2020; Dixon et al., 2018; Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Friedkin, 2001; Hall et al., 2014; Hung & Wang, 2011; Jacquet & Stedman, 2014; Kim & Jung, 2019; Larsson et al., 2019; Nelkin, 1989; Paluch & Wunderlich, 2016; Renn & Benighaus, 2013; Siegrist et al., 2007; Sokolowska & Tyszka, 1995; Weisenfeld & Ott, 2011; Weller et al., 2015; Xie et al., 2011)
Existing organisational communication system	(Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Kim & Jung, 2019; Larsson et al., 2019; Mathews et al., 2018; Renn & Benighaus, 2013; Roper & Tapinos, 2016; Sadeh & Dvir, 2020; Stoutenborough & Vedlitz, 2016)
Ability to integrate the technology with existing operating processes	(Drottz-Sjöberg & Sjöberg, 2010; El-Haddadeh, 2020; Kim & Jung, 2019; Larsson et al., 2019; Mathews et al., 2018; Roper & Tapinos, 2016; Sadeh & Dvir, 2020)
Privacy risk	(Addae et al., 2019; AlHogail, 2018; Biucky et al., 2017; Digmayer & Jakobs, 2016; El-Haddadeh, 2020; Fox & Connolly, 2018; Hsu & Lin, 2018; Huang et al., 2011; Paluch & Wunderlich, 2016; van Schaik et al., 2017)
Increased learning curve	(El-Haddadeh, 2020; Paluch & Wunderlich, 2016)

Perceived job discrimination	(El-Haddadeh, 2020; Paluch & Wunderlich, 2016; Weller et al., 2015)
Compatibility of technology with personal working styles	(Byrne et al., 2016; El-Haddadeh, 2020; Huang et al., 2011; Kim & Jung, 2019; Larsson et al., 2019; Mathews et al., 2018; Roper & Tapinos, 2016; van Schaik et al., 2017; Weller et al., 2015)
Scale of implementation	(Renn & Benighaus, 2013; Roper & Tapinos, 2016; Sadeh & Dvir, 2020; Stoutenborough & Vedlitz, 2016)
Availability of technological support	(El-Haddadeh, 2020; Mathews et al., 2018; Paluch & Wunderlich, 2016)
Organizational red tapes	(El-Haddadeh, 2020; Kim & Jung, 2019; Larsson et al., 2019; Mathews et al., 2018; Paluch & Wunderlich, 2016; Renn & Benighaus, 2013; Stoutenborough & Vedlitz, 2016)
Need for improvements in project quality	(El-Haddadeh, 2020; Kim & Jung, 2019; Roper & Tapinos, 2016; Sadeh & Dvir, 2020)
Traditional media exposure	(Byrne et al., 2016; Drottz-Sjöberg & Sjöberg, 2010; Garrick, 1998; Huang et al., 2011; X. Lu et al., 2015; Nelkin, 1989; Renn & Benighaus, 2013; Slovic, 2016; Stoutenborough & Vedlitz, 2016; Tosun, 2017; van Schaik et al., 2017; Weisenfeld & Ott, 2011; Xie et al., 2011)
Social media exposure	(Byrne et al., 2016; Drottz-Sjöberg & Sjöberg, 2010; Garrick, 1998; Huang et al., 2011; X. Lu et al., 2015; Nelkin, 1989; Renn & Benighaus, 2013; Slovic, 2016; Stoutenborough & Vedlitz, 2016; Tosun, 2017; van Schaik et al., 2017; Weisenfeld & Ott, 2011; Xie et al., 2011)

Table 2. Factors influencing Project Manager's Technological Competency

Technological Competency Component	Factor	Reference
Knowledge in project management	Project integration management	(Project Management Institute, 2017)
	Project scope management	
	Project schedule management	
	Project cost management	
	Project quality management	
	Project resource management	
	Project communications management	
	Project risk management	
	Project procurement management	
	Project stakeholder management	
Knowledge in disruptive technologies	Cyber-physical system	(Dallasega et al., 2018; Ghobakhloo, 2018; Jabbour et al., 2018; Kamble et al., 2018; Y. Lu, 2017; Müller et al., 2018; Oesterreich & Teuteberg, 2016; Pereira & Romero, 2017; Stock et al., 2018)
	Internet-of-things	
	Big data	
	Artificial intelligence	
	Autonomous vehicles	
	Robotics	
	Augmented reality	
	Virtual reality	
	Additive manufacturing	
	3D imaging	
	Blockchain	
Skills	Project management skills	(Alvarenga et al., 2019; Chen et al., 2019; Edum-Fotwe & McCaffer, 2000; El-Sabaa, 2001; Hwang & Ng, 2013; Succar et al., 2013; Udo & Koppensteiner, 2004)
	Technical and operational technology skills	(Alvarenga et al., 2019; Chen et al., 2019; El-Sabaa, 2001; Gann & Senker, 1998; Hwang & Ng, 2013; Succar et al., 2013; Van Deursen & Mossberger, 2018; Van Laar et al., 2017; Voogt & Roblin, 2012; World Economic Forum, 2018)
	Information management skills	(Chen et al., 2019; Dainty et al., 2004; Udo & Koppensteiner, 2004; Van Deursen & Mossberger, 2018; Van Laar et al., 2017; Voogt & Roblin, 2012; F. Zhang et al., 2013)
	Planning and organizing skills	(Alvarenga et al., 2019; Chen et al., 2019; El-Sabaa, 2001; Hwang & Ng, 2013; Odusami, 2002; Succar et al., 2013; Udo & Koppensteiner, 2004)

	Communication skills	(Alvarenga et al., 2019; Chen et al., 2019; Creasy & Anantatmula, 2013; Edum-Fotwe & McCaffer, 2000; El-Sabaa, 2001; Fisher, 2011; Gann & Senker, 1998; Hwang & Ng, 2013; Odusami, 2002; Udo & Koppensteiner, 2004; Van Deursen & Mossberger, 2018; Van Laar et al., 2017; Voogt & Roblin, 2012; F. Zhang et al., 2013; L. Zhang & Fan, 2013; Zuo et al., 2018)
	Social, cultural and organizational awareness	(Alvarenga et al., 2019; Chen et al., 2019; El-Sabaa, 2001; Fisher, 2011; Gann & Senker, 1998; Odusami, 2002; Van Laar et al., 2017; Voogt & Roblin, 2012; F. Zhang et al., 2013; L. Zhang & Fan, 2013; Zuo et al., 2018)
	Ethical awareness	(Van Laar et al., 2017)
	Creativity	(Creasy & Anantatmula, 2013; Fisher, 2011; Van Laar et al., 2017; Voogt & Roblin, 2012; World Economic Forum, 2018)
	Problem solving skills	(Alvarenga et al., 2019; Chen et al., 2019; Dainty et al., 2004; Edum-Fotwe & McCaffer, 2000; El-Sabaa, 2001; Fisher, 2011; Hwang & Ng, 2013; Odusami, 2002; Udo & Koppensteiner, 2004; Van Laar et al., 2017; Voogt & Roblin, 2012; World Economic Forum, 2018; F. Zhang et al., 2013; Zuo et al., 2018)
	Flexibility	(Alvarenga et al., 2019; Chen et al., 2019; Creasy & Anantatmula, 2013; Fisher, 2011; Van Laar et al., 2017; L. Zhang & Fan, 2013; Zuo et al., 2018)
	Strategic planning skills	(Chen et al., 2019; Odusami, 2002; Succar et al., 2013; Udo & Koppensteiner, 2004; Van Deursen & Mossberger, 2018; Zuo et al., 2018)
	Active learning	(Van Laar et al., 2017; World Economic Forum, 2018)
	Leadership skills	(Alvarenga et al., 2019; Chen et al., 2019; Dainty et al., 2004; Edum-Fotwe & McCaffer, 2000; El-Sabaa, 2001; Fisher, 2011; Hwang & Ng, 2013; Odusami, 2002; Succar et al., 2013; Udo & Koppensteiner, 2004;

		World Economic Forum, 2018; F. Zhang et al., 2013; Zuo et al., 2018)
	Social influence	(Alvarenga et al., 2019; Chen et al., 2019; Dainty et al., 2004; El-Sabaa, 2001; Fisher, 2011; World Economic Forum, 2018; F. Zhang et al., 2013)
	Composure	(Alvarenga et al., 2019; Chen et al., 2019; Creasy & Anantatmula, 2013; Dainty et al., 2004; Fisher, 2011; Hwang & Ng, 2013; Odusami, 2002; F. Zhang et al., 2013; L. Zhang & Fan, 2013)
	Conflict management skills	(Alvarenga et al., 2019; Chen et al., 2019; Creasy & Anantatmula, 2013; Fisher, 2011; Udo & Koppensteiner, 2004; F. Zhang et al., 2013; L. Zhang & Fan, 2013)
	Decision making skills	(Alvarenga et al., 2019; Edum-Fotwe & McCaffer, 2000; Hwang & Ng, 2013; Odusami, 2002; Succar et al., 2013; Udo & Koppensteiner, 2004; Zuo et al., 2018)
	Delegation skills	(Alvarenga et al., 2019; Chen et al., 2019; Edum-Fotwe & McCaffer, 2000; El-Sabaa, 2001; Hwang & Ng, 2013; Odusami, 2002; Udo & Koppensteiner, 2004; F. Zhang et al., 2013; Zuo et al., 2018)
	Motivation skills	(Chen et al., 2019; Dainty et al., 2004; Edum-Fotwe & McCaffer, 2000; El-Sabaa, 2001; Fisher, 2011; Odusami, 2002; F. Zhang et al., 2013; Zuo et al., 2018)
	Negotiation skills	(Alvarenga et al., 2019; Chen et al., 2019; Edum-Fotwe & McCaffer, 2000; Hwang & Ng, 2013; Odusami, 2002; Udo & Koppensteiner, 2004; F. Zhang et al., 2013; Zuo et al., 2018)
	Teamwork skills	(Alvarenga et al., 2019; Chen et al., 2019; Dainty et al., 2004; Edum-Fotwe & McCaffer, 2000; Fisher, 2011; Hwang & Ng, 2013; Odusami, 2002; Succar et al., 2013; Udo & Koppensteiner, 2004; Van Laar et al., 2017; Voogt & Roblin, 2012; F. Zhang et al., 2013; L.

		Zhang & Fan, 2013; Zuo et al., 2018)
	Teambuilding skills	(Alvarenga et al., 2019; Chen et al., 2019; Fisher, 2011; Odusami, 2002; Udo & Koppensteiner, 2004; F. Zhang et al., 2013; Zuo et al., 2018)
	Initiative	(Alvarenga et al., 2019; Dainty et al., 2004; F. Zhang et al., 2013; Zuo et al., 2018)
Technology self-efficacy	I could complete a job task using the technology…	(Compeau & Higgins, 1995; Venkatesh et al., 2003; Venkatesh & Davis, 1996)
	If there was no one around to tell me what to do as I go	
	If I had only the user manuals for reference	
	If I had seen someone else using it before trying it myself	
	If I could call someone for help if I got stuck	
	If someone else had helped me get started	
	If I had a lot of time to complete the job for which the technology was provided for	
	If I had just the built-in help facility for assistance	
	If someone showed me how to do it first	
	If I had never used a technology like it before	
	If I had used similar technology before to do the same job	
Technology affect	Finding that disruptive technologies make work more interesting	(Venkatesh et al., 2003)
	Feeling pleasant during the actual process of using the disruptive technology	(Venkatesh, 2000; Venkatesh & Bala, 2008)
	Looking forward to the aspects of the job that require the use of disruptive technologies	(Heinssen et al., 1987)
	Liking to work with disruptive technologies	(Venkatesh et al., 2003)
	Enjoying the use of the disruptive technologies	(Venkatesh, 2000; Venkatesh & Bala, 2008)
	Thinking that disruptive technologies are necessary tools in work settings	(Heinssen et al., 1987)

	Having fun using the disruptive technology	(Venkatesh, 2000; Venkatesh & Bala, 2008)
Technology anxiety	Feeling scared to think that a lot of information could be lost by hitting the wrong key when using the disruptive technology	(Heinssen et al., 1987; Venkatesh et al., 2003)
	Feeling insecure about your ability to interpret an outcome from disruptive technologies	(Heinssen et al., 1987)
	Afraid to become dependent on disruptive technologies and lose some reasoning skills	(Heinssen et al., 1987)
	Feeling apprehensive about using the disruptive technology	(Heinssen et al., 1987; Venkatesh et al., 2003)
	Thinking that disruptive technologies are frustrating to work with	(Nickell & Pinto, 1986)
	Feeling hesitant to use disruptive technologies for fear of making mistakes that cannot be corrected	(Heinssen et al., 1987; Venkatesh et al., 2003)
	Feeling nervous or anxious working with disruptive technologies	(Venkatesh, 2000; Venkatesh & Bala, 2008)
	Feeling intimidated or overwhelmed by disruptive technologies	(Heinssen et al., 1987; Nickell & Pinto, 1986; Venkatesh et al., 2003)
	Feeling uncomfortable using disruptive technologies (potentially due to physical factors/ limitations of the technologies)	(Nickell & Pinto, 1986; Venkatesh, 2000; Venkatesh & Bala, 2008)
	Feeling uneasy or disturbed (mental or emotional) using disruptive technologies	(Venkatesh, 2000; Venkatesh & Bala, 2008)
Perceived usefulness	Thinking that the use of disruptive technologies would enhance job effectiveness	(Davis, 1989; Venkatesh, 2000; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000)
	Thinking that the use of disruptive technologies would make it easier to do a job	(Davis, 1989)
	Thinking that the use of disruptive technologies would increase productivity	(Davis, 1989; Venkatesh, 2000; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000)
	Thinking that the use of disruptive technologies would enable you to accomplish tasks more quickly	(Davis, 1989; Venkatesh et al., 2003)
	Thinking that the use of disruptive technologies would improve job performance	(Davis, 1989; Venkatesh, 2000; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000)

	Overall, finding disruptive technologies useful in a job	(Davis, 1989; Venkatesh et al., 2003; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000)
Perceived ease of use	Finding the disruptive technology to be flexible to interact with	(Davis, 1989)
	Finding that not a lot of mental effort is required when interacting with the disruptive technology	(Davis, 1989; Venkatesh, 2000; Venkatesh & Davis, 2000)
	Finding the interaction with the disruptive technology to be clear and understandable	(Davis, 1989; Venkatesh, 2000; Venkatesh et al., 2003; Venkatesh & Bala, 2008)
	Finding it easy to become skilful at using the disruptive technology	(Davis, 1989; Venkatesh et al., 2003)
	Finding it easy to get the disruptive technology to do what you want it to do	(Davis, 1989; Venkatesh, 2000; Venkatesh & Bala, 2008)
	Finding it easy to learn to use the disruptive technology	(Davis, 1989; Venkatesh et al., 2003)
	Overall, finding the disruptive technology easy to use	(Davis, 1989; Venkatesh et al., 2003)
Personal innovativeness in technology	Look for ways to experiment with new technologies	(Agarwal & Prasad, 1998)
	Is usually the first among peers to try out new technologies	
	Is usually hesitant to try out new technologies	
	Enjoy experimenting with new technologies	

Table 3. Profile of respondents, organizations and projects

		Frequency	Percentage (%)
Respondent's job role	Project manager	48	100
Respondent's years of experience in the construction industry	Less than 3 years	7	14.6
	3 to 5 years	6	12.5
	6 to 10 years	4	8.3
	11 to 15 years	8	16.7
	16 to 20 years	7	14.6
	More than 20 years	16	33.3
Respondent's years of experience in current role	Less than 3 years	18	37.5
	3 to 5 years	8	16.7
	6 to 10 years	11	22.9
	More than 10 years	11	22.9
Gender	Female	10	20.8
	Male	38	79.2
Education	Diploma and below	13	27.1
	Bachelor	20	41.7
	Postgraduate	16	33.3
Age	25 to 34	15	31.3
	35 to 44	15	31.3
	45 to 54	10	20.8
	55 to 64	8	16.7
Experience with disruptive technologies	Yes	35	72.9
	No	13	27.1
Organization domain	Consultant	8	16.7
	Contractor	22	45.8
	Developer	10	20.8
	Government agency	8	16.7
Organization's years of experience in construction industry	Less than 10 years	7	14.6
	10 to 20 years	9	18.8
	21 to 30 years	13	27.1
	More than 30 years	19	39.6
Organization size	Small and medium enterprise	26	54.2
	Large enterprise	14	29.2
	Government agency	8	16.7
Experience with disruptive technologies	Yes	33	68.6
	No	15	31.3
Number of projects respondents are involved in	Conventional projects	251	64.7
	Projects with at least one disruptive technology	137	35.3
Number of projects organizations are involved in	Conventional projects	1049	81.2
	Projects with at least one disruptive technology	243	18.8

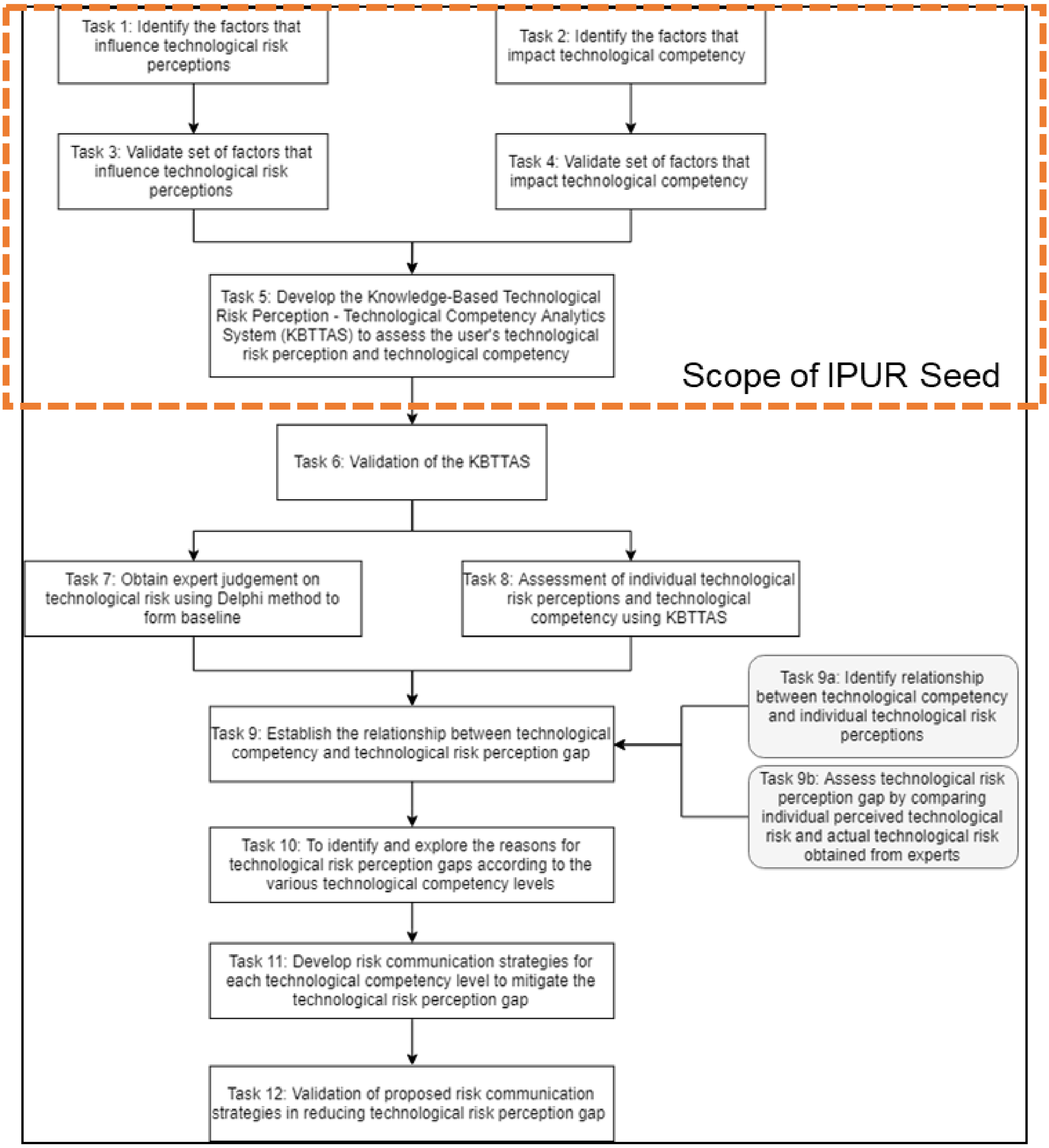

Figure A. Research Approach

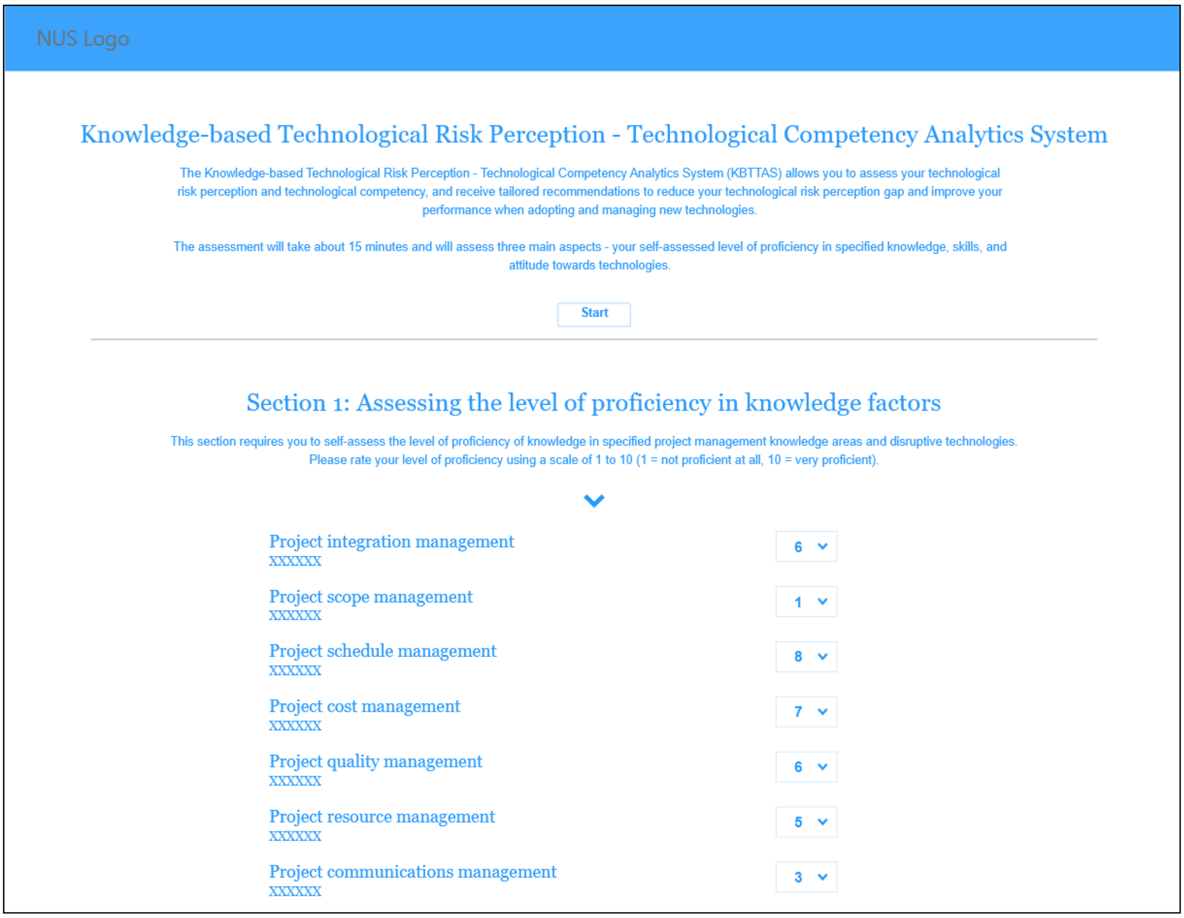

Figure B. Introduction page

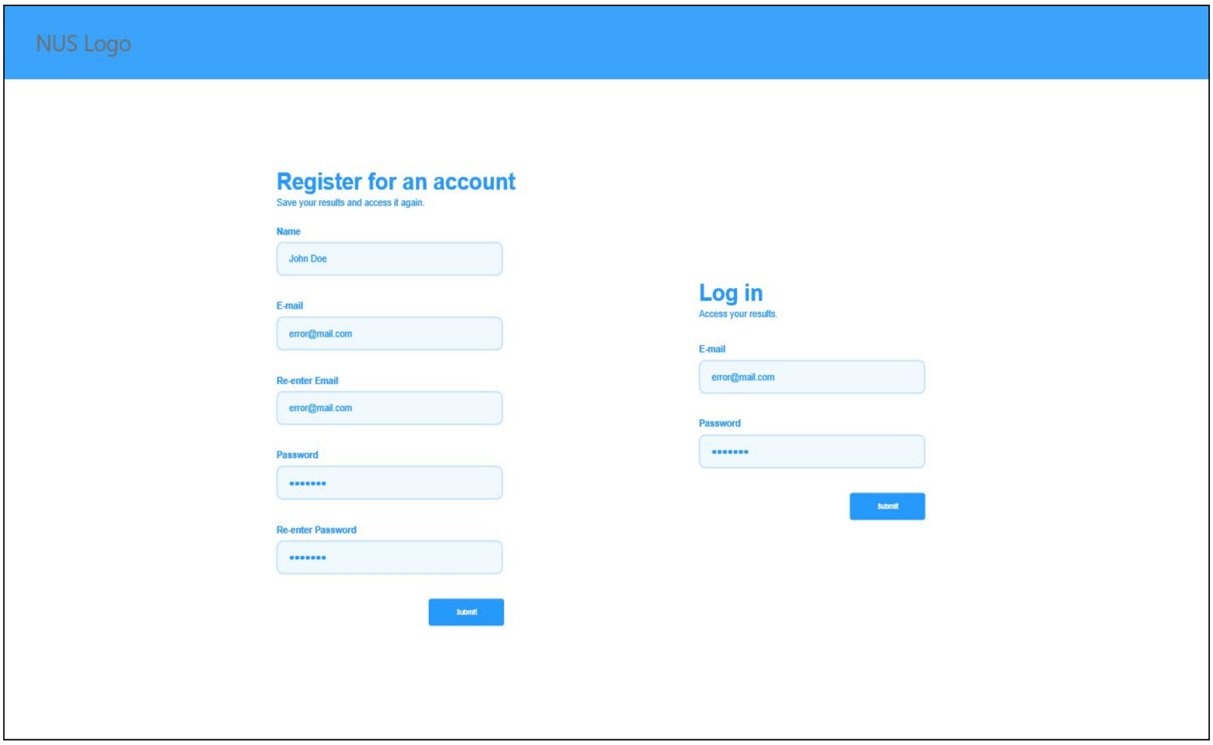

Figure C. Login and registration page

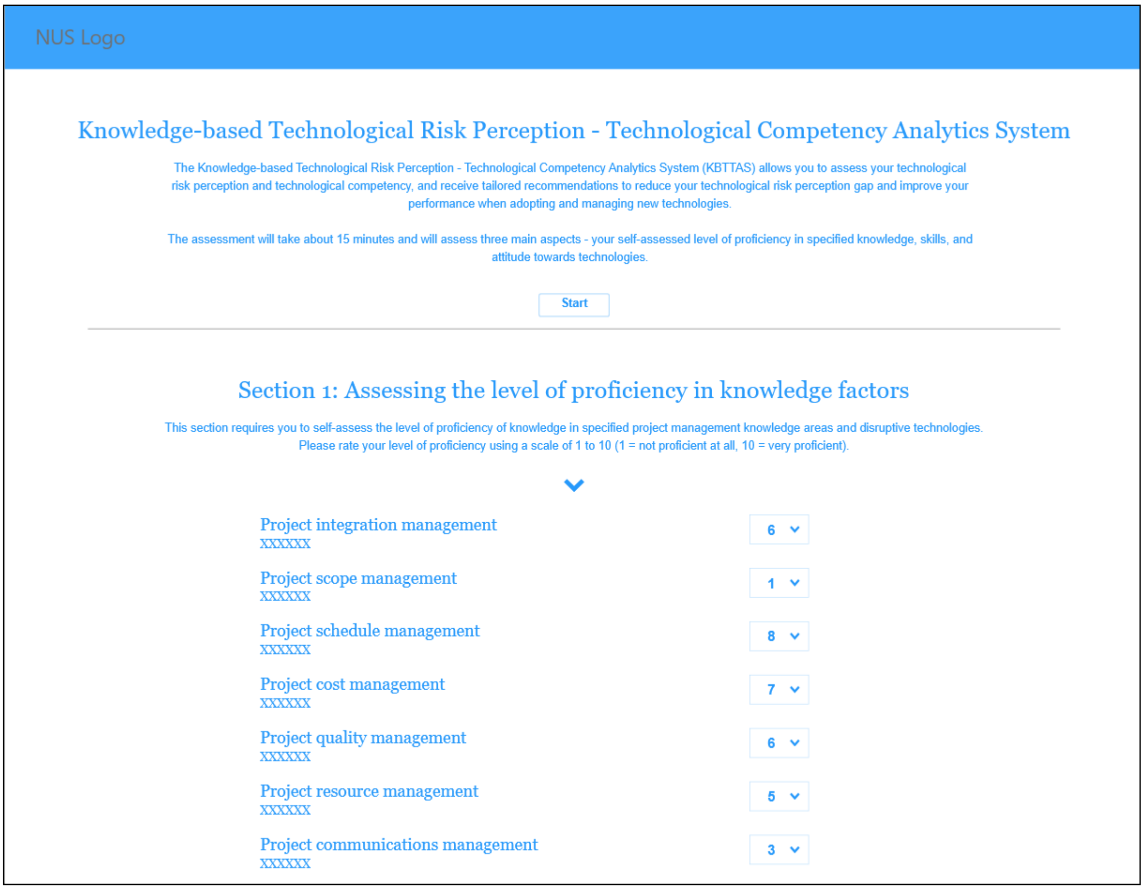

Figure D. Assessment page

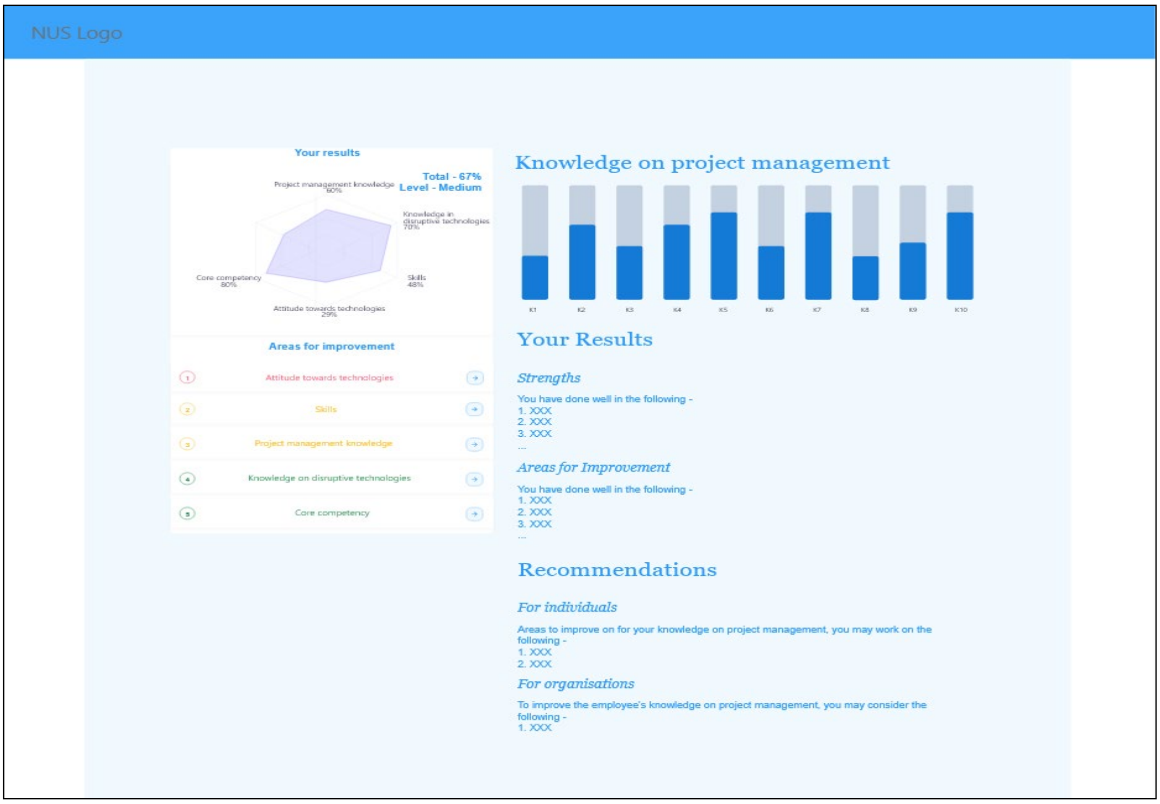

Figure E. Results page

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