

## Part B1#@APP-FORM-HEMSCAPF@#

### 1. Excellence #@REL-EVA-RE@#

#### 1.1 Quality and pertinence of the project's research and innovation objectives #@QUA-LIT-QL@#

##### 1.1.1 Introduction

This research project examines how costume professionals, specifically costume makers, respond to new manufacturing technologies. Costume manufacturing technologies are the tools, equipment and processes used to turn sketches or design ideas into finished garments. As it stands, costume manufacturing predominantly relies on well-established technologies such as the sewing machine and even needle and thread. However, as the world experiences its fourth industrial revolution, commonly known as Industry 4.0, like many artisanal professionals, **costume makers internationally are beginning to engage with Industry 4.0 (I4.0) technologies**, such as virtual patternmaking software and 3D printing.

Such technologies are digitising previously analogue processes, enabling distributed production, mass customisation and sustainable sampling. These characteristics closely align with the processes of costume construction, which is usually custom-made for a specific performer and stage production. Industry 4.0 (I4.0) manufacturing technologies can improve time and resource use and thus have a strong potential to enhance the workflow and workplace well-being of the profession. However, currently, there is an **intellectual and industry discourse that suggests the work of costume makers**, the people who realize costumes for the stage, **is technologically static**. This attitude limits investment in new equipment, training, and resourcing for this cohort, which needs to be addressed for sector renewal. Going beyond this significant professional necessity, this **discourse reflects deeply entrenched but frequently unconscious systematic gender biases** in industry and academia that need to be exposed and addressed.

Using the adoption in costume practice of two Industry 4.0 technologies, **virtual patternmaking** software and **3D printing**, as **case studies**, this project will employ **practitioner interviews and digital ethnography** to: a) investigate and map the barriers to uptake of these technologies; and b) to develop a holistic model that facilitates the adoption of new technologies in the costume industry. This model will draw on **technological adoption and diffusion theories**, intersecting them with the specific operational and institutional structures of live performance production. This interdisciplinary methodology is a novel approach for the field; thus, this research is **methodologically cutting edge**. The structures of live performance, such as collaborative hierarchies, production timelines or employment conditions, frame and sometimes constrain costume work. The model and surrounding findings will be then translated using co-design methods into a suite of industry-targeted planning tools. Researching Technological Innovations in Costume Practice (TICP) is crucial for enabling costume professionals and the companies that employ them to understand the challenges of applying new technologies, and to provide resources to eventually overcome them. Beyond these innovative objectives for industry, as one of the first studies of theatre production technologies to apply theories of technological adoption, this research will **break new ground across the broader discipline of performance studies** and advance conversations in the field significantly.

I will move from Australia to **Aalto University** (Aalto) in Finland, to complete this fellowship. As a world-leading design research institution hosting the **most prominent and active costume research group in Europe**, Aalto provides the necessary disciplinary guidance, research expertise, and access to extensive international costume research and practice networks that this project requires. The fellowship builds on my past research and professional expertise in costume for live performance. This project supports my development as an academic and will position me as an internationally respected researcher in the emerging field of theatrical production and technical craft.

##### 1.1.2 Aims and Objectives

By addressing the central research question: *As costume practitioners implement new manufacturing technologies in their workflow, what are the structural and attitudinal factors that constrain and facilitate their adoption?* the project aims to improve researchers' knowledge of costume practice and to propose tools for costume industry professionals to adopt new technologies in their work. To achieve this aim, the project addresses four research objectives (RO):

- RO1: **Examine the experiences of costume professionals** in response to two Industry 4.0 technologies (virtual patternmaking software and 3D printing) using theories of technological adoption.
- RO2: Using the findings of RO1, **create a model** that facilitates technological adoption in live performance costume production; by

- a. **Identifying** how the **operational and institutional structures and biases** of the live performance industry intersect with the adoption of new technologies; and
  - b. Identifying **consistent barriers and enablers** of 14.0 adoption and how these are navigated by costumers.
- RO3: Using knowledge gained from RO1 and RO2, **co-design with practitioners industry-targeted resources (a suite of planning tools)** that facilitate the adoption of new manufacturing technologies in live performance costume.
- RO4: **Disseminate research results**, in the form of scientific knowledge and industry resources (planning tools) to researchers and industry practitioners, enabling them to evaluate and exploit them.

### 1.1.3 State of the Art

While a rapidly growing research discipline with rich theoretical tools, costume studies tend to focus on the “visual and finalised aspects,” rather than its core collaborative practice, as noted by Pantouvaki and McNeil.<sup>1</sup> Essin explains that backstage professionals and their work are “mostly overlooked, misunderstood, or deemed unworthy of examination” in performance studies scholarship.<sup>2</sup> The demand for research on costume craft, expressed by Monks in 2014,<sup>3</sup> remains partially addressed by recent studies into collaboration, communication, and material processes, but the impact of technological innovation in costume practice is still insufficiently addressed to date. My past research suggests this is due to an industry discourse that positions costume as less technically innovative than domains such as lighting, sound, or stage design.<sup>4</sup> Contributing to this perspective is the identification of costume as a potentially anachronistic craft practice using Industry 1.0-3.0 technologies such as the sewing machine; the fact that costume frequently adopts existing technologies from the fashion industry, despite having its own goals and methods of production; and the professional values which suggest costume is meant to recede in favour of character and story.<sup>5</sup> Overarching all of these factors is the fact costume work is notably gendered and feminised and due to this, has been undervalued creatively, culturally and financially.<sup>6</sup> The systematic devaluing of ‘female professions’ is a crucial reason technological innovation in costume practice is overlooked. Evidence of this can be found in the recent Erasmus+ project A CANON of Theatre Technical History, which saw significant EU investment in research and teaching infrastructure on the history of theatre technologies, including stage machinery and lighting technologies, but completely ignored costume. Building a model and resources accessible by researchers and practitioners that combats theoretically and practically such elisions regarding technology, which is too often considered a masculine domain, is the ambitious goal of this project.

This specific project will progress the state of the field. Currently, research on technology in costume practice focuses on design rendering tools and processes for animated and 3D rendered costumes for the screen, whether movie or gaming or returns to the visual and finalised aspects by exploring the scenographic possibilities of new technologies on stage.<sup>7</sup> There are basic handbooks instructing on design software for costume rendering and patternmaking, but no critical scholarship investigating the impact of technological innovations in costume manufacturing or the experiences of practitioners using it or seeking to. There are considerable barriers, whether practical (e.g., time, resources, cost, or training) or attitudinal (whether from costume practitioners themselves, or the broader performance industry including their collaborators, employers and managers) that make the development of such a model more urgent.

The proposed model must respond to theatre’s specific structures and processes to be valuable. For example, in the Q&A following a research presentation about the results of using virtual patternmaking software Clo3D in costume practice, Sbrizzi mentioned that precariously employed pattern cutters called and asked the permanently employed practitioner-researchers to halt their project based on the long-term threat it posed to their jobs. While this response

<sup>1</sup> Pantouvaki, S, and P. McNeil. 2021. *Performance Costume: New Perspectives and Methods*. London: Bloomsbury, p. 2.

<sup>2</sup> Essin, C. 2021. *Working Backstage: A Cultural History and Ethnography of Technical Theater Labor*. Ann Arbor: University of Michigan Press, p. 9.

<sup>3</sup> Monks, A. 2014. “In Defense of Craft: A Manifesto.” Scene 2 (1–2): 175–78.

<sup>4</sup> Taylor, M. 2021. “Technical Skill, Emotional Intelligence, and Creative Labour: The Collaborative Work of Costume Realisation.” PhD.; University of Melbourne.

<sup>5</sup> Bruzzi, S. 1997. *Undressing Cinema: Clothing and Identity in the Movies*. London; New York: Routledge; Monks, A. 2010. *The Actor in Costume*. Basingstoke: Palgrave Macmillan.

<sup>6</sup> Grimshaw, D, and J. Rubery. 2007. *Undervaluing Women’s Work*. Equal Opportunities Commission Working Papers 53. Manchester: Equality and Human Rights Commission, p.7; Essin, C. 2021. *Working Backstage: A Cultural History and Ethnography of Technical Theater Labor*. Ann Arbor: University of Michigan Press, p. 52, 187; Kodicek, C. 2022. “Lack of Transparency over Salaries Is Fuelling the Gender Pay Gap.” *The Stage*. April 21, 2022.

<sup>7</sup> E.g., Kalmakurki, M. 2021. *Digital Character Costume Design in Computer-Animated Feature Films*. Helsinki: Aalto University; Salomaa, H. 2018. *Video Games and Costume Art - Digitalizing Analogue Methods of Costume Design*. Masters, Aalto University; Plummer, B, E.A. Sanders, and F. Baytar. 2017. “The Rise of Online Digital Textile Printing Services and its Impact on Costume Design Practice.” *International Textile and Apparel Association Annual Conference Proceedings* 74 (1). Scully, L. 2017. 3D-Printed Costumery Creates Juxtaposition between Culture, Theater, and Tech. *Machine Design*. November 10, 2017. Dicketmüller, Y. 2021. *3D-Printed Theatre Costumes, Digital Theatre Projects*. Collings, J. S. 2016. *Laser and Waterjet Cutting for Theatrical Costumes*. Thesis, Austin: University of Texas. Sbrizzi, C, K. Spallin, E. Sutherland, and M. Bygate. 2022. *Digital Patterning in Costume Production* World Stage Design. Calgary, August.

may be dismissed as Luddism, applying domestication theory which suggests technologies can be perceived as both a threat and an opportunity<sup>8</sup> immediately prompts consideration of correlations between employment conditions and the responses of practitioners to technological developments. Relatedly, costumers frequently mention lifelong learning as an intrinsic reward of the profession,<sup>9</sup> an orientation that can be leveraged to enable deployment. Such nuances must be understood and factored in if the model is to help practitioners navigate the deployment of new manufacturing technologies in their specific context.

## 1.2 Soundness of the proposed methodology

### 1.2.1 Overall methodological soundness and integration of methods and disciplines

To examine the structural and attitudinal factors that constrain and facilitate the incorporation of new manufacturing technologies into professional costume practice, this research combines qualitative data collection, in the form of practitioner interviews and digital ethnography, with theories about sociotechnical change, specifically domestication and innovation diffusion theories. Domestication theory considers both the symbolic and practical aspects of adopting new technologies, such as emerging meanings or changes to routines and examines the role of users in innovation.<sup>10</sup> Similarly, Roger's well-regarded diffusion theory addresses the elements of influence (the innovation itself, adopters, communication channels, time, and surrounding social system) and the process of decision-making (awareness, interest, evaluation, trial, and adoption).<sup>11</sup> These two theories inform the research design including data collection, coding, and analysis, and when combined with costume and theatre production theory, also the model development. Integrating the two different disciplinary perspectives of costume and sociology, specifically technology and innovation studies, enables research originality, rigour, and potential transferability of findings. As a new approach for costume, and live performance research broadly, it responds to the need to diversify methodologies in the field<sup>12</sup> and further ensures this research goes beyond the state-of-the-art.

RO1 examines the experiences of costume professionals with the two new technologies used as case studies for the research, 3D printing and virtual patternmaking. To begin, literature and contextual reviews regarding theories of technology and innovation diffusion and current I4.0 technologies in practice and research will provide a foundation for the data collection and subsequent analysis. The data required for the research will come from two key external sources: Interviews with purposively sampled costume makers who are early adopters of I4.0; and digital ethnography (DE) in online costume networks, such as the Costume Networking Group on Facebook, in which practitioners share their work in progress and crowdsource construction advice. The DE will provide clues to barriers and facilitators of two case study technologies, which can be explored in detail in the interviews. Crucially, DE will facilitate analysis of attitudes to the technologies by both users and non-users. Further, DE will enable a longitudinal content analysis of diffusion, via frequency of mention, types, and kind of use. I currently have basic training in both I4.0 technologies but will receive advanced training at AALTO Studios to better inform my interview questions and overall investigation.

Developing a model for technological adoption in live performance costume production (RO2) will rely on conducting a qualitative content analysis of the semi-structured interviewing and digital ethnography data. The triangulation of data collected through these two methods will generate findings about symbolic and practical elements of influence in decision-making regarding technology adoption. Then, the two socio-technological theories named above in conjunction with the operational and institutional structures of live performance (e.g., power hierarchies, employment arrangements, and production routines) drawn from contextual review and my past expertise will be used as analytical frameworks for this content analysis and subsequent model structure.

RO3 seeks to transform the scientific findings of RO1 and RO2 into industry-targeted resources. These will be created using co-design methods in workshops with local costume professionals in Finland, Aalto costume staff and students, and Costume in Focus (CiF) practitioner-researchers. This will draw on Aalto's strong connections with national associations of theatre professionals. The expected output of the co-design workshops is a suite of planning tools. Working under the assumption that explicating and understanding the barriers, enablers and structures that surround the adoption of new technology will help people navigate them, these planning tools will help companies and

<sup>8</sup> Baym, N.K. 2015. *Personal connections in the digital age*. John Wiley & Sons, pp 44–49

<sup>9</sup> Taylor, M. 2021. "Technical Skill, Emotional Intelligence, and Creative Labour: The Collaborative Work of Costume Realisation." PhD.; University of Melbourne.

<sup>10</sup> Silverstone, R, E. Hirsch (Eds.) 1992. *Consuming Technologies: Media and information in domestic spaces*. London/New York: Routledge; Williams, R., Stewart, J, Slack, R. 2004. *Social Learning in Technological Innovation*, Cheltenham, Edward Elgar.

<sup>11</sup> Rogers, E. M. 2003. *Diffusion of Innovations*, 5th Edition. New York: Free Press.

<sup>12</sup> Pantouvaki, S, and P. McNeil. 2021. *Performance Costume: New Perspectives and Methods*. London: Bloomsbury, p. 1.

individuals self-assess their receptiveness to and readiness for technological change, and then develop a plan for how to integrate technologies smoothly and progressively into their practices.

RO4 focuses on research dissemination for scientific and end-user exploitation. I will lead two research-sharing initiatives to test the model and resources proposed by TICP. The first will be a **panel and workshop for World Stage Design (WSD) 2025**, an international quadrennial event for performance design professionals supported by the OISTAT Costume Sub-commission. At this multi-speaker panel, I will share the project results, while selected costume professionals using I4.0 technologies will present their work. The panel will display the I4.0 technology's use, value, and complexity, and establish the crucial need for this research. This will be followed by an interactive workshop, which will share the suite of planning tools and professionals will learn to apply them. Piloting the tools in this forum will enable their evaluation and testing by both researchers and practitioners. The second initiative is developing a **book proposal for an edited volume**. During the fellowship, I will distribute a Call for Proposals (CfP) for book contributions, select potential authors, help shape their chapter abstracts, and develop a sample introduction and the proposal document itself for submission to an international publisher.

### 1.2.2 Diversity considerations including gender

This research, partly driven by a need for research justice for a feminised field and workforce, must be acutely aware of the gender dimension of any research activity. The project aligns with AALTO's Equity, Diversity and Inclusion plan and embeds consideration of gender-based and international diversity in its selection of research contributors and participants. Recognising the importance of a plurality of voices, participant recruitment will seek women, men, and gender-diverse people for participation proportionate to their occupational representation,<sup>13</sup> and analysis will consider gender-based dimensions. To avoid perpetuating the feminisation of the costume field, gender-inclusive language will be used for any research communication, content, and final book. While the research will be carried out and published in English, leveraging existing international networks will provide geographic and professional cultural diversity to the project.

### 1.2.3 Open science

Following the FAIR principles, field-appropriate Open Science (OS) practices are implemented throughout the project. During the project development, these include the early distribution of newsletter items to costume advocacy groups and the book Call for Proposals (CfP) via research mailing lists and boards to prompt engagement and questions about the research for industry and peer feedback. As the project progresses, knowledge-generating activities such as interviews and digital ethnography will themselves disseminate the ideas of TICP much earlier than formal publication methods, inviting and enabling practitioner input. I will also progressively share research progress and findings for open peer feedback, using Aalto and discipline-specific events and platforms such as Costume and Research in Finland, WSD 2025, and the seminar-provocation format of the International Federation of Theatre Research annual conference for work-in-progress. Finally, OS in the dissemination phase includes ensuring all scientific publications are open access; communicating research findings on industry platforms in co-designed accessible and useful formats; and publishing the interview research data on the European Open Science Cloud (EOSC). For this, I will be guided by Aalto's research data management guidelines. The project Data Management Plan is deliverable 1.1 of the project.

## 1.3 Quality of the supervision, training, and the two-way transfer of knowledge between the researcher and the host

### 1.3.1 Supervision

Prof. Sofia Pantouvaki (supervisor), has led a distinguished career with over 120 research outputs including celebrated books and articles, as well as creative works including over 90 designs for theatre, film, opera and dance productions in Europe and the curation of many international exhibits. Pantouvaki's publications cover costume history, technologies, sustainability, and performance. Throughout this research is an agenda of explicating professional costume practice, a perspective that is core to TICP. Pantouvaki's internationally recognised expertise, leadership and contributions to the costume field are seen in numerous research projects, prizes and accolades. She has led significant initiatives for the development of costume research and scholarship, including founding *Costume in Focus* (2013), the first research group on performance costume, and led the Academy of Finland-funded research project *Costume Methodologies*. She is a founder and Chair of the international research network *Critical Costume*, and a founding editor of the international peer-reviewed journal *Studies in Costume and Performance*, both of which

<sup>13</sup> My past research suggests approx. 80% of costume professionals are female. Taylor, M. 2021. "Technical Skill, Emotional Intelligence, and Creative Labour: The Collaborative Work of Costume Realisation." PhD, Melbourne: University of Melbourne. p. 63.



are important resources for TICP. An expert on costume practice with a deep understanding of developing methodologies for costume research<sup>14</sup> and a critical force in the field's development, Pantouvaki is ideally placed to theoretically and practically support TICP. She has supervised over 40 Masters students, 8 PhD students to completion (+10 in progress) and 7 postdoctoral fellows. Her experience with qualitative interviewing, and interdisciplinary and multimodal research methods will be invaluable in offering high-quality mentorship for this project. Interaction with other School staff, such as Prof. Lily Diaz, who focuses on virtual design projects, will greatly bolster the research.

Establishing a thorough Career Development Plan in the first month of the project will be followed by fortnightly meetings, either in person or by Zoom, which will incorporate written and verbal feedback. Prof. Pantouvaki holds extensive experience in supervision and research career development. She was Academic Board member of Nida Doctoral School (2015-2022), co-founder and supervisor of Performing Dress Lab, an international research network for research and knowledge exchange (2016-ongoing), and PI for the *Costume Methodologies* project which had a strong focus on early career researcher training. Through the latter, Prof. Pantouvaki has already mentored specific aspects of my past doctoral research.

### 1.3.2 Training activities

This fellowship offers substantial scientific and transferable skill training. The project will enable scientific training on deep content knowledge, development of theoretical models, and substantial experience with I4.0 technologies. Transferable skills training from the project include project management and research leadership, via the book proposal preparation and conference activity. Aalto will provide formal research training (e.g., writing major grant applications, ethics, open science) and career development opportunities via postgraduate supervision I will undertake. At the School level, I will be given opportunities to lead some Masters' student course seminars and to advise Ph.D. students. As outlined below, these competencies serve my long-term career objective to be a world-leading researcher in Western live performance costume practice.

Desired skill	Level now	Level end	WP	Training delivery	Responsible
<b>Scientific</b>					
Socio-technological theory knowledge	Low	High	1/2/3	Hands-on practice	Supervisor, myself
Innovation research and application knowledge	Med	High	3	Aalto short course <i>History of Innovations and Design</i> , practice	Aalto Design Department, myself
Digital Fabrication expertise	Low	Medium	2/3	Aalto FabLab training course, interviews	FabLab staff, myself
<b>Transferable</b>					
Research project management	Med	High	1-5	Hands-on practice	Supervisor, myself
Research leadership	Med	High	4/5	Hands-on practice, mentoring	Supervisor, myself
Research grant writing; Research for industry impact	Low	High	4	Hands-on practice, mentoring, workshops	Supervisor, Faculty staff
Research ethics in EU context/ Open Science principles, data publication	Low	High	1/4	Formal module and hands-on practice	Aalto admin, Supervisor, Faculty staff
Masters coursework level teaching experience	Nil	Medium	5	Masters in Costume Design teaching	Supervisor, course staff
PhD supervision experience	Nil	Low	5	Assist supervision of CiF PhD students as advisor	Supervisor

### 1.3.3 Knowledge transfer Host to Fellow

Aalto's primary contribution to TICP is providing well-established practices for peer feedback within the research community of the CiF research group, as well as a frame for the testing of the research findings and outputs through Aalto's direct links and active and continuous collaboration with industry practitioners and international research

<sup>14</sup> Pantouvaki, S, and P. McNeil. 2021. Performance Costume: New Perspectives and Methods.; Pantouvaki, S. 2019. "A Touch of Green with an Emerald Hue": A Multimodal Research Methodology for the Study of Costume." In *Dance, Body, Costume*, 41–76. Leipziger Universitätsverlag.

networks. This will not only support the development of this project but will also teach me knowledge on how to build a rigorous research community. Importantly, Aalto will offer me opportunities to develop my teaching and supervision skills at the Masters and PhD levels, under the supervisor's mentorship. On a technical level, I will be able to improve my knowledge of specific tools related to costume production. The ambitious interdisciplinary and practice-focused nature of TICP means that the guidance provided by such a specialised department will provide clear and discipline-relevant feedback on major decisions as the project progresses, ensuring that my research contributes to the field.

#### 1.3.4 Knowledge transfer Fellow to Host

Peers/other researchers: My past and current research knowledge in costume practice, on collaboration and technologies respectively and my familiarity with applying novel research methodologies is of significant value to Aalto. This will be shared formally via the annual Costume and Research in Finland symposia, hosted by CiF, and in institution-wide knowledge transfer events run by the Aalto Creative Technologies community; informally via the monthly CiF research sharing meetings, which will enable productive dialogue and information exchange.

Teaching: During the fellowship, I will contribute to the Aalto Masters programme in Costume Design, via guest lectures and short-term seminars, drawing on my professional experience and research regarding costume practice. I will also pass on my methodological expertise and knowledge to PhD students. In the second half of the project, I will contribute to undergraduate and postgraduate costume education at Aalto, instructing on the application of I4.0 technologies for costume practice.

#### 1.4 Quality and appropriateness of the researcher's professional experience, competences and skills

Having spent 20 years working as a costume maker and designer in the industry, and 13 years researching it, I have an intimate and nuanced knowledge of how costumers work and learn together, communicate information and new ideas. I also possess concrete knowledge of the rhythms of production and operational frames that structure their work. My doctoral thesis, funded by the Australian Government's Research Training Program (University of Melbourne, completed in 2022), drew on this experience and broke new ground in explicating the collaborative practices of costumers. Methodologically innovative, it was the first costume study to use linguistic ethnography, an interdisciplinary approach that enabled rich and novel research findings. This research will be published in my monograph *Costumers at Work: Collaborative Creativity, Emotional Labour and Technical Skill in Costume Making* for Routledge in 2024 (contracted). My existing body of publications, which is extensive for someone at my career stage, with this forthcoming monograph, seven journal articles, three chapters in edited collections and numerous other writings, provides a solid basis for this research project.

Following my Ph. D., I applied sociological theories to understand the interpersonal dynamics of backstage crews. Another project studying digital gift economies on Facebook has given me recent experience conducting digital ethnography and online interviews. For each, I sought to disseminate the research to industry professionals by using forums and formats familiar to them, whether this is written reports and industry events or articles for arts news sites. As an example of industry appetite for my research, one article translating my research on the industry news site Arts Hub performed 300% better than a standard article across the site's 90-day average. Recently I took on leadership positions in the field as a panel convenor for the highly competitive Prague Quadrennial Talks program (2023), co-convenor of the Critical Costume 2022 conference, and co-editor of a special issue of the journal *Studies in Costume and Performance* (the latter both under the mentorship of Prof. Pantouvaki). This has given me experience in bringing researchers together, providing editorial guidance and coordinating events and speakers. As a Lecturer at Queensland University of Technology, I teach undergraduate fashion and performance design, informed by my ongoing creative practice. My cutting-edge investigations of costume practice are thus communicated through my creative practice, publications and teaching, providing great potential for excellence. My deep professional and research knowledge of costume practice combined with my methodological expertise builds a solid foundation for success for TICP.

## 2. Impact #@IMP-ACT-IA@#

### 2.1 Credibility of the measures to enhance the career perspectives and employability of the researcher and contribution to her skills development

This fellowship will provide me with a platform of publications, skills and experiences that will see me shift rapidly from early career researcher status to the next level of my career. The scientific skills developed through TICP include data collection and analysis, model development using interdisciplinary theory, and relationships for networking with global and European industry professionals and researchers. Transferrable skills offered through TICP include project management and research leadership skills, and an improved ability to communicate with research stakeholders and

colleagues and transform research results into actionable industry outcomes. The experience at Aalto will also equip me with Master's level teaching and PhD supervision experience. Advanced research training offered at Aalto will enable me to apply for large-scale research funding. These skills are sought by academic employers in the fields of theatre, performance studies and design throughout the world. Further, collaborating across European and international scholarly communities and communicating my research throughout the fellowship will significantly internationalise my profile at a critical juncture of my career. By my return to geographically, and sometimes academically, isolated Australia, I will have developed a foundational network that I can leverage for collaborative research projects, activity and grants for the rest of my career.

Aalto's reputation, expertise, position within and connection to scholars and practitioners internationally is essential for taking the next steps towards this ambition. Under the supervision of Prof. Pantouvaki, this project will offer vital mentorship and connections to the field that will substantially enhance my future career perspective. My long-term goal is to be a Professor of Costume at a world-leading university, with a research-teaching nexus in which my cutting-edge costume practice research both reflects on and pushes industry development, and lead an innovative, risk-tolerant, collaborative, and socially conscious degree program. TICP at Aalto is a significant step toward this goal.

## 2.2 Suitability and quality of the measures to maximise expected outcomes and impacts #@COM-DIS-VIS-CDV@#

### 2.2.1 Communication, Dissemination and Exploitation Plan

The project has three target audiences. The first is the scientific community researching live performance, costume or technical production; the second is live performance institutions and industry practitioners, especially costume makers; and the final is art-loving members of the public interested in live performance generally and costume specifically. Each has several specific dissemination objectives or messages, with strategically planned outputs and targeted forums that ensure both one-way and two-way communication activities with each audience. This focused approach enables the research exploitation.

- Scientific outputs disseminated throughout the project include **four presentations in peer-reviewed academic conferences and seminars**, a **research article**, an **edited book proposal** and publishing the project **data set and method workflow for data collection, analysis and model development** on the EOSC. The presentations will be used for peer feedback and to build networks for the future. Before publication, the article will be presented at the International Federation of Theatre Research (IFTR), a high-profile international conference. Publishing my data set and methods will help other researchers examine the area themselves and further exploit the research outside of the specific publications and results. The edited book proposal will include a sample introduction written by me, contextualising costume practice amidst the four industrial revolutions, alongside chapter abstracts by the 8–12-chapter authors I have selected as editor. Associate Prof. Christin Essin, editor of the 'Studies in Scenographic Practice, Theatrical Design, and Technical Craft' book series for Routledge, has already provisionally indicated significant interest in this edited book, to be disseminated following the project which will encourage long-term exploitation of TICP results.
- Industry outputs aimed at costume professionals and live performance institutions, such as theatre companies and their technical staff, include a **suite of planning tools**. A variety of **trade journal articles**, a **talk, newsletter items** for costume professional and advocacy groups, and **blog and social media posts** promoting the research and its results will be carried out both during and at the end of the fellowship to encourage research exploitation. A **workshop** at WSD, supported by the OISTAT Costume sub-commission will enable tool testing and evaluation.
- This industry-aimed communication and dissemination will be boosted by **articles** on popular arts websites that draw a general public audience of artists and art lovers, as from prior experience writing for ArtsHub I know the reach and impact of such forums. A **public talk** at the European Researchers' Night will further inform citizens of the use and benefits of the project, and MSCA actions.

The below table summarises the project's dissemination, communication, and exploitation plan for each audience.

Dissemination (output and forum)		Message/Objective	Exploitation/Purpose
One-way communication	Two-way exchange		
Scientific community			
- <b>JOURNAL ARTICLE</b> ( <i>Theatre and Performance Design</i> journal)	- <b>CONFERENCE PAPER</b> (IFTR 2025) - <b>SEMINAR</b> (Costume & Research in Finland 2025)	TICP Model improves understanding of industry practice	- Model enables future costume research - Model adaptable for other live performance discipline

- <b>DATA AND METHODS</b> - <b>BLOG POST</b> (Aalto Co-How)	- <b>SEMINAR</b> for Creative Technologies series - Share work-in-progress - CIF monthly meetings	TICP offers an interdisciplinary, novel, and generative methodology	- Data and methods support future costume research - Encourages diversity in methodology
- <b>BOOK PROPOSAL</b> (Routledge)	- <b>PANEL</b> (WSD 2025) - <b>CfP</b> for TICP book	TICP challenges dominant discourse that costume practice is not innovative	- Substantially moves the field forward and opens new research avenues
<b>Industry/ end users</b>			
- <b>PLANNING TOOLS</b> - <b>TRADE JOURNAL ARTICLE</b> (e.g., <i>Theatre Design &amp; Technology</i> ) - <b>SOCIAL MEDIA</b> (in DE research site 70k+)	- <b>RECRUITMENT &amp; DATA COLLECTION</b> - <b>CO-DESIGN WORKSHOP</b> - <b>PILOT WORKSHOP</b> (WSD2025)	Tool suite enables practitioners and institutions to assess, plan, and adopt new technologies	- Significant social and economic benefits from tool use and subsequent shifts in I4.0 adoption
- <b>NEWSLETTER ITEMS</b> (e.g., CiTEA; Kostümkollektiv)	- <b>RECRUITMENT &amp; DATA COLLECTION</b>	TICP addresses deeply entrenched gender biases	- Results beneficial for pay parity and recognition advocacy
<b>General public</b>			
- <b>ARTICLES</b> (e.g., ArtsHub, The Stage)	- <b>TALK</b> (European Researchers' Night)	Costumers use innovative I4.0 technologies	- Educates, builds respect and shifts public discourse on costume practice

### 2.2.2 Intellectual Property Management

The suite of planning tools may require an intellectual property management plan due to copyright, which will be devised in consultation with internal support by Aalto Innovation Services. I expect this to use a creative common's licence which will enable wide exploitation of the resources. Publication agreements negotiating authorship rights and crediting will be created for any outputs and will follow academic best practices.

## 2.3. The magnitude and importance of the project's contribution to the expected scientific, societal, and economic impacts

### 2.3.1 Scientific Impacts

As the first study of theatre technologies to apply theories of technological adoption, significant new knowledge for the multidisciplinary field of performance practice research will come from the project. Crucially, while advancing discussions in the field, TICP also centres costume firmly in the middle of this conversation. Its methodological innovation, in its generative use of digital ethnography to explore performance-making practices, also has the potential to be applied by other researchers. Currently, digital ethnography is limited to studies of performance audiences,<sup>15</sup> rather than creative professionals, makers, and processes.

### 2.3.2 Societal Impacts

Explication of technical innovation and the implicit existing gender bias in this area will bolster costume professionals' and unions' arguments for recognition of the costume practice's complexity. Short term, the research enables more informed and effective education and evaluation of new technologies in practice, valuable as the industry grapples with these and other I4.0. technologies, with flow-on effects for inventive and exciting creative outcomes for audiences. Longer-term, supporting the adoption of I4.0 technologies may reduce waste in costume production, as such technologies enable more sustainable manufacturing via virtual sampling and prototyping.<sup>16</sup> The knowledge generated from the study about barriers and enablers to adoption may be transferrable to other artisanal practitioners outside of costume, multiplying the study's impact. These impacts align the project with the important goals of the Horizon Europe Cluster 2: Culture, creativity, and inclusive society.

<sup>15</sup> E.g., Liedke, H. 2023. *Livecasting in Twenty-First-Century British Theatre*. Lonon: Bloomsbury Publishing; Mark, T. 2023. "Digital Audience Engagement in Nigeria" *Arts and the Market* 13 (2): 80–93.

<sup>16</sup> Khan, I, M. Ahmad, J. Majava. 2023, Industry 4.0 innovations and their implications: An evaluation from sustainable development perspective, *Journal of Cleaner Production*, vol. 405.



### 2.3.3 Economic Impacts

Costume production is time and labour-intensive and using the virtual sampling capabilities of 3D printing and virtual patternmaking offers potential time and cost savings. Understanding the stages and barriers to technological adoption can help theatre companies, which usually have limited finances and/or are publicly funded, target their new equipment investment, deployment, and training, reducing the likelihood of expensive equipment sitting unused. Costume practitioners suffer from a gender wage gap compared to other (male-dominated) production areas, and building on the societal impacts above, this research can bolster their advocacy for pay parity. The need for this research becomes even more pertinent with the knowledge that production managers and technical directors, the people who usually oversee the equipment, training, and wage budgets for costume departments, usually come from non-costume backgrounds. #COM-DIS-VIS-CDV# #IMP-ACT-IA#

## 3. Quality and Efficiency of the Implementation #QUA-LIT-QL##@WRK-PLA-WP@# #CON-SOR-CS@##@PRJ-MGT-PM@#

### 3.1 Quality and effectiveness of the work plan, assessment of risks and appropriateness of the effort assigned to work packages

#### 3.1.1 Workplan and timeline aspects

The project's interrelated research objectives (RO) are addressed through five work packages (WP). WPs progress from training and data-gathering to writing and dissemination. The plan considers time and scaffolding needed to produce deliverables, and distribution of workload. Regular milestones and distribution of engagement and publishing activities create a longer-term structure. The tasks, deliverables (D), milestones (M) and training associated with each WP are outlined in the below table and Gantt chart.

<b>WP1</b>	<b>Title: Project and Methodology Planning (RO 1)</b>	<b>Months: 1-3</b>
<b>TASKS:</b> Initial project management admin; Literature review; Contextual review		
<b>DELIVERABLES:</b> 1.1) Data management plan; 1.2) Career development plan		
<b>MILESTONES:</b> 1.1) Ethics application		
<b>TRAINING:</b> Ethics module; Open science + Data publication modules		
<b>WP2</b>	<b>Title: Data Collection &amp; Prelim Analysis (RO 1 &amp; 2)</b>	<b>Months: 4-5</b>
<b>TASKS:</b> Participant recruitment and data collection (Interviews + DE); Transcription + preliminary analysis); Development of initial data analysis coding structure		
<b>DELIVERABLES:</b> 2.1) Blog post/newsletter items announcing research via costume advocacy groups		
<b>MILESTONES:</b> 2.1) Complete data collection		
<b>TRAINING:</b> Digital fabrication training @ FabLab		
<b>WP3</b>	<b>Title: Model Development (RO 2)</b>	<b>Months: 6-8</b>
<b>TASKS:</b> Content analysis and revision of coding against operational and institutional structures of live performance; Initial development of model; Revision of model following peer review		
<b>DELIVERABLES:</b> 3.1) Article for T&PD or equivalent trade journal		
<b>MILESTONES:</b> 3.1) Present model at IFTR (scientific community); 3.2) Present research at Creative Technologies; 3.3) Present to industry via OISTAT Costume Sub-commission for open peer feedback		
<b>TRAINING:</b> History of Innovations and Design short course		
<b>WP4</b>	<b>Title: Research Dissemination and Application (RO 3&amp;4)</b>	<b>Months: 9-13</b>
<b>TASKS:</b> Run co-design workshops to develop planning tools; Finalise planning tools; Plan WSD workshop		
<b>DELIVERABLES:</b> 4.1) Public talk @ Euro research night; 4.2) Presentation at Costume Research in Finland seminar; 4.3) Arts site's blog posts or articles; 4.4) Social media materials; 4.5) Article in an industry journal		
<b>MILESTONES:</b> 4.1) Results dissemination and exploitation plan; 4.2) WSD workshop; 4.3) Publish data set and method;		
<b>TRAINING:</b> Research translation; research grant writing		
<b>WP5</b>	<b>Title: Research Leadership (RO 4)</b>	<b>Months: 1-13</b>
<b>TASKS:</b> Plan conference panel for WSD; Write book CfP; First editorial review of book submissions; Second editorial review; Writing sample chapter; Writing book proposal		
<b>DELIVERABLES:</b> 5.1) Sample book chapter (introduction); 5.2) Book Proposal		
<b>MILESTONES:</b> 5.1) Book CfP release; 5.2) Chair and present WSD panel		
<b>TRAINING:</b> Mentoring for Masters teaching and PhD supervision; Coordinating WSD panel; Coordinating edited book proposal		

Project Gantt Chart													
Month	1	2	3	4	5	6	7	8	9	10	11	12	13
WP1		D1.1 M1.1	D1.2										
WP2				D2.1	M21								
WP3						M3.1	M3.2	D3.1/ M3.3					
WP4									M4.1	D4.1/ M4.2	D4.2	D4.3/ D 4.4	D4.5/ M4.3
WP5			M5.1				D5.1			M5.2			D5.2

### 3.1.2 Risk management

Critical research risks for TICP include data access issues and dissemination challenges (see table below). Administrative risks include the ambitious work plan compromising the planned deliverables. I will be responsible for the financial and scientific management of the project, an important part of my skill development and training. Aalto has an excellent track record of managing EU projects and MSCA projects, and an ongoing process of project review alongside support from a dedicated team of experienced administrative staff for the practical dimensions of the project will mitigate this risk.

Critical risk	Likelihood/Severity	Mitigating mechanisms
Can't carry out digital ethnography on planned Facebook groups	Low/ Medium	<ul style="list-style-type: none"> <li>• Seek group admin support early in the project</li> <li>• Find alternate FB groups or digital spaces (e.g., Reddit, Instagram)</li> <li>• Use fieldwork ethnography. This will increase research admin, decrease participant diversity, and curtail longitudinal data but is a viable alternative</li> </ul>
Ethics approval delayed	Low/ Medium	<ul style="list-style-type: none"> <li>• Consulting with Aalto ethics support staff early (this has begun)</li> <li>• Use delays as time to write up frameworks and contextual information and organise other aspects of the project</li> </ul>
Publisher or editors not interested in research	Medium/ Low	<ul style="list-style-type: none"> <li>• Find another equally respected book publisher or journal, drawing on the supervisor's recommendations</li> <li>• Have already sought and received in-principle support for publication</li> </ul>

### 3.2 Quality and capacity of the host institutions and participating organisations, including hosting arrangements

One of the world's top design universities and with an international reputation for cutting-edge costume research under Prof. Pantouvaki's leadership of *Costume in Focus* (CiF), Aalto University is the best place for this project to occur, and for me to complete this fellowship. I will be hosted by and become a member of the CiF research community, attending its monthly meetings, which enable dialogue and peer feedback on each member's research progress. I will be physically situated in the Department of Film's office space with a dedicated desk space and computer so I can interact regularly with the supervisor and other academic staff, beyond agreed meetings. Other valuable existing networks and research groups based at Aalto I will draw on and link to include *Cumulus*, a leading global association of art and design education and research, for which Aalto is a coordinating entity and hosts the secretariat; and internal active cross-disciplinary research sharing communities *Creative Technologies* and *Aalto Digital Creatives*. Further groundbreaking research groups aligned with this project's objectives I will connect with include *Fashion/Textile Futures* and *Aalto Factory of the Future*.

Aalto provides significant services for incoming international researchers and has experience in hosting numerous MSCA Fellows. It is equipped with a well-resourced design library, visual resource centre, design studios and workshops. A responsive research office can support the ethics, data management and administrative parts of my fellowship. Internationalisation is a key operating principle of Aalto, with 27% of professors and 72% of post-docs being international, and English (my native language) is one of Aalto's three official work languages. As such, I am convinced that I will be well-integrated into the intellectual and social life of Aalto.

#\$CON-SOR-CSS# #S\$PRJ-MGT-PM\$# #S\$QUA-LIT-QL\$# #S\$WRK-PLA-WP\$#