



University of
Southampton

Organisational Opportunities and Challenges for HCD Integration in the Maritime Domain

ErgoShip 2023

Dhwani Oakley
University of Southampton
3rd November 2023

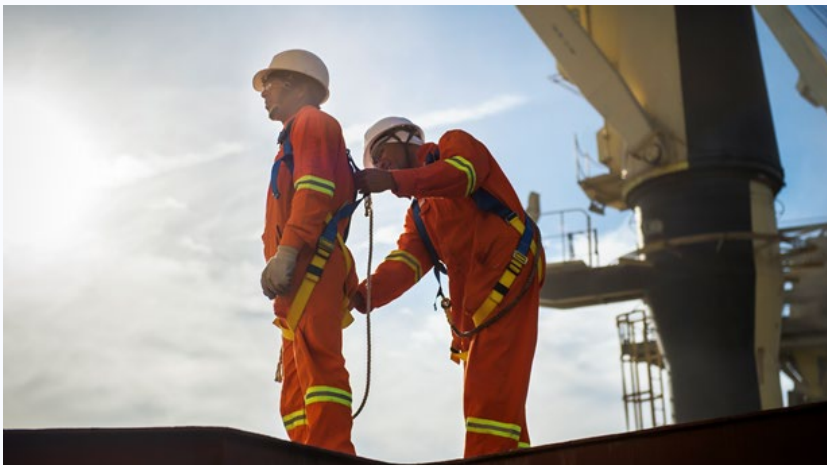
INTRODUCTION

The Error of Human Error

**“80% of maritime accidents are
caused by **human error**”**

THE RESEARCH PROBLEM

Design-Induced Error



Source (Right to Left): 1. Gard, (2023); 2. IMPA (XXXX); 3. Gard, (2014); 4. Marine Insight (2020)

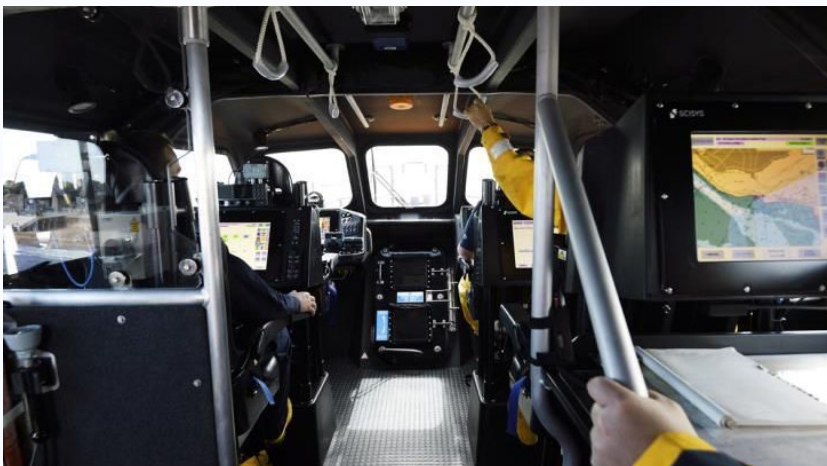
THE RESEARCH PROBLEM

A Vignette



THE RESEARCH PROBLEM

The Current Status of Human-Centred Design in the Maritime Domain



Source (Right to Left):

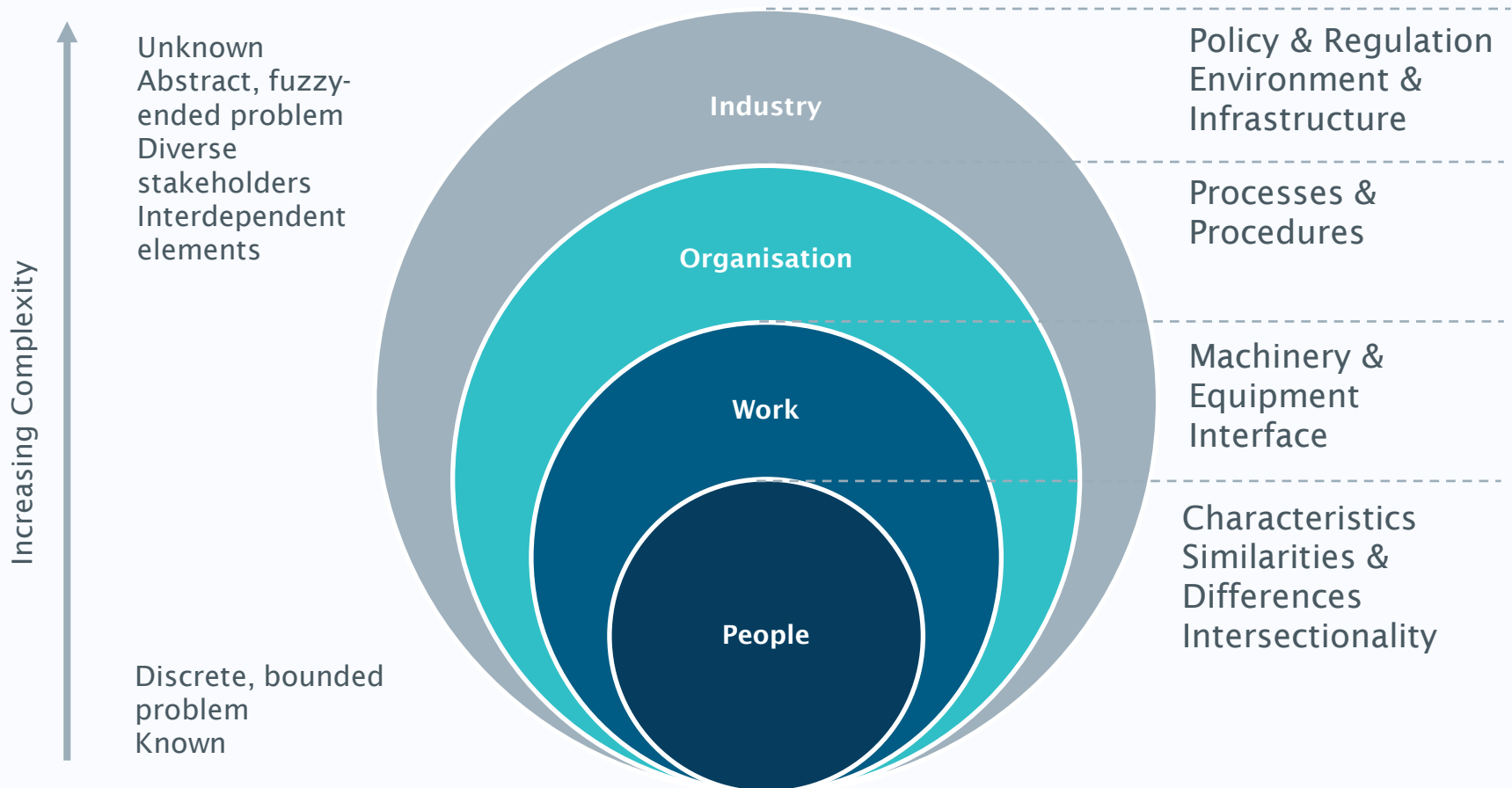
THE RESEARCH QUESTION

Aim and Objectives

1. To **understand** the knowledge, perceptions, and attitudes held by different stakeholders within shipping organisations about adopting a human-centred approach.
2. To **assess** the extent to which shipping organisations currently integrate a human-centred approach into key design, operation, and management activities.
3. To **identify** key opportunities and barriers which impact the integration of a human-centred approach within organisational processes, procedures, and practices.
4. To **develop, implement** and **evaluate** solutions to improve the integration of a human-centred approach across shipping organisations.

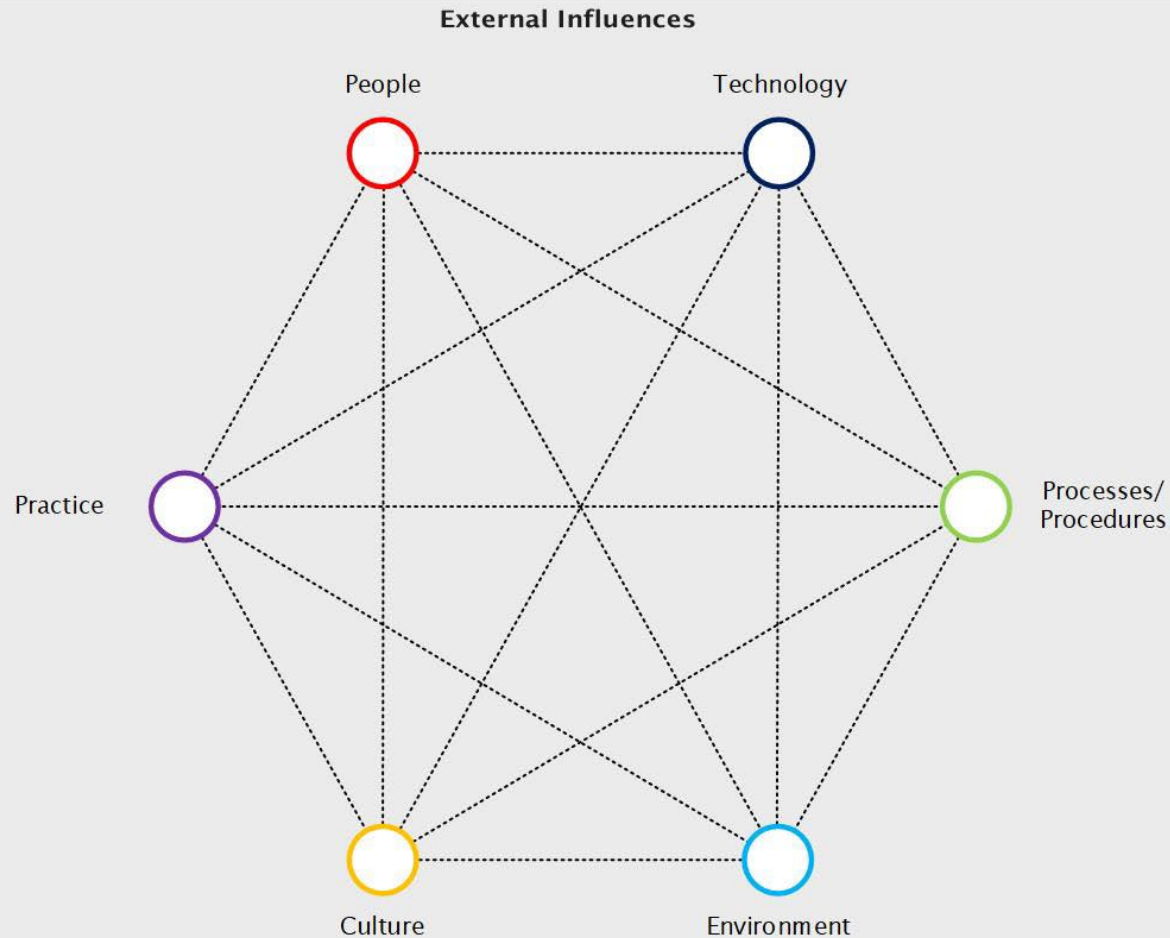
THEORETICAL PERSPECTIVE(S)

A Systems Perspective of HCD



THEORETICAL PERSPECTIVE(S)

The Shipping Organisation as a Sociotechnical System



THE RESEARCH METHOD

Expert Interviews

- 15 semi-structured interviews conducted with personnel working in diverse roles across design, management and operational divisions in order to develop a ‘thick’ description of the organisation and understand:
 1. How human-centred design is perceived within shipping organisations, including knowledge, attitudes, and behaviours.
 2. How human-centred design principles are currently applied within and/or across design, operation, and management activities.

THE RESEARCH CONTEXT

A 'Thick' Description of the Case-Study Organisation

External Influences

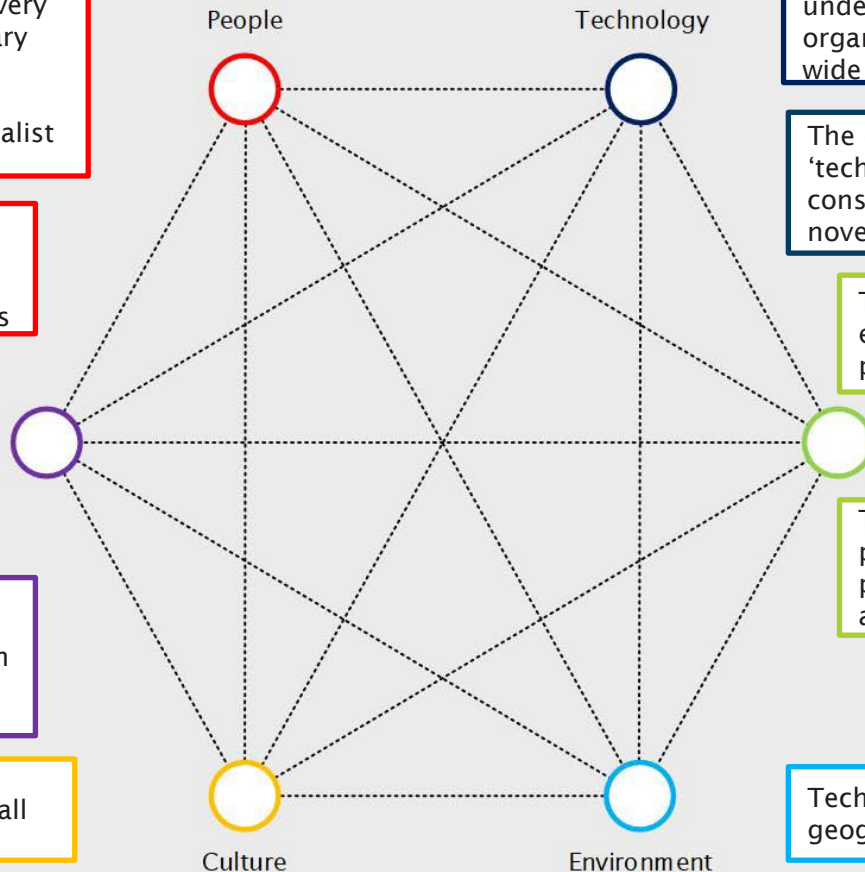
Technical personnel are responsible for project delivery and work in multi-disciplinary teams including project managers, naval architects, marine engineers and specialist advisors.

Operational personnel are responsible for asset management, including safety management systems

H & S personnel are responsible for the organisation's H&S policy, safety compliance and accident investigation.

Communication, collaboration, and knowledge transfer between design and operational teams is limited.

The organisation aspires to achieve 'zero harm' across all its operations.



The technical projects undertaken within the organisation are extremely wide scoping.

The organisation is 'technopositive' and is considered an early adopter of novel technology solutions.

The freedom to innovate is extremely variable from project to project.

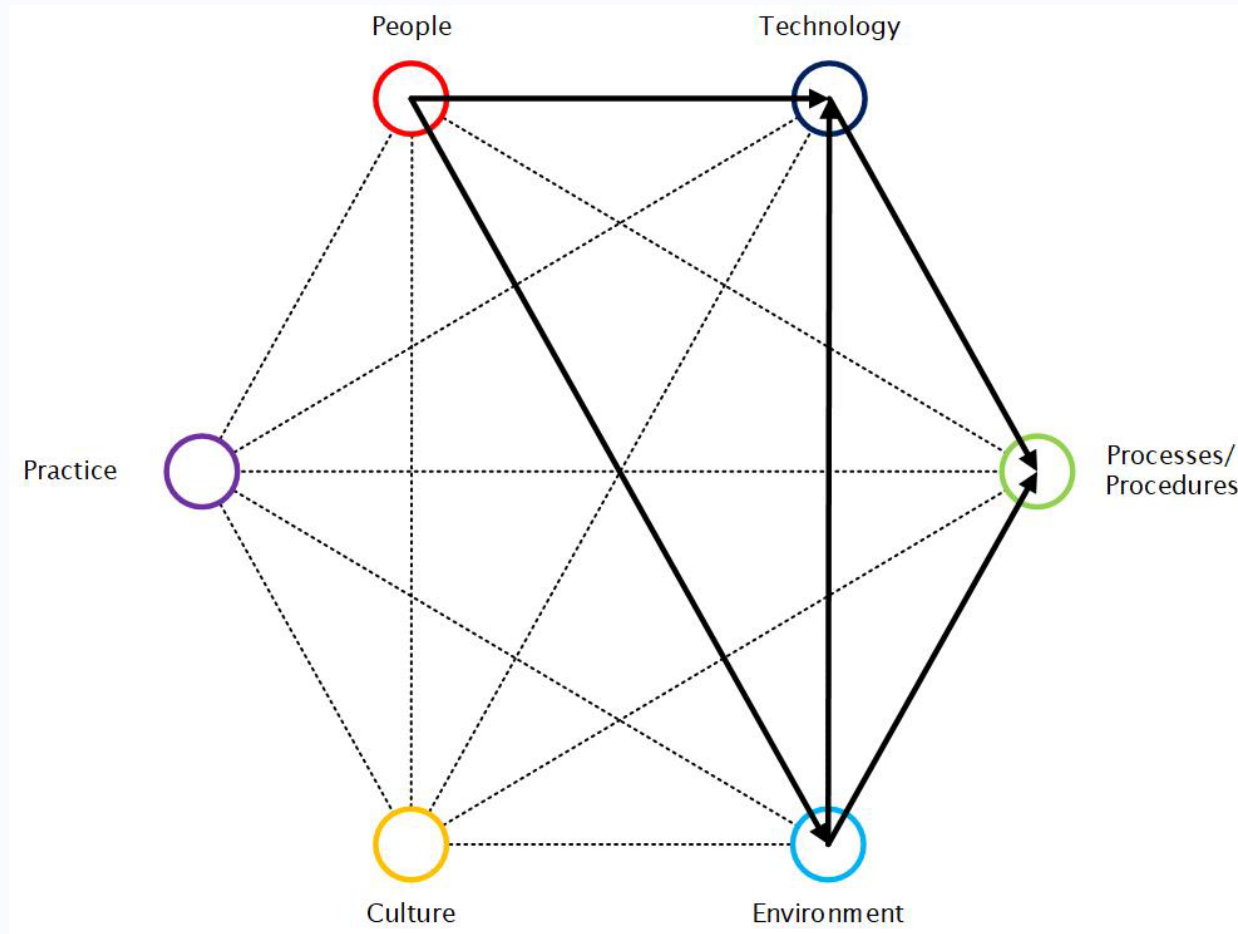
Processes/Procedures

The management processes for technical projects and operational assets are independent.

Technical project are often geographically dispersed.

HUMAN-CENTRED DESIGN IN PRACTICE

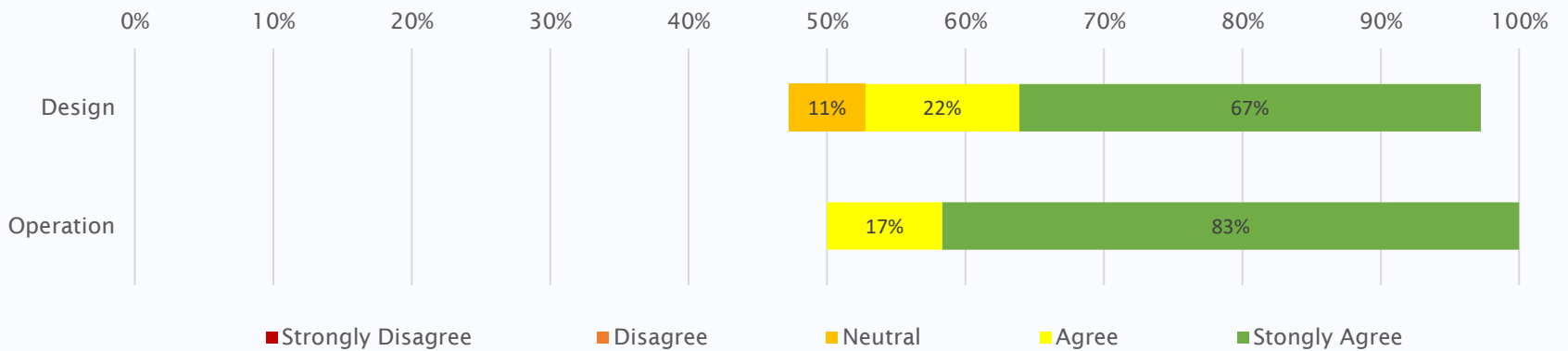
Design and Operational Processes



ORGANISATIONAL PROCESSES

Continuous Improvement

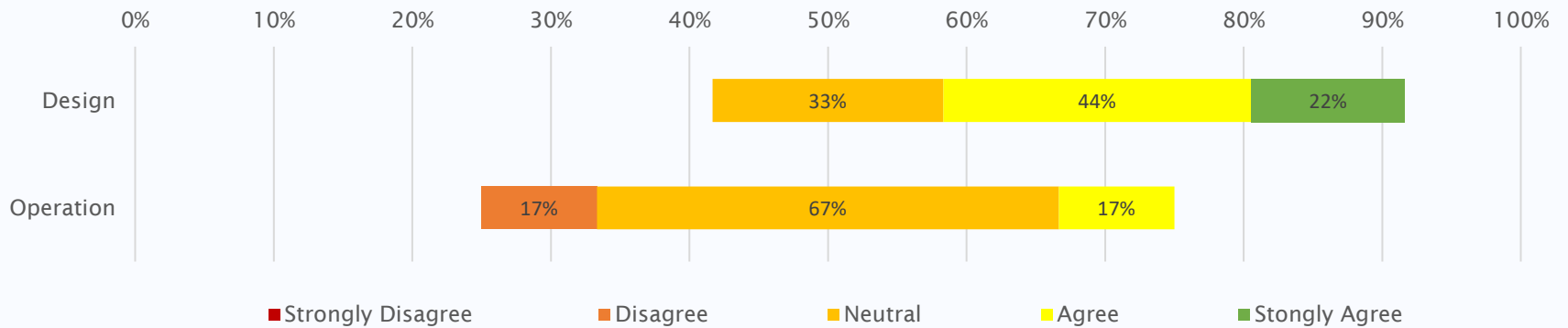
Adopting a human-centred approach promotes continuous improvement



ORGANISATIONAL PROCESSES

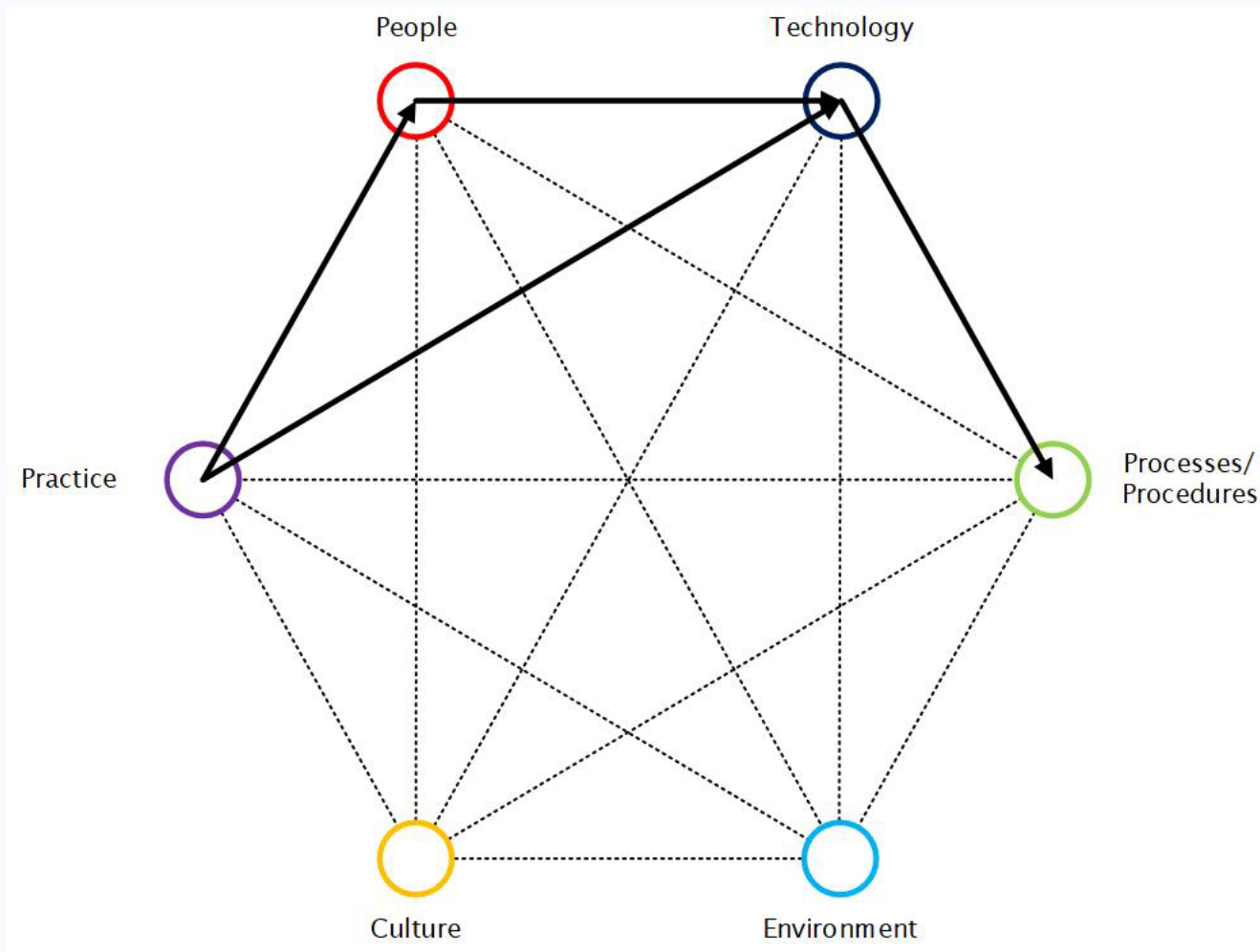
Risk Management

Human-centred design provides a technical basis for risk management



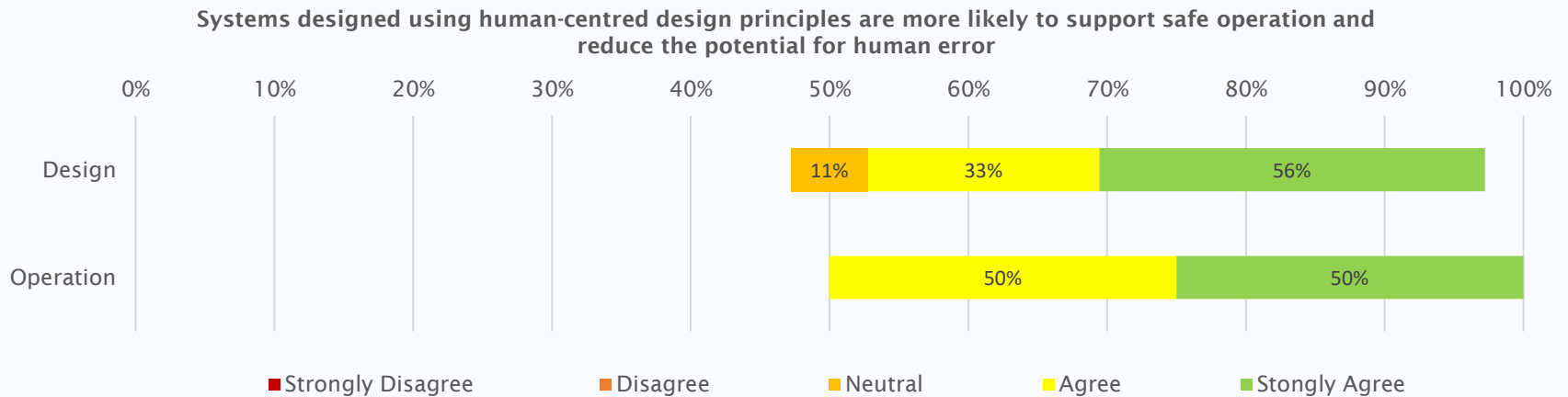
HUMAN-CENTRED DESIGN IN PRACTICE

Engineering Design Practice



PERCEPTIONS OF HUMAN-CENTRED DESIGN

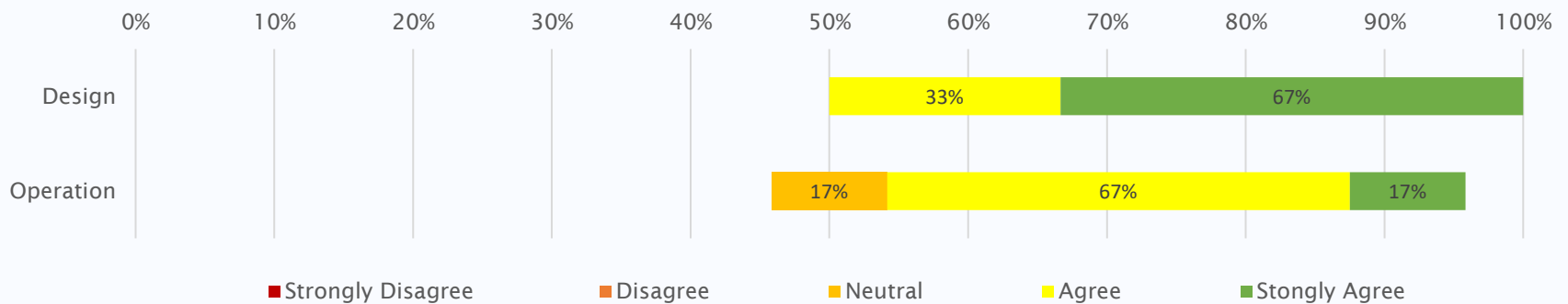
Perceptions of Safety as an Outcome of Human-centred Design



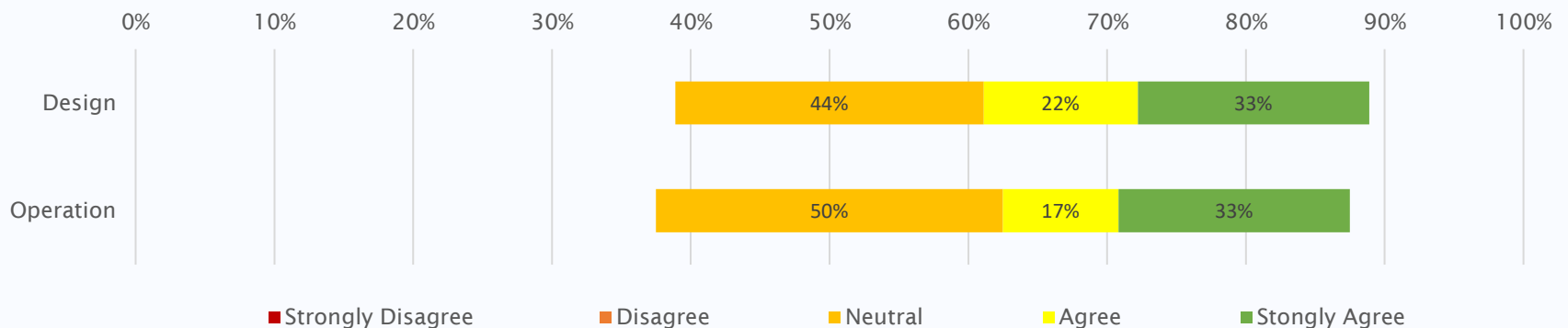
PERCEPTIONS OF HUMAN-CENTRED DESIGN

Perceptions of Usability as an Outcome of Human-Centred Design

Human-centred design improves user satisfaction

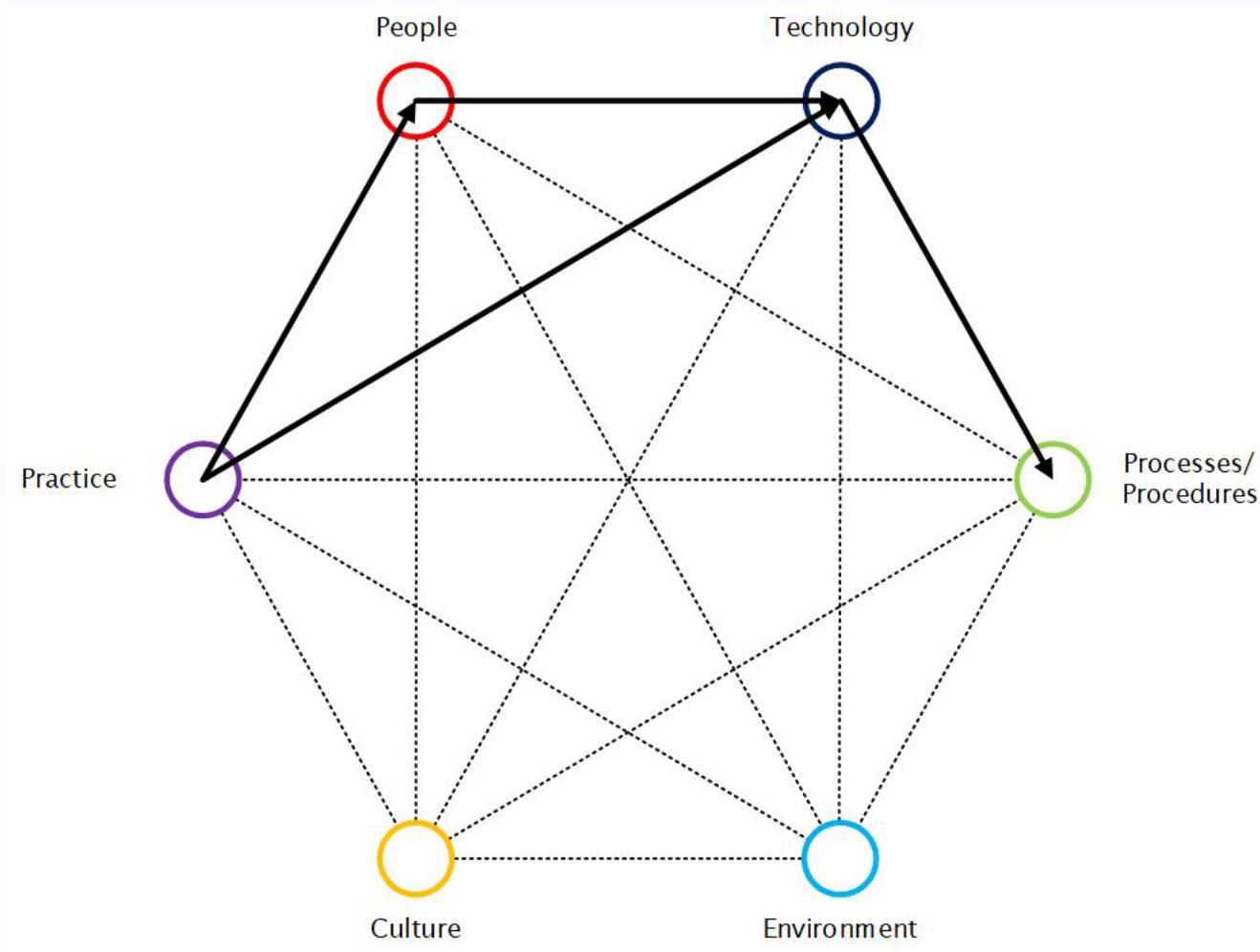


Human-centred design improves system efficiency



HUMAN-CENTRED DESIGN IN PRACTICE

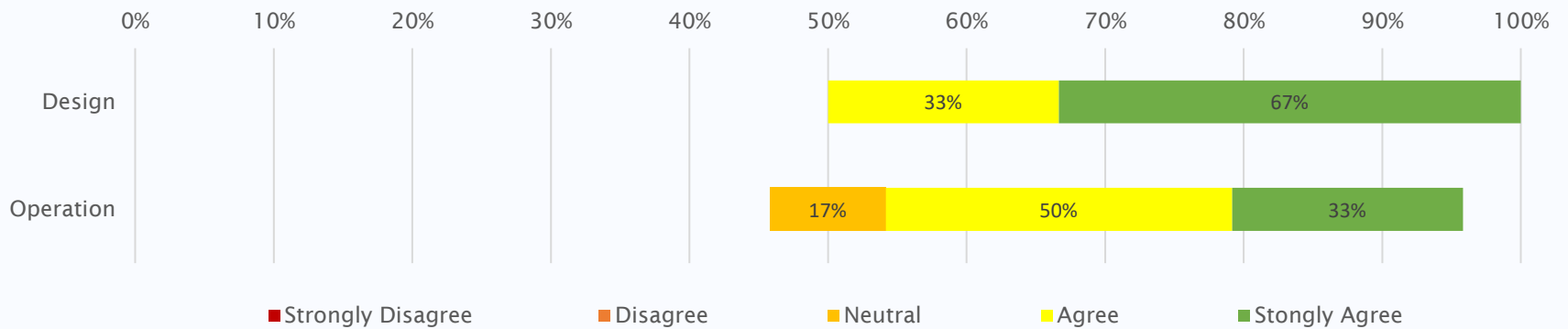
Engineering Design Practice



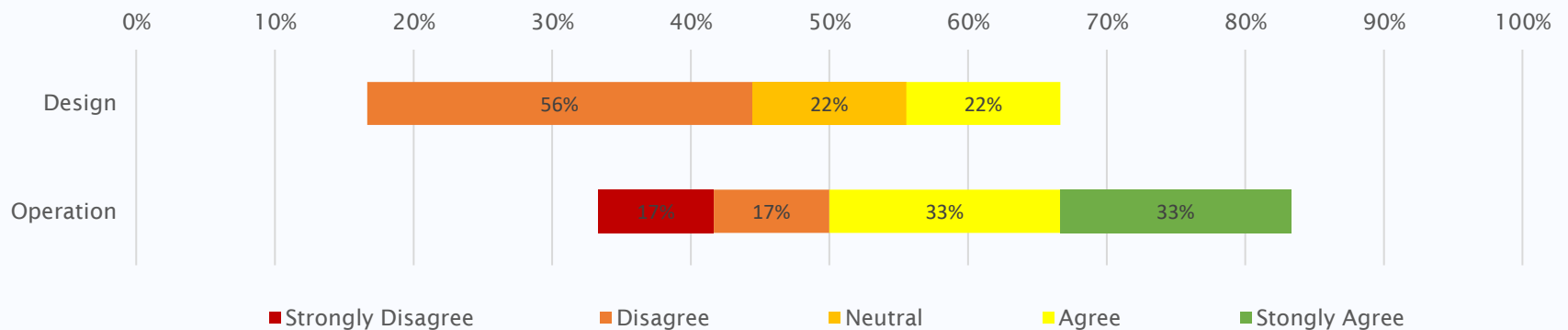
PERCEPTIONS OF HUMAN-CENTRED DESIGN

Perceptions of Other Maritime Stakeholders

A human-centred design is likely to be popular with seafarers

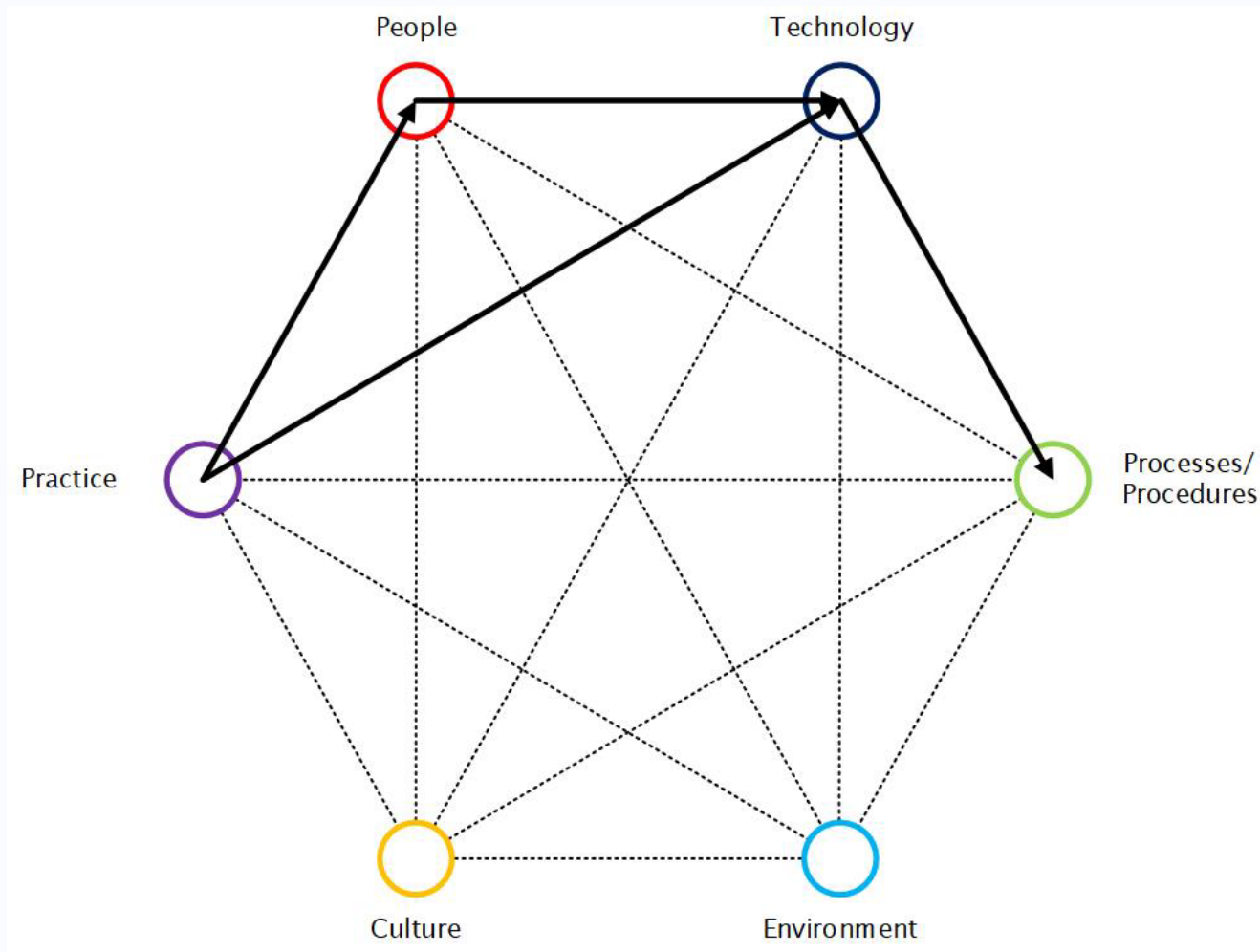


A human-centred design is likely to be popular with shipyards



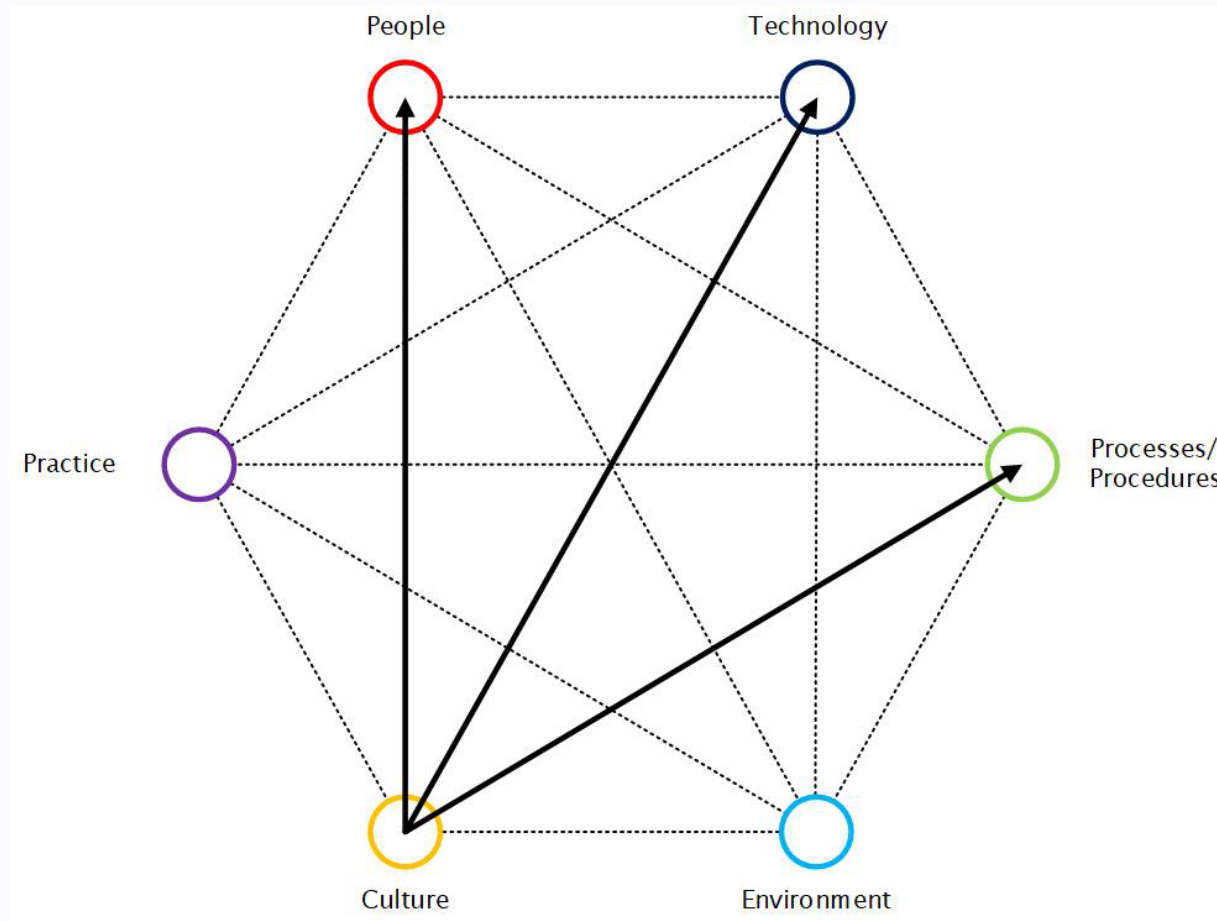
HUMAN-CENTRED DESIGN IN PRACTICE

Engineering Design Practice



HUMAN-CENTRED DESIGN IN PRACTICE

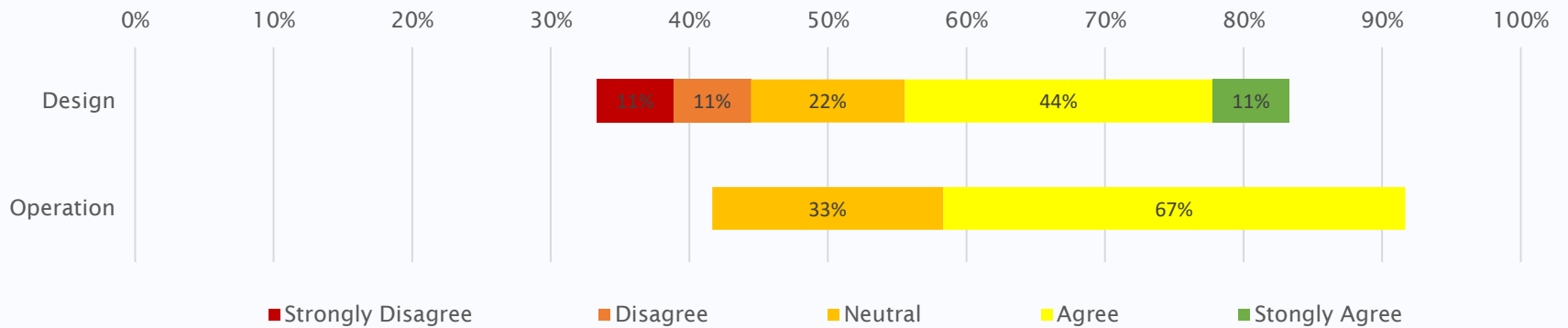
Conflicts in Organisational Culture



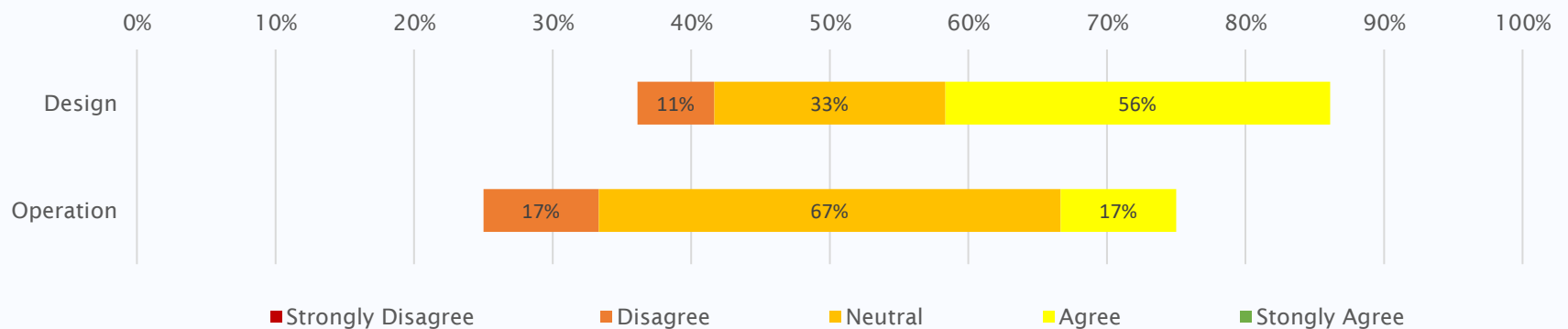
PERCEPTIONS OF HUMAN-CENTRED DESIGN

Perceptions of Cost

Human-centred design is cost-effective

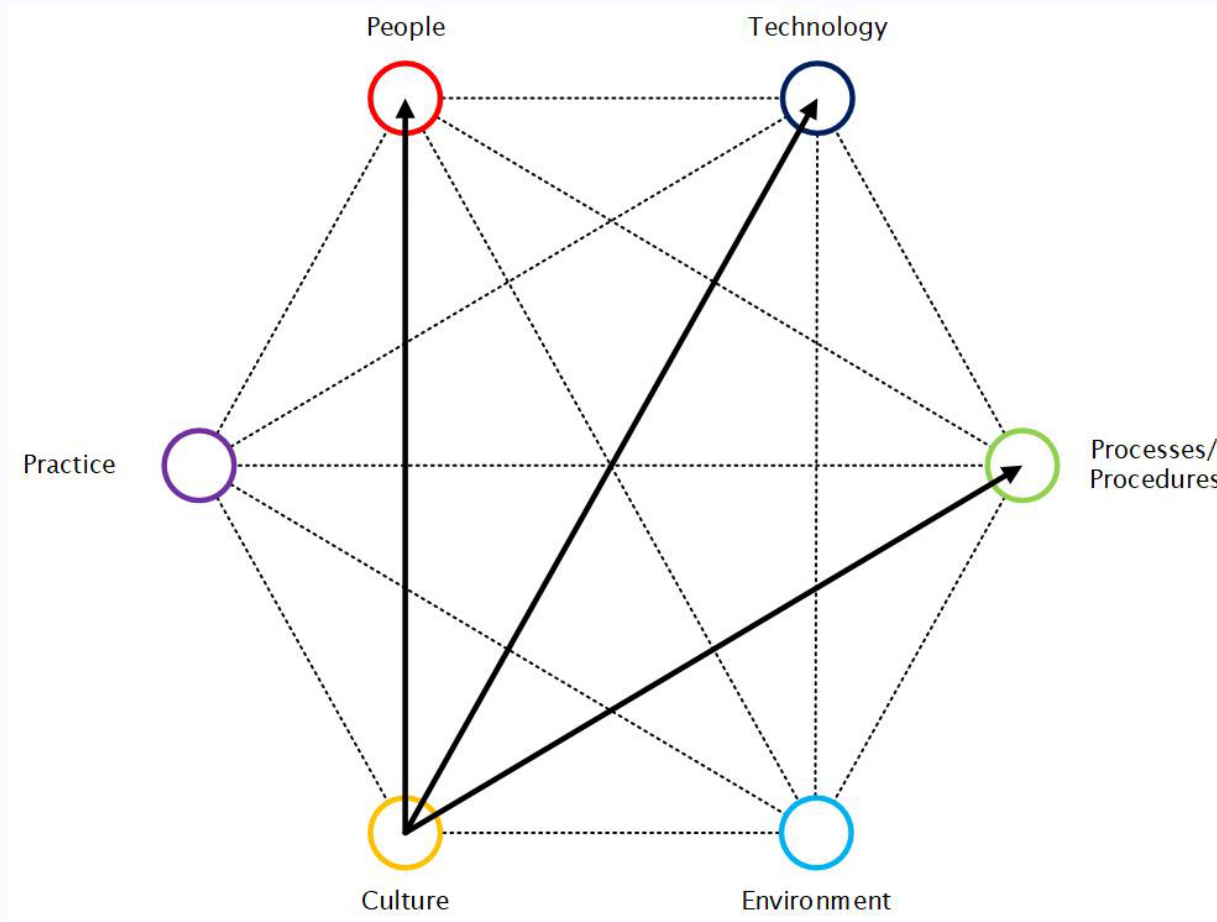


Human-centred design is affordable



HUMAN-CENTRED DESIGN IN PRACTICE

Conflicts in Organisational Culture



CONCLUSIONS

Implications for the Shipping Organisation

- The research has provided insight into ‘work-as-done’ across the ship lifecycle.
- The case study can be generalised to an extent, but further research is needed to understand how engineering design varies across organisations at different scales and sectors.

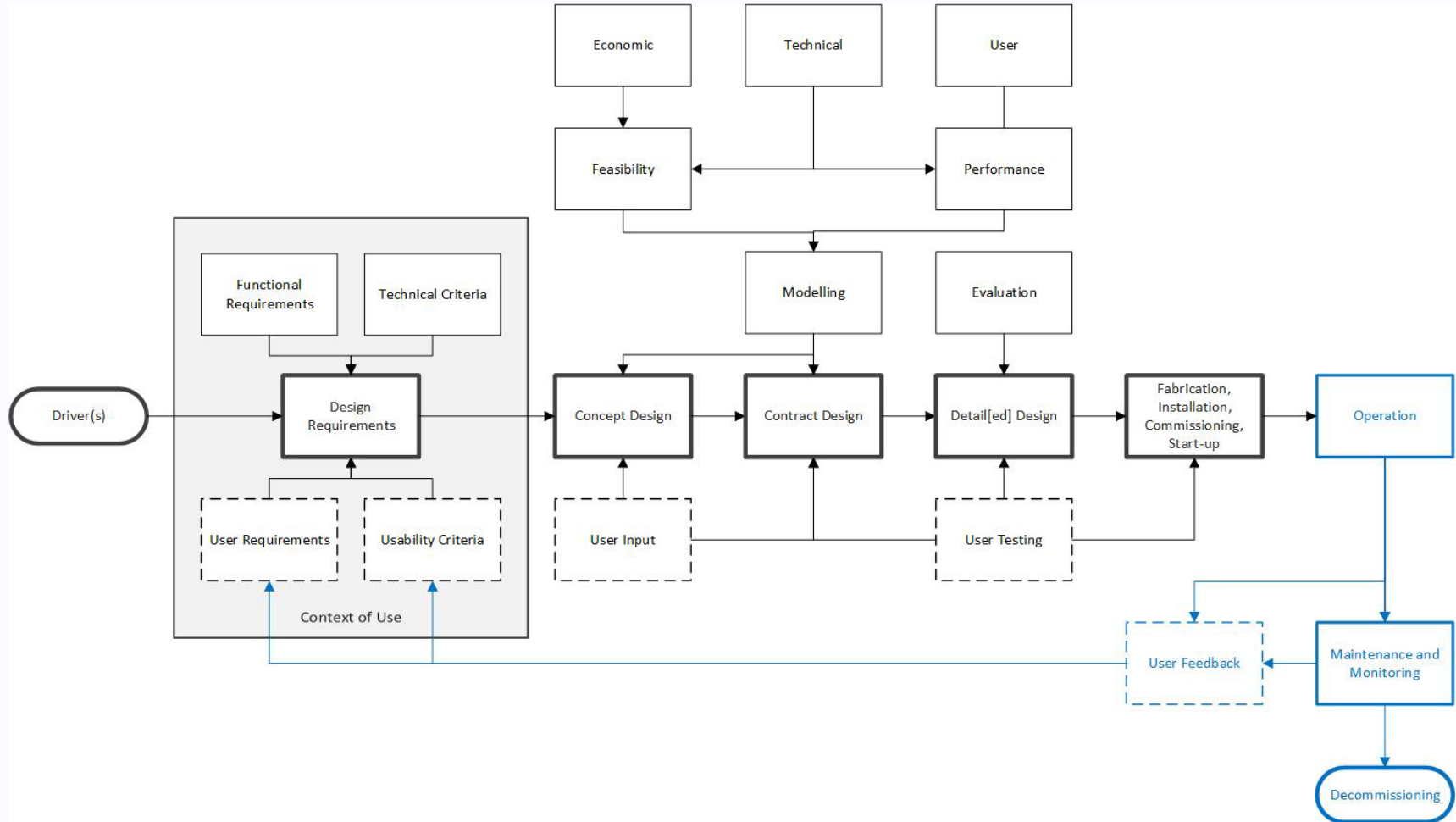
CONCLUSIONS

Implications for the Maritime Industry

- Opportunities and barriers to human-centred design integration go beyond the boundaries of the organisational work system.
- Successful human-centred design integration requires change across all levels of the maritime industry.

NEXT STEPS

Action Planning



REFERENCES

- Brooks, J., McCluskey, S., Turley, E., & King, N. (2015). The Utility of Template Analysis in Qualitative Psychology Research. *Qualitative Research in Psychology*, 12(2), 202-222.
<https://doi.org/10.1080/14780887.2014.955224>
- Davis, M. C., Challenger, R., Jayewardene, D. N. W., & Clegg, C. W. (2014). Advancing socio-technical systems thinking: A call for bravery. *Applied Ergonomics*, 45(2, Part A), 171-180.
<https://doi.org/https://doi.org/10.1016/j.apergo.2013.02.009>
- de Vries, L., Hogström, P., Costa, N., and Mallam, S. (2017), “Designing for safe operations: promoting a human-centred approach to complex vessel design”, *Ships and Offshore Structures*, Vol. 12, No. 8, pp. 1016-1023. doi:
<https://doi.org/10.1080/17445302.2017.1302637>
- Costa, N. A., Holder, E., & MacKinnon, S. N. (2017), “Implementing human centred design in the context of a graphical user interface redesign for ship manoeuvring. *International Journal of Human-Computer Studies*, 100, 55-65. doi: <https://doi.org/10.1016/j.ijhcs.2016.12.006>
- Earthy, J. V., Jones, B. S., and Bevan, N. (2001), “The improvement of human-centred processes—facing the challenge and reaping the benefit of ISO 13407”, *International Journal of Human-Computer Studies*, Vol. 55, No. 4, pp. 553-585.
<https://doi.org/10.1006/ijhc.2001.0493>
- Gaspar, J. F., Teixeira, A. P., Santos, A., Soares, C. G., Golyshev, P., and Kahler, N. (2019), “Human centered design methodology: Case study of a ship-mooring winch”, *International Journal of Industrial Ergonomics*, Vol. 74, pp. 102861. doi:
<https://doi.org/10.1016/j.ergon.2019.102861>
- Geertz, C. (1973). Thick Description: Towards an Interpretive Theory of Culture. In C. Geertz (Ed.), *The Interpretation of Cultures*. Basic Books.
- Grech, M., Horberry, T., & Koester, T. (Eds.). (2008). *Human Factors in the Maritime Domain* (1st ed.). CRC Press.
<https://doi.org/https://doi.org/10.1201/9780429355417>

REFERENCES

Hale, A., Kirwan, B., & Kjellén, U. (2007). Safe by design: where are we now? *Safety Science*, 45(1), 305-327.
<https://doi.org/https://doi.org/10.1016/j.ssci.2006.08.007>

Mallam, S. C., Lundh, M., and MacKinnon, S. N. (2015), Integrating human factors & ergonomics in large-scale engineering projects: Investigating a practical approach for ship design”, *International Journal of Industrial Ergonomics*, Vol. 50, pp. 62-72.
<https://doi.org/10.1016/j.ergon.2015.09.007>

International Organisation for Standardisation, (2019), ISO 9421-210: 2019 Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems, International Organization for Standardization, Geneva.

Vu, V. D. and Lutzhoft, M. H. (2020), “Improving human-centred design application in the maritime industry – Challenges and Opportunities”, *Human Factors in Ship Design and Operation*, Royal Institute of Naval Architects, London, UK.

ACKNOWLEDGEMENTS

This work was supported by Shell Shipping and Maritime under the Centre for Maritime Futures partnership. For further information on the work of the Centre for Maritime Futures, please see [here](#)



ANY QUESTIONS?

If you have any further questions please don't hesitate to contact Dhwani Oakley at d.d.oakley@soton.ac.uk