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Enhancing Research Support Services Through an EU Project: A Case Study

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ENHANCING RESEARCH SUPPORT SERVICES THROUGH AN EU PROJECT: A CASE STUDY

ABSTRACT

This article focuses on capacity-building activities designed for the Technology Transfer Office (TTO) in Türkiye's Acibadem University (ACU) via the GEMSTONE Project, a Twinning scheme project funded under the Horizon Europe Program.

The project's objective was to identify best practices in research and technology transfer management and to enhance the professional capabilities of TTO personnel, thereby providing ACU researchers with more comprehensive and effective support services. The project employed an iterative process of defining standards, implementing improvements, and reassessing outcomes with the goal of helping to strengthen ACU's research environment and international competitiveness over the long term.

The process used a three-phased approach, with each phase addressing a core objective. The initial phase involved mapping the existing competencies, skills, policies, and practices in research management and administration at ACU. In this phase, Lund University in Sweden was used for comparison, as an exemplary model of best practices. The second phase identified areas for improvement to enhance the capacity and efficiency of research support. As the third phase, training programs, mentoring sessions, and short-term visits were designed to enhance the capabilities of ACU's TTO staff.

The impact of this effort was achieved by enhancing research support services, guided by the expertise and assistance required to navigate complex processes, and ensure alignment with funding agency guidelines and institutional policies. Türkiye's higher education research ecosystem was strengthened by activities designed to share best practices, fostering an environment conducive to scholarly advancement.

Keywords: Research Support Services, Best Practice Sharing, Research Management, Academic Impact, Academic Competencies

INTRODUCTION

Universities are key drivers of innovation, and their technology transfer offices (TTOs) serve as crucial intermediaries between academic research and industry needs. These offices facilitate partnerships, manage intellectual property rights, and support the commercialization of research outputs. By fostering an environment that encourages collaboration and entrepreneurship, TTOs contribute significantly to regional and national economic development while reinforcing the research capacity of their host institutions.

Recent studies show the significance of a robust administrative framework in nurturing high-quality research outcomes. For example, Soares and Torkomian [1] explore the impact of TTO employees' individual capabilities on the technology transfer process, addressing a significant gap in the literature. This study examines how officers with particular capabilities influence the early and late stages of the transfer process. TTO employees must perform a range of tasks effectively, which requires a diverse set of soft and hard skills. This study explores the impact of TTO staff members' individual capabilities on the technology transfer process (p. 2).

The Turkish National Technology Transfer Ecosystem Report (2022), prepared by University-Industry Collaboration Centers Platform (ÜSİMP) [2] indicates that TTOs in Türkiye differ in structure and mission, depending on the services they provide. These differences are mostly attributed to the varying expertise of the TTO staff (p. 11). In terms of the use of research funds, national projects (230 out of 304, a 75% success rate) were supported at a higher level than international projects (46 out of 127, a 36% success rate). ÜSİMP's [3] findings on TTO expert staff engagement and job satisfaction indicate that only 49% of TTO experts were actively engaged, while 51% did not feel engaged (which of 20% reported as very low engagement) level.

The highest engagement was observed among staff members older than 55, while the lowest engagement rates occurred in the 25-and-under and 30–34 age brackets. The investigation identified career development limitations as a primary reason for low satisfaction, with specific challenges including the absence of performance management

systems and inadequate salaries (p. 8). Furthermore, the study noted that TTO experts with undergraduate degrees exhibited the lowest engagement, while those with PhDs demonstrated the highest engagement.

TTOs have reported a wide range of challenges, including weak institutionalization, unclear procedures, poorly defined workloads, insufficient documentation, limited career opportunities, inexperienced staff, and inadequate digitalization (p. 10). According to the Turkish Ministry of Industry and Technology (2021) [4], one of the primary goals of a TTO's activities is to increase research funds (p. 5), and taking a more active role in the international fund ecosystem was identified as a key area for improvement (p. 7). One of the report's recommendations, which aligns with the focus of this study, was that TTOs should have specialized human resources focused on procuring international funding.

The book "Teknoloji Transfer Ofisleri" ([5], which is based on technology transfer offices in Türkiye from conceptualization through governance, emphasizes the importance of recognition and the visibility for TTOs. In addition, it suggests practices to improve fund management capabilities.

To address TTOs' challenges and support TTO experts in providing enhanced services for researchers, ACU initiated the GEMSTONE project, which was funded by the European Union under Horizon Europe Research and Innovation Programme-Twinning scheme The project was initiated to enhance research support services at ACU by upgrading the competencies and efficiency of personnel in the TTO (also referred to as the Research Support Office), addressing disparities in research support between ACU and Sweden's Lund University (ULUND). The project proposal emphasized the challenges ACU faces in producing competitive research compared to ULUND, and identified a gap in the TTO staff's expertise with respect to project applications, management, technology transfer, and intellectual property. Through the project, ACU's research support office was strengthened by refining researcher support services and upgrading the staff's soft skills through various means, including competency and skill matrixes, surveys, and training.

METHODS

APPROACH AND PLAN

We adopt a case study approach here, as it allows for an exhaustive examination of the capacity-building process within a single institution, namely ACU's TTO. In the social sciences, a case study done by Yin [6] enables a detailed exploration of a specific "bounded system" that comprehensively investigates its unique organizational context, stakeholders, and processes .

This section provides a detailed explanation of the case study method. In this study, the TTO's capacity-building activities were viewed as an integrated system with interdependent modules (e.g., project management, IP management, and funding applications). By integrating qualitative (e.g., semi-structured interviews and focus groups) and quantitative (e.g., questionnaires and performance metrics) data collection methods, the study captures the intricacies of organizational change, providing nuanced insights into staff competencies, institutional resources and administrative procedures.

Our case study design allows for a comprehensive investigation of the TTO's operational structure, staff skill levels, and stakeholder interactions, offering contextual richness that would have been obscured in a broad comparative analysis involving multiple institutions. We employed a range of data collection techniques (i.e., surveys, interviews, and focus groups) to triangulate the findings. This methodological triangulation enhances the validity of the conclusions regarding capacity-building outcomes and staff development.

The practical and action-oriented nature of the study is also a notable strength. Our objective was not solely theoretical; we sought to implement and evaluate interventions (e.g., trainings, mentoring programs, and short visits) to enhance research management services. The case study method facilitated the ongoing assessment of these interventions, allowing researchers to capture real-time feedback and observable shifts in practice. The transferability of insights is as follows: While the study focuses on a single institution, the processes by which ACO's TTO improved its capacities offer lessons for other universities or research offices with similar structural or developmental contexts.

By using a case study approach, the TTO's research team gained a comprehensive understanding of how capacity-building measures influence performance, staff engagement, and organizational workflows. This methodological approach allowed us to capture the intricate dynamics at play within a singular yet instructive setting, thereby generating findings that are both contextually grounded and analytically robust.

DESIGN AND DATA COLLECTION

We first examined the structure of the TTO office, also referred to as the Research Support Office, as the central target of all capacity-building activities. We explored each operational module's stated objectives and its existing mechanisms for supporting researchers. We clarified the institutional context within which the TTO functions and outlined the diverse challenges of its various staff members, ranging from senior to junior personnel. These challenges were then considered in relation to the broader aims of the GEMSTONE project, underlining the significance of a well-defined organizational structure for facilitating research services and ensuring effective project management.

Next, we introduced the main objectives of the capacity-building activities implemented under the GEMSTONE project, emphasizing their crucial role in strengthening the TTO's ability to secure funding, manage intellectual property, and foster collaborations. These aims were then mapped against the identified needs of the TTO staff. A detailed description followed a needs assessment process conducted by administering questionnaires to the ACU TTO team, and through semi-structured interviews designed to uncover both overt and latent challenges in research support practices. These investigations informed the development of an action plan that was described and implemented through short visits and a structured mentoring program. Each step of the plan addressed the identified capacity gaps, such as insufficient project management know-how, limited international fund-tracking strategies, or inadequate networking with industry partners.

The subsequent section, entitled "Findings" presents the outcomes and experiences derived from these capacity-building efforts. These were organized into four main headings, with each one capturing a distinct aspect of the TTO's development. We obtained relevant data through participant feedback, workshop evaluations, and practical applications of the new skills and procedures.

Our conclusion provides a concise summary of our general findings and offers a perspective on the capacity-building process. Finally, we emphasize that all of the data used in this study was collected from questionnaires directed to the ACU TTO team, semi-structured interviews with key personnel, and reports documenting the interventions and trainings that shaped the TTO's transformation.

PROCESS OF THE STUDY

STRUCTURE OF ACU TECHNOLOGY TRANSFER OFFICE

The TTO at ACU is responsible providing research services, structured under seven modules that address several research support activities. In accordance with the TTO's fundamental mission to increase awareness among researchers and stakeholders regarding support mechanisms and research opportunities, and offer guidance on intellectual and industrial property rights, technology transfer, and entrepreneurship, the following modules were implemented as integrated services.

MODULE 1: Promotion and Dissemination of Fund Programs – aims to raise awareness and provide guidance for researchers about national and international research funding opportunities.

MODULE 2: Project Management Services – supports the development and operational management of funded research projects.

MODULE 3: University-Industry Collaboration Consultancy – encourages R&D collaboration between universities and industry.

MODULE 4: Intellectual Property (IP) Management and Licensing Services – established to handle IP rights and commercialization processes for ACU researchers' output.

MODULE 5: Entrepreneurship and Incorporation Activities – promoted through the Incubation Center to support entrepreneurial endeavors.

MODULE 6: Prototype Development and Biodesign Services – executed at the Biodesign Center to address the prototyping and design of medical devices that meet the demands of hospitals, medical personnel, academics, and entrepreneurs.

MODULE 7: The Test and Analysis Unit – established to fulfill test and analysis requests from companies, including validation and verification tests mandated by the Turkish Medicines and Medical Devices Agency.

These comprehensive research support services ensure that projects are thoroughly guided from the pre-application phase through the post-approval process while strengthening industrial and academic collaborations and seamlessly integrating research outputs into commercial and clinical environments.

Although the term TTO is used throughout this article, we acknowledge that this designation coincides with what is commonly referred to as a "Research Support Office." In academic institutions, the Research Support Office extends beyond traditional technology transfer functions, covering a broad spectrum of services that facilitate and enhance research activities. Consequently, all references to the TTO as outlined in the previous sections are intended to reflect the broader scope of the Research Support Office.

GEMSTONE Project methodology steps

As part of the GEMSTONE project, five fundamental steps were identified to guide the appropriate methods and development approaches.

The first step was to conduct an initial *assessment* of ACU's current organizational capacity through supporting research. This assessment included an analysis of existing policies, procedures, and practices related to research management and administration, conducted using qualitative and quantitative approaches. Data were collected from ACU TTO staff and researchers, and through collaborative communication with ULUND Research Support Services.

After the assessment phase was completed, attention was directed toward *identifying*, which involved pinpointing the differences between the ACU and ULUND to be addressed. These gaps were predominantly related to the competencies and skills of the TTO staff, ACU's organizational resources and infrastructure, and the structured administrative procedures required to secure grants and manage projects in accordance with international standards. After identifying these needs, a capacity-building plan was developed in consultation with the ULUND Research Support Staff and Fondazione ICONS. This plan was guided by the findings from the *mapping analysis* and included specific objectives and timelines, with clearly defined responsibilities assigned for each activity.

During the *implementation phase,* the capacity-building plan was operationalized through a range of activities, including training programs, workshops, mentoring sessions, and coaching opportunities. These efforts were designed to strengthen the competencies of TTO staff and refine the organizational mechanisms that underpin research support services.

Finally, *monitoring and evaluation* processes were implemented to ascertain whether the desired outcomes outlined in the original proposal had been achieved. This follow-up relied on both quantitative and qualitative methods, including surveys, interviews, and focus groups, to provide a comprehensive view of the effectiveness of the capacity-building strategy.

Capacity-building Objectives of the GEMSTONE Project

A three-phase process, designed within the GEMSTONE project to achieve the goal of strengthening the TTO office's capacity, was created with three main objectives.

-Objective 1: Assess current organizational capacity

For Objective 1, a detailed mapping of the competencies and skills represented among the research support staff was conducted to identify how policies and practices in research management and administration were applied at both ACU and ULUND. This included generating a competency and skills matrix to document the range of expertise possessed by the ACU TTO staff. To ascertain the gap between the ACU and ULUND, discussions were held with the ULUND Research Services Manager about the ULUND team's skills, competencies, and operational framework. Similar insights were obtained from the TTO manager at ACU, who defined the roles, responsibilities, and expected competencies for each position within the TTO. The project team discussed and standardized each identified competency and created a questionnaire to capture the TTO staff's perceptions of their own capabilities. Furthermore, several focus group meetings were held with ACU TTO staff to gather qualitative input regarding their roles and

expectations in collaborating with ULUND. All collected data, including both quantitative and qualitative, were analyzed and incorporated into this case study.

After the initial matrix and focus group analysis had been completed, the second stage commenced by inviting ACU researchers—through e-mail outreach—to fill out a questionnaire designed to evaluate their experiences with and assessments of the ACU TTO's services. This step provided additional insight into the everyday challenges the research community was facing and highlighted areas where capacity gaps were most pronounced.

In the third stage of the assessment, ULUND's research management and administration policies were reviewed by examining policy documents related to its broader research strategies. This analysis was reinforced by an online (virtual) meeting involving research support staff from both universities to discuss the best practices currently employed at ULUND and explore how these methods could be effectively transferred to ACU. These dialogs informed the resulting recommendations for enhancing research support capacity and efficiency and establishing a foundation for targeted capacity-building activities aimed at bridging the identified gaps.

-Objective 2: Identifying weaknesses, knowledge, and skills gaps and best practices

To achieve Objective 2, the analyses and assessment results obtained from the work to satisfy Objective 1 were presented to the project consortium and the relevant stakeholders at both ACU and ULUND. These findings guided a thorough examination of the organizational capacity gaps that emerged from the earlier mapping phase, shedding light on the differences between the structures and operations of the TTOs at ACU and ULUND. Emphasis was placed on understanding which shortfalls demanded attention to enhance ACU's organizational capacity, particularly in terms of its TTO's skillsets and competencies. These gaps were grouped under two principal themes: the university's organizational resources and infrastructure, and its structured administrative procedures. Concentrating on these areas provided insights into how the existing framework could be improved to more closely align with the successful practices observed at ULUND. Through this collaborative process, concrete steps were developed to address specific institutional and procedural elements that interfered with the ACU TTO's ability to more effectively support and manage research.

-Objective 3: Increase the TTO's capacity

A capacity-building plan was developed to address the organizational gaps identified through the mapping analysis, in close consultation with the ULUND Research Support Staff and ICONS. This included training sessions, mentoring opportunities, and short-term visits designed to benefit ACU personnel engaged in research support services, with the goal of strengthening the specific skill sets highlighted in the gap analysis. A phased implementation plan was then conducted to ensure that staff members could acquire relevant competencies and apply them to their daily tasks. Workshops, coaching activities, and targeted seminars were held to improve the knowledge base of ACU researchers and TTO staff, focusing on best practices in grant writing, project management, and international funding mechanisms.

After the plan had been implemented, monitoring and evaluation efforts were conducted to verify that the anticipated outcomes outlined in the proposal were achieved. Quantitative and qualitative tools—including surveys, interviews, and focus group discussions—were used to gauge improvements in staff capabilities and organizational readiness. A self-evaluation questionnaire was administered to ACU TTO personnel 18 months after the plan was implemented to capture any changes in perceived competencies, confidence levels, and new strengths or weaknesses. The follow-up phase clarified whether the training and support measures had effectively contributed to achieving the desired impact, particularly regarding skills development in line with international benchmarks.

Other evaluations, including 1- and 24-month questionnaires, were distributed to TTO employees, asking them to assess their competencies individually and as a team. Level 3 was defined as the expected standard of proficiency, and data collected through these questionnaires was incorporated into visualizations that illustrated progress over time (Table 1). By combining the initial and follow-up results into a unified graph, shifts in competencies became readily apparent, allowing stakeholders to gauge the effectiveness of the interventions and determine which areas of organizational capacity required further attention. This iterative cycle of planning, implementation, and evaluation fostered continuous improvements in ACU's research support infrastructure, thus fortifying the TTO's role in advancing the university's broader research objectives.

Implementing the Capacity-Building Effort within the Scope of the GEMSTONE Project at ACU

Questionnaires to TTO Staff

Questionnaires were administered to TTO staff to obtain insights into their competencies, professional challenges, and perceptions of their day-to-day tasks and broader operational goals. This method was selected as it allowed for the collection of both quantitative and qualitative data as well as a systematic assessment of how staff perceptions aligned with the capacity-building objectives. The findings helped to more precisely identify knowledge gaps and informed evidence-based improvements, strengthening the TTO's capability to support research initiatives effectively.

In this section, we use radar charts to illustrate the distribution of scores from the questionnaire and to facilitate an in-depth understanding of capacity-building outcomes. We use the Python programming language and the matplotlib plotting library (v3.8.0) to generate customized graphical representations. Within this library, we use the pyplot module to plot and connect data points, producing the polygonal shape that is characteristic of radar charts. The charts were customized by adjusting axis limits, modifying labels and colors, and inserting legends and annotations, to enhance readability and interpretability. This provides a clearer view of skill and competency levels among TTO staff, enabling the project team to identify areas of progress and opportunities for further enhancement.

The graphics and charts are displayed for each Dimension. In these figures, the one on the left represents individual scores, and the one on the right reflects team scores.

-Dimension 1

Dimension 1 **(Figure 1 & 2)** shows varying degrees of self-perceived competence among the ACU TTO's staff and TTO Manager with respect to research infrastructure, human resources, tools, and the overall ecosystem. While planning process abilities were considered robust, the team was primarily viewed as capable of laying the groundwork rather than fully implementing and developing necessary procedures. This finding suggests that despite a high level of knowledge and awareness, additional efforts are needed to translate planning into practical outcomes**.**

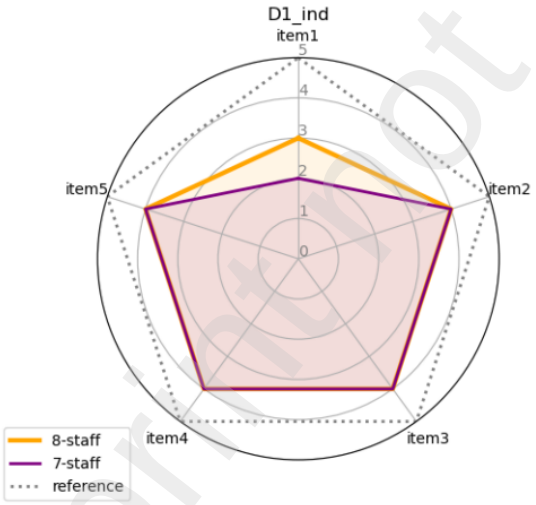

Figure 1: Dimension 1 - Research (Infrastructure, HR, Tools, Ecosystem): Individual Scores

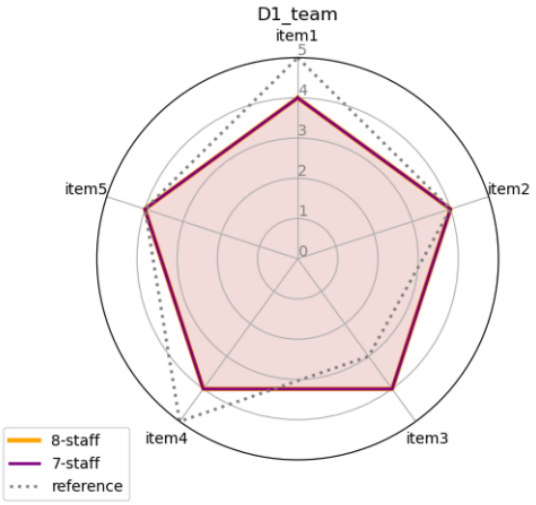

Figure 2: Dimension 1 - Research (Infrastructure, HR, Tools, Ecosystem): Team Score

-Dimension 2

Dimension 2 **(Figure 3 & 4)** reveals a significant discrepancy between the self-assessments of individual employees and the collective assessments of their teams. This discrepancy pertains to funding information and project management. TTO employees did not rate themselves as highly competent in these areas, yet they believed the team's performance surpassed expectations. This discrepancy indicates a compensatory dynamic in which collective efficacy offsets individual weaknesses. The results signal the value of maintaining strong team cohesion and collaborative practices while simultaneously addressing the skill deficits identified at the individual level**.**

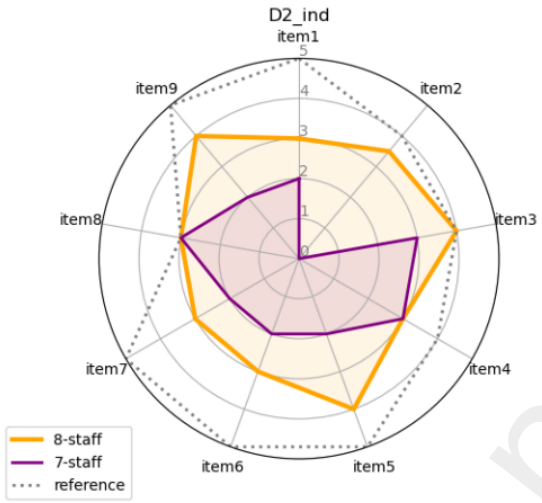

Figure 3: Dimension 2 - Funding Information and Project Management: Individual Scores

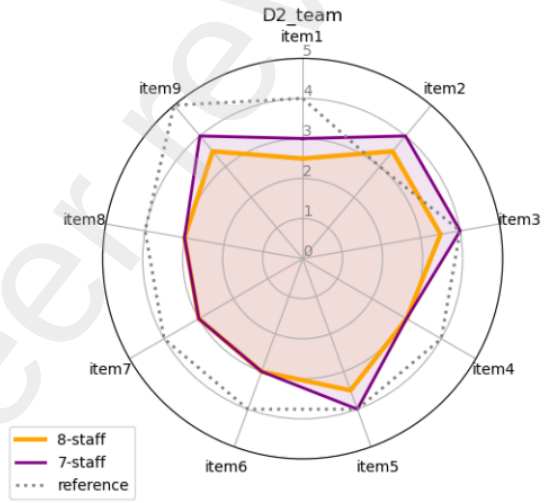

Figure 4: Dimension 2 - Funding Information and Project Management: Team Score

-Dimension 3

In Dimension 3 **(Figure 5 & 6)**, managing funds, financial resources, and human resources were seen as areas of considerable strength by both managers and TTO employees. The self-perception of competence was high, and the team was consistently evaluated as having a strong foundation in these essential functions. The presence of a reliable framework for financial and resource management underscored the importance of capitalizing on existing expertise to reinforce TTO operations more broadly**.**

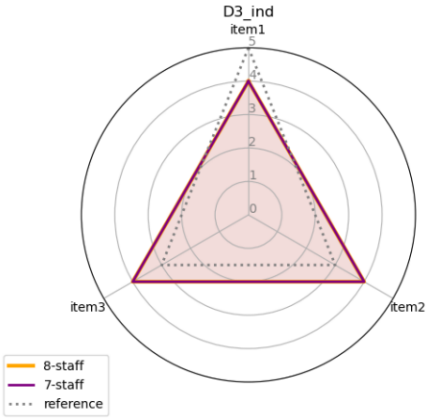

Figure 5: Dimension 3 - Financial and Human Resources Management of Funds: Individual Scores

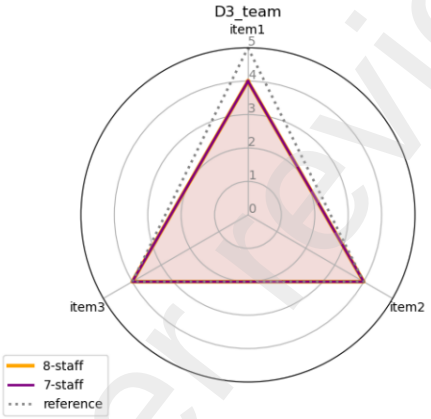

Figure 6: Dimension 3 - Financial and Human Resources Management of Funds: Team Score

-Dimension 4

In Dimension 4 **(Figure 7 & 8)**, which focuses on university-industry collaboration, TTO employees did not perceive themselves as particularly proficient on an individual basis. Nevertheless, they regarded the team as functioning at a satisfactory level. However, the TTO Manager considered himself fully competent in one subfield and at the expected standard in the others. These disparities highlight the importance of targeted training for individual staff members, despite the collective competence attributed to the team**.**

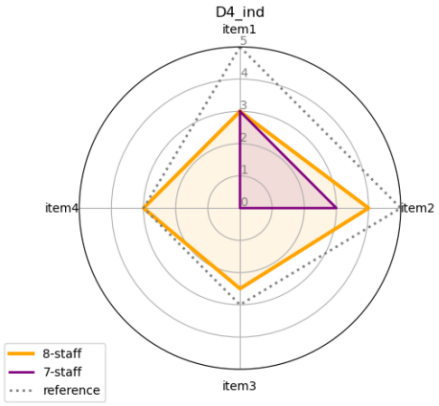

Figure 7: Dimension 4 - University-Industry Cooperation: Individual Scores

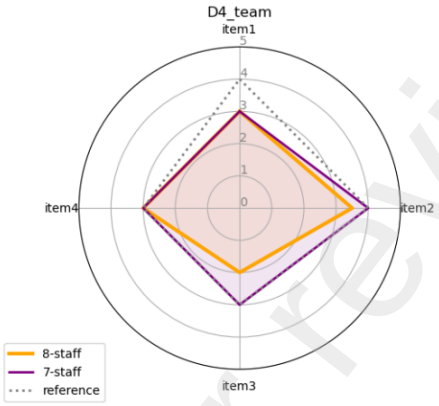

Figure 8: Dimension 4 - University-Industry Cooperation: Team Score

-Dimension 5

Dimension 5 **(Figure 9 & 10)**, which focused on the management of intellectual property (IP) rights, also identifies a discrepancy between individual and collective competency ratings. TTO employees evaluated their personal skills as being below the expected reference level but perceived the team's collective proficiency as being in accordance with the standard. This discrepancy suggests that although institutional processes for IP management appear to be adequate, individual staff members would benefit from additional opportunities to enhance their expertise in this critical domain**.**

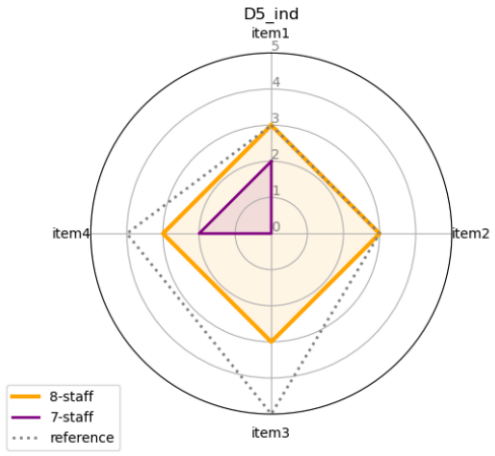

Figure 9- Dimension 5-Intellectual Property Rights Management: Individual Scores

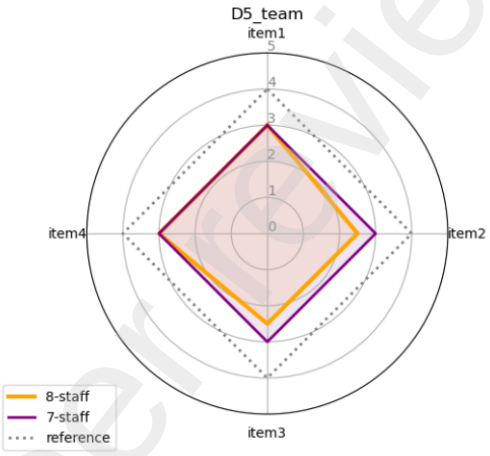

Figure 10- Dimension 5-Intellectual Property Rights Management Team Score

-Dimensions 6 and 7

Dimensions 6 and 7 **(Figure 11 & 12 & 13 & 14)** reveal that entrepreneurship and biodesign activities were seen as less pertinent to TTO employees' day-to-day responsibilities. Nevertheless, the staff maintained a positive evaluation of the team's capacity in these areas, to a certain extent. A willingness to engage, coupled with limited direct involvement, suggests the potential for enhancement if these domains were to be given greater prominence. The existing level of awareness establishes a foundation for potential expansion within entrepreneurship and biodesign support functions**.**

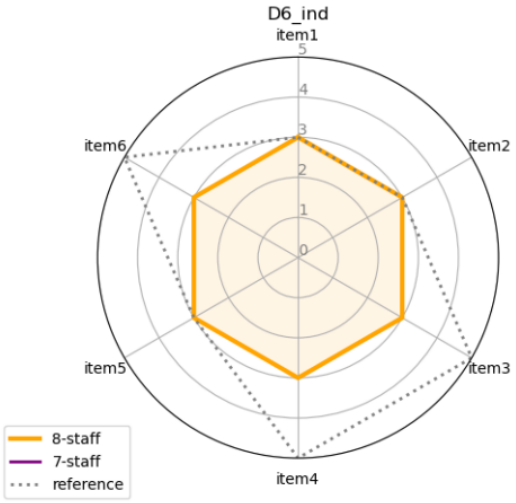

Figure 11: Dimension 6-Entrepreneurship - Incubation Activities: Individual Scores

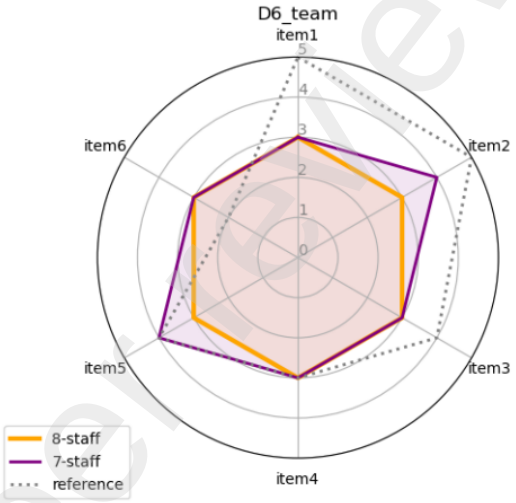

Figure 12: Dimension 6-Entrepreneurship - Incubation Activities: Team Score

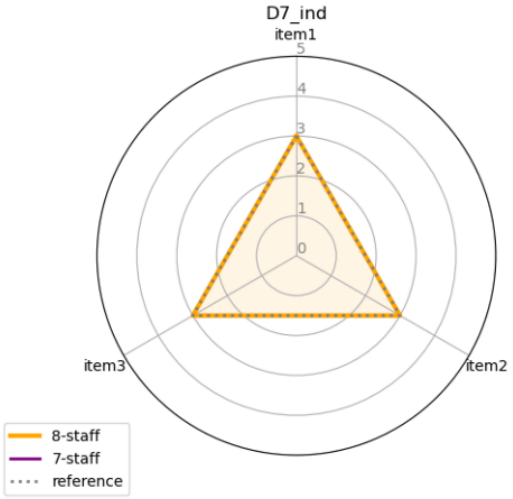

Figure 13: Dimension 7 - Bio-design Activities: Individual Scores

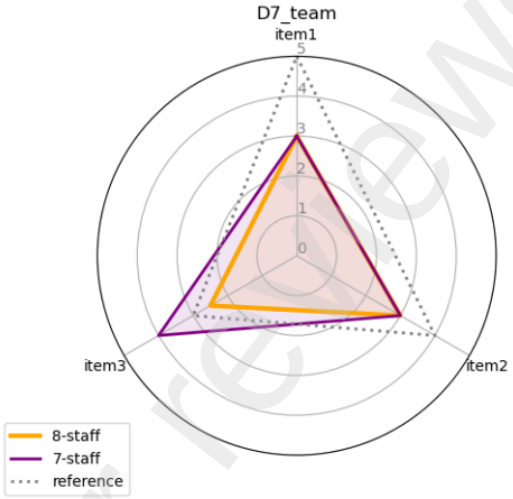

Figure 14: Dimension 7 - Bio-design Activities: Team Scores

-Dimension 8

Within Dimension 8 **(Figures: 15-1 & 15-2, 15-3 & 15-4, and 15-5 & 15-6)**, which comprises 27 subdomain qualifications on professional skills and attitudes, notable variations were detected. TTO employees considered themselves more competent in some sub-areas than others, but team-based evaluations showed lower scores in specific domains. This pattern suggests that even though certain employees may excel individually, the TTO staff as a whole does not demonstrate the same level of proficiency. As a result, targeted interventions were proposed to enhance professional competencies and improve attitudes across the range of sub-domains**.**

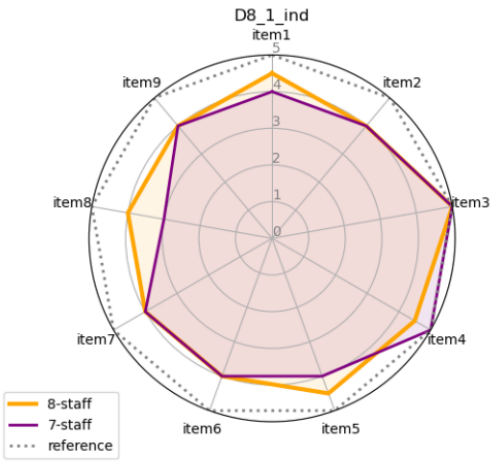

Figure 15.1: Dimension 8 - Self-evaluation of Individual Team Members' Skills and Attitudes: Scores for items 1-9

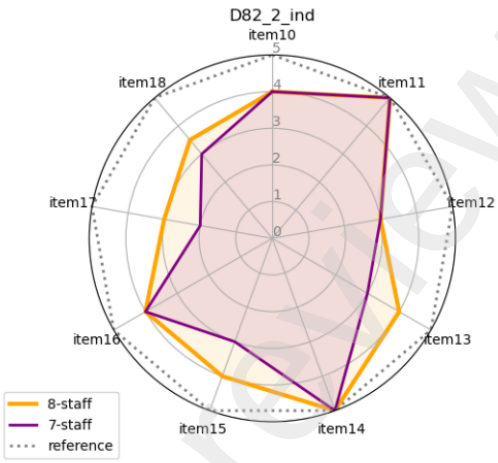

Figure 15.2: Dimension 8 - Self-evaluation of Individual Team Members' Skills and Attitudes: Individual Scores for items 10-18

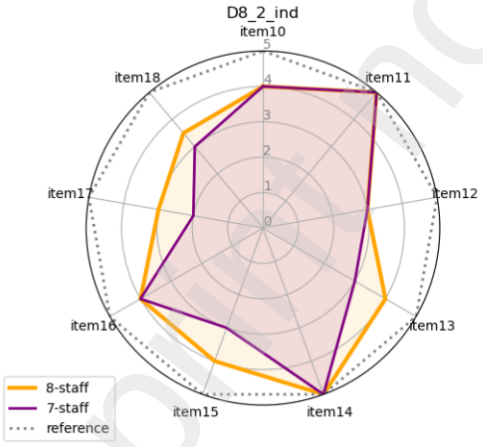

Figure 15.3: Dimension 8 - Self-evaluation of Teams' Skills and Attitudes: Team scores for items 10-18

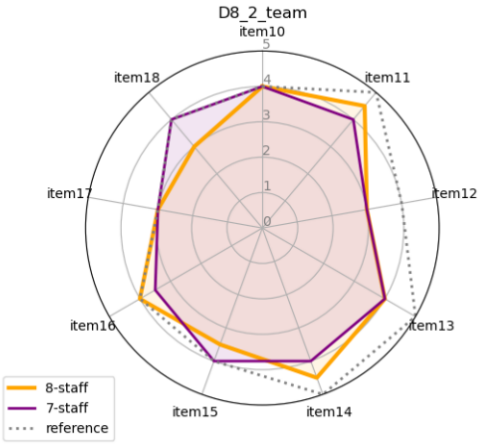

Figure 15.4: Dimension 8 - Self-evaluation of Teams' Skills and Attitudes: Team Scores for items 10-18

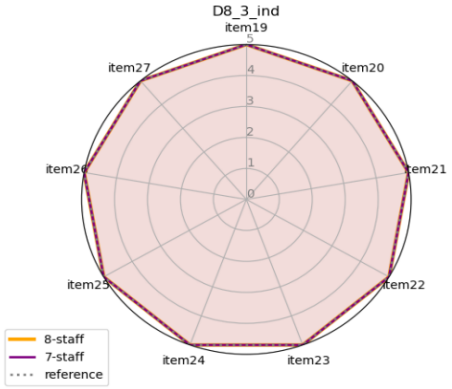

Figure 15.5: Dimension 8 - Self-evaluation of Team Members' Skills and Attitudes: Individual Scores for items 19-27

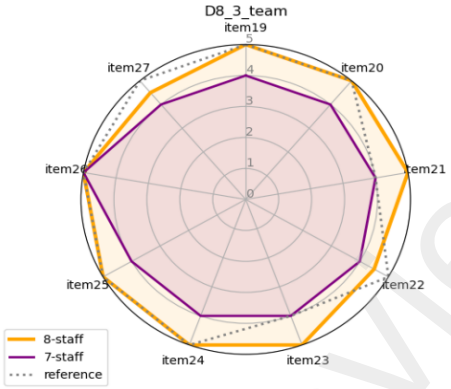

Figure 15.6: Dimension 8 - Self-evaluation of Team Members' Skills and Attitudes: Team Scores for items 19-27

Semi-Structured Interviews

We conducted semi-structured interviews to obtain more nuanced insights into the specific objectives and context of capacity-building activities implemented at ACU's TTO. The choice of semi-structured interviews was justified by the flexibility this method provides, as it allows interviewers to follow a predetermined guide with the flexibility to explore issues that may emerge spontaneously during a conversation. This flexibility ensures that participants' experiences, perspectives, and concerns are captured in a manner that would not be achievable through strictly structured or entirely unstructured interview formats. Additionally, participants are afforded the opportunity to elaborate on topics they consider significant. This enabled us to access more in-depth reflections on TTO employees' roles, the challenges they encounter, and the perceived outcomes of capacity-building interventions. Using an open-ended dialog framework within the semi-structured interview process enhanced the richness of the dataset, supporting the reliability of our thematic analysis.

After the conclusion of the interviews, the audio recordings were meticulously transcribed during the familiarization phase. This procedure ensured accurate data handling and facilitated close attention to linguistic nuances and contextual elements that were pivotal in capturing each participant's perspective. Subsequently, we adopted an open coding approach to identify words and concepts indicative of recurring patterns or salient ideas. During this phase, units of meaning were identified, labeled, and assigned initial codes that reflected their distinctive content. Using these codes revealed latent and explicit themes in the participants' discussions about their experiences with the TTO's capacity-building activities and the resulting shifts in institutional practices.

Following the initial open coding, we employed axial coding to identify relationships among the codes. This procedure entails integrating individual codes into broader categories by examining how they intersect and interact. For example, we categorized codes of perceived skill deficits in specific domains of project management under overarching themes encompassing training, mentorship, and resource allocation. By establishing connections between codes in this manner, a coherent representation of the participants' experiences and perspectives on capacity-building processes emerged. This stage also clarified and refined the categories, eliminating redundancies and ensuring that the conceptual structure captured the essence of the interviews.

Finally, we developed and examined the various themes arising from these categories using a thorough review process. Each theme was evaluated for internal consistency, alignment with the coded data, and relevance to the research objectives. This thematic analysis produced insights into how the TTO staff perceived the strengths and

limitations of the interventions designed to strengthen research support capacity. For example, certain themes highlighted variations in how different team members adapted to new administrative procedures, while others drew attention to shifts in the understanding of roles and responsibilities within collaborative projects. The interplay between individual skills development and collective team dynamics emerged as a recurring motif, illustrating the complexity of organizational change within the TTO.

Mentoring and Training Program

A mentoring and training program was implemented under the GEMSTONE project to strengthen the capacities of ACU's TTO staff, in alignment with the tiered plan previously outlined for senior, intermediate, and junior personnel. This initiative was refined and expanded through collaborations with ICONS and ULUND, thus bridging the earlier framework with new opportunities for international knowledge exchange and enhanced research support services. Integrating short visits, on-site sessions, and case-based mentoring has enabled the TTO staff to acquire profound insights into Horizon Europe's operational requirements and other external funding mechanisms, in addition to the day-to-day functions of effective project management.

A mentoring and training framework was devised to address the specific needs of the TTO staff. This plan, based on a tiered structure that distinguishes between senior, intermediate, and junior staff, was formulated in close collaboration with project partners. Its primary objectives were threefold: first, to strengthen staff capabilities in navigating diverse funding programs; second, to clarify essential procedures for research administration; and third, to promote effective institutional policies to optimize the grant process. Despite variations in individual responsibilities, a shared emphasis on understanding Horizon Europe and other international funding mechanisms supported the comprehensive approach.

ICONS played a pivotal role by offering external training opportunities, resources, and events that supplemented the goals delineated in the original plan. ICONS periodically shared podcasts, factsheets, and checklists with TTO staff and the GEMSTONE Project Manager to consolidate and broaden the knowledge base developed during formal sessions. On October 6, 2023, an ICONS representative delivered a teaching session at ACU, introducing key aspects of the Horizon Europe program. On 3 July 2024, an ICONS representative delivered a teaching session at ACU, explaining the financial statements and audit process in the Horizon Europe program. After these sessions, individual discussions were held with TTO representatives to better understand each staff member's professional needs, existing skill sets, and aspirations. These discussions helped to refine the plan ensuring a close match between the staff's actual requirements and the training content offered by ICONS and other partners.

- Senior Staff Members

Senior staff members were asked to enhance their familiarity with the specialized competencies of various university teams and units. It was deemed essential that these staff members learn to detect collaboration and funding opportunities, both internally and externally, and foster meaningful connections that could lead to strategic partnerships. In addition, the need to effectively promote the university's strengths in networking contexts, such as brokerage events, was highlighted. The Horizon Europe program was introduced to the group with a particular emphasis on increasing the impact of funding applications. The plan devotes a section to establishing clear roles and policies throughout the grant lifecycle, and suggests that by focusing on efficiency and effectiveness, these senior personnel will be better positioned to provide leadership and oversight to the TTO, thereby reinforcing institutional expertise.

- Intermediate Staff Members

Intermediate staff members were mentored to enhance their knowledge of European and global programs pertinent to the objectives of the TTO. The plan emphasized understanding the structure of Horizon Europe and other potential funding mechanisms, including detailed eligibility requirements. Practical training was provided on searching for grants and navigating dedicated digital tools and platforms, such as the Funding and Tenders (F&T) portal. The program fostered the capacity to comprehensively evaluate funding applications and track and monitor project progress so that any deviations could be addressed promptly and in collaboration with appropriate stakeholders.

A substantial proportion of the training program emphasized the significance of effective project meetings, equipping these staff members with the management skills needed to support project goals from inception to completion.

- Junior Staff Members

Training for junior staff members encompassed an introduction to the broader landscape of European and global funding options, with particular emphasis on the foundational elements of Horizon Europe and other critical funding avenues, including how to recognize eligibility criteria. In addition, the training provided step-by-step guidance on interpreting the structure of funding applications, along with practical instructions in using essential tools and platforms like F&T. Developing an understanding of project workflow, from preliminary grant searches to final closeout activities, was prioritized. While monitoring project progress was addressed in a fairly general manner, junior staff members acquired the fundamental knowledge needed to offer reliable support within the TTO's overall mission of facilitating research innovation.

- GEMSTONE Project Manager

The GEMSTONE Project Manager was included in the mentoring program, expanding the capacity-building plan beyond its original scope. This helped to comprehensively address the complexities of international project management, enriching the training content made available to both senior and junior TTO staff. Through structured interactions with the Project Manager, participants gained insights into cross-institutional collaborations, resource allocation, and specific administrative and financial requirements associated with multi-layered funding mechanisms. Introducing these managerial dimensions supported a more cohesive learning environment, as the project manager's day-to-day experiences and strategic oversight provided a practical framework for interpreting theoretical lessons. The TTO team increased their knowledge of funding programs and research administration, an gained a broader understanding of how these processes align with international project governance standards. The mentoring program further solidified institutional capacities and bridged potential gaps between operational tasks and high-level management strategies by leveraging the project manager's expertise.

By delineating the training objectives in this way, the mentoring program ensured that personnel at different stages of professional development were equipped to contribute to the TTO's overall mandate. Senior staff members strengthened their ability to steer institutional policies and cultivate strategic networks; intermediate staff developed practical competencies for managing projects in real time; and junior staff secured a critical foundation in key administrative and organizational procedures. This structured approach ensured that the TTO's capacity-building objectives were integrated into daily operations, thereby reinforcing the office's role in supporting research excellence at ACU.

Short-Term Visits to ULUND and ICONS

A series of short-term visits to ULUND and ICONS were organized for the ACU research support services staff with the aim of enhancing specific competencies. These visits focused on digital solutions, research funding systems, protecting IP, investments, university-industry collaboration, commercialization agreements, incubation, and data management in research. These visits were overseen by Research Funding Advisor at ULUND, and the program was tailored to the professional focus of each participating staff member, thereby facilitating a direct exchange of expertise between the two institutions. Through this immersion in ULUND's operational framework, the ACU team was exposed to established strategies, tools, and best practices that informed improvements in the research support services at ACU.

During these visits, the participants engaged in discussions about ULUND's internal processes for monitoring research tasks, including the use of digital platforms for tracking deadlines, managing resources, and reporting project outcomes. The discussions emphasized learning how ULUND staff structured internal research funding systems, from application procedures to post-award management, illustrating an integrated approach that supports both established and emerging research projects. Intellectual property and commercialization mechanisms were explored in depth, providing ACU's TTO staff with practical insights into drafting contracts and licensing terms, and strategies for attracting investment.

The program also included a thorough examination of university-industry collaborations, focusing on initiating, sustaining, and evaluating such partnerships at ULUND. This component elucidated institutional policies that foster knowledge transfer, entrepreneurial ventures, and market-driven research initiatives. Participants observed incubation processes that identify the stages at which academic concepts are refined, evaluated, and prepared for

external funding, or spun off to establish separate enterprises. At the same time, data management strategies were investigated to ensure compliance with regulatory requirements and optimize the collection, storage and dissemination of research output. Each visit spanned multiple days, as outlined in the plan, and was aligned with the capacity-building objectives described in the GEMSTONE project. TTO staff members, including managers, specialists in business development, and project management personnel, participated in these exchanges according to their roles and professional development priorities. The program included opportunities for hands-on engagement and case-based discussions in which the visiting staff analyzed concrete scenarios drawn from their ongoing assignments at ACU. By comparing ULUND's methods of addressing similar challenges, participants clarified how theory translates into practice and how certain approaches could be adapted to ACU's institutional environment.

This series of short visits to ULUND and ICONS to provided ACU staff members with direct exposure to research administration practices at an internationally recognized institution. These visits were organized in alignment with the original three-tier training framework but were adapted to meet particular needs identified during the assessment of TTO staff competencies. Interactions with ULUND and ICONS research support professionals enabled the ACU TTO to observe and discuss best practices in grant application processes, collaborative partnerships, and integrating data protection guidelines. These interactions reinforced the structured approach proposed in the initial plan.

FINDINGS

-Finding #1: Overarching Objectives and Outcomes

The principal aim of the GEMSTONE project was to capture an accurate picture of ACU's TTO and to identify areas in need of improvement to strengthen the university's research capacity. This goal was achieved through a combination of methods that included examining current TTO operations, consultations with GEMSTONE project partners, and a comparison of best practices. The outcomes were quantifiable, providing insights into organizational needs and paving the way for targeted interventions.

As part of the project, it was observed that research services at ULUND were conducted by a Research Funding Office, which differed from the TTO structure at ACU. The distinction between the two was primarily manifested in the scope of services offered, with ULUND's Research Funding Office operating in alignment with the functions covered by Modules 1 and 2 of ACU's TTO. This comparison showed that ULUND's organizational design and operational focus concentrated on identifying and managing funding opportunities, whereas ACU's TTO encompassed a broader range of activities.

Briefings and administrative training were provided to various governing bodies in the university that are linked to the TTO's workflow. This facilitated a more seamless collaboration across different administrative units as overlapping responsibilities and parallel objectives were clarified. This interoffice alignment was found to positively impact the TTO's potential to better support ACU's institutional research goals.

-Finding #2: TTO Composition and Modular Structure

The ACU TTO comprises 10 expert staff members who operate in seven modules. The existence of these distinct modules demonstrates the multifaceted nature of research support services, which range from project management and intellectual property services to industry collaborations. Maintaining specialized teams for each module enabled the TTO to offer a comprehensive suite of services that address researchers' diverse needs. This modular framework also clearly delineated various responsibilities, enabling more effective coordination and task assignment across units.

There was a marked shift in the nature and volume of project profiles supported by the TTO before and after the capacity-building activities. Operational workflows for international funds were found to be more structured, and TTO staff had received specialized training in relevant procedures. Researchers were also more aware of the TTO's services and expressed eagerness to access and leverage international funding opportunities. Furthermore, there was a discernible alignment between institutional policies and official documentation and international standards, and the university's overarching research vision became more attuned to global fund management practices.

-Finding #3: Communication and Awareness-Raising Efforts

Within the scope of the project, the TTO's roles and responsibilities were communicated to a targeted group of ACU researchers on a continuous basis. This was achieved through meetings, electronic bulletins, emails, and social media channels, to ensure that all researchers were aware of the support and resources available to them. This strategy of repeated outreach proved crucial for establishing continuous engagement as it extended beyond a single event and fostered an ongoing dialog between the TTO and the potential beneficiaries of its services. By sustaining these communication efforts, the TTO strengthened its visibility and relevance within ACU's broader research ecosystem.

We observed a substantial foundation in specific areas of the TTO's operations, particularly the management of funds and the coordination of financial and human resources. However, certain arenas, such as university-industry cooperation, managing intellectual property rights, and cultivating professional skills and attitudes, were identified as areas for further development. Targeted training and structured development initiatives were identified as ways to address individual deficiencies and enhance team performance in these domains.

We identified a general increase in self-awareness, encompassing both motivation and recognition **(Figure 8).** Visibility for the TTO staff increased among in-house researchers and other university offices, as well as in inter-institutional networks such as EARMA. This broader acknowledgment of the TTO's expertise and contributions fostered a climate of mutual respect and facilitated a more proactive engagement with potential collaborators.

Establishing explicit targets for the TTO within the projects heightened the interest in developing internal research initiatives. Involvement in such projects increased motivation levels, particularly when senior management provided consistent institutional and individual support. This support was found to be essential for sustaining staff dedication, advancing project outcomes, and enhancing the overall momentum of capacity-building efforts.

We found that the TTO's role gained recognition after mapping outcomes were disseminated through promotional events, announcements, and meetings. This enhanced visibility contributed to an expanded awareness of the TTO's objectives and functions, both within the ACU and among external stakeholders. The data collected during the mapping process provided a solid foundation for outreach efforts, effectively positioned the TTO as a key facilitator of research excellence.

-Finding #4: Enhancement of Professional and Soft Skill Skills

The fourth finding indicates that TTO staff members enhanced their skills both in terms of professional knowledge (e.g., expertise about research methodologies, grant-writing procedures, and data management) and their soft skills (e.g., communication abilities, networking capabilities, and empathetic listening). Improving these soft skills enabled staff members to better understand researchers' needs, recommend more appropriate research pathways, and employ social media tools to connect with specialized audiences. The enhanced interaction with the research community contributed to more accurate problem identification, improved service delivery, and a heightened ability to adapt to evolving project demands.

The ACU TTO staff exhibited a strong predisposition toward teamwork. Individual self-awareness regarding competencies was noted to be high; however, the collective trust placed on the team exceeded the perception of individual competence. This finding underscores the presence of a collaborative culture within the TTO, where challenges are addressed collectively and responsibility is distributed in a manner that capitalizes on the collective strengths of the staff, as opposed to relying solely on individual expertise.

The TTO has become a focal point of attention at ACU as a result of its research capacity-building activities. This heightened prominence has been endorsed by both the TTO staff and the university Rectorate, which support the continuation and expansion of development measures. A steady increase in the number of international fund applications was noted, underscoring the growing engagement of ACU researchers in global collaborations. Concurrently, membership in COST Actions exhibited an upward trend, reflecting the parallel expansion of the institution's project consortium networks. Furthermore, connections among TTOs across different universities were strengthened through new meetings and brokerage events, indicating an enlarged scope of collaborative possibilities.

CONCLUSION

The GEMSTONE project was developed to address existing gaps in ACU's TTO operations, communication channels, and skills development. By integrating the findings discussed here, the TTO services, combined with tailored enhancements of the staff's professional and soft skills, resulted in a more responsive and agile infrastructure to

support ACU's research initiatives. The multifaceted approach described here established a foundation for sustained improvements in ACU's research capacity and strengthened its potential for broad collaborations.

The findings of the questionnaires used in our data gathering showed the TTO team was already competent in managing funds, financial resources, and human resources. However, other areas such as university-industry cooperation, securing intellectual property rights, and certain professional competencies had room for improvement. The TTO implemented targeted training and development programs to address individual skill deficits and enhance collective performance to ensure that future research support activities would benefit from a well-rounded, skilled team. All observations related to these dimensions presented herein are aligned with the qualitative findings of the initial focus group; this Conclusion section provides a concise summary of the outcomes.

By combining the findings derived from semi-structured interviews with questionnaires and focus group discussions, we were able to construct a comprehensive picture of the ways in which capacity-building efforts influenced the TTO's operations. Our approach allowed us to clearly identify the TTO team's strengths and challenges while accounting for the nuanced nature of the TTO staff's perspectives. The interviews captured sentiments regarding evolving competencies, the sometimes uneven distribution of new responsibilities, and the dynamic interplay between policy adjustments and day-to-day practices.

Using semi-structured interviews along with a structured thematic analysis process allowed us to gain a comprehensive and context-rich understanding of how the TTO's structure and operations affect its capacity-building. The insights obtained through open coding, axial coding, and theme formulation allowed us to identify areas where capacity-building initiatives had been successful and areas requiring additional support or strategic realignment. The results of our study emphasize the importance of continuous reflection and feedback in shaping capacity-building measures that are sustainable over the long term. This underscores the importance of an iterative, evidence-based approach to developing and refining research support services.

The use of real-world case studies to apply fundamental lessons derived from training sessions was a recurrent theme. Staff members were encouraged to present realistic challenges they encounter in their day-to-day tasks, helping to translate the theoretical knowledge imparted by ICONS and ULUND experts into actionable solutions. Discussions of these cases occurred in a supportive environment, enabling participants to learn collectively and witness first-hand the applicability of new strategies and procedures. This iterative form of learning helped to maintain alignment with the original plan's objective of enabling the TTO staff to integrate advanced competencies into their professional routines.

Combining the ICONS-led training sessions, on-site visits to LUND, and a mentoring approach based on case studies enabled the TTO to successfully implement a capacity-building plan that was designed to address the varying roles and expertise levels of its various staff members. The mentoring program, comprising layers of senior, intermediate, and junior staffers, along with the additional involvement of the GEMSTONE Project Manager, was guided by a unifying logic focused on refining existing practices, promoting strategic thinking and reinforcing a culture of collaboration. This synergistic effort was anchored in a previously proposed tiered plan that was enriched and adapted according to ACU's evolving needs. The result is a TTO that is more robust and versatile, and capable of managing complex research projects and international partnerships.

Incorporating the series of short-term visits to ULUND and ICONS into the Project reinforced the previously outlined mentoring plan, in which senior, intermediate and junior staff members were provided with targeted training. The on-site experiences built upon the foundational knowledge gained through earlier workshops, webinars, and remote sessions, creating a cohesive learning pathway. Each participant was encouraged to share newly acquired perspectives upon returning to ACU, thereby generating a multiplier effect that benefited the entire research support team. Over time, these exchanges promoted a robust and interconnected research ecosystem, as lessons learned abroad were integrated into day-to-day administrative processes, project workflows, and strategic planning at ACU.

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APPENDICES

Table 1: Evaluation Scale for Competencies and Skill Matrix of ACU TTO Staff

0 - This topic is not related to my field of study.
1- I do not know about this subject;
2 - I have knowledge about the subject, but I cannot manage it without help
3 - I can perform the relevant process at the expected level;
4 - I can completely carry out and develop the relevant process
5 - I am competent enough to replan the relevant process

ENHANCING RESEARCH SUPPORT SERVICES THROUGH AN EU PROJECT: A CASE STUDY

ABSTRACT

This article focuses on capacity-building activities designed for the Technology Transfer Office (TTO) in Türkiye's Acibadem University (ACU) via the GEMSTONE Project, a Twinning scheme project funded under the Horizon Europe Program.

The project's objective was to identify best practices in research and technology transfer management and to enhance the professional capabilities of TTO personnel, thereby providing ACU researchers with more comprehensive and effective support services. The project employed an iterative process of defining standards, implementing improvements, and reassessing outcomes with the goal of helping to strengthen ACU's research environment and international competitiveness over the long term.

The process used a three-phased approach, with each phase addressing a core objective. The initial phase involved mapping the existing competencies, skills, policies, and practices in research management and administration at ACU. In this phase, Lund University in Sweden was used for comparison, as an exemplary model of best practices. The second phase identified areas for improvement to enhance the capacity and efficiency of research support. As the third phase, training programs, mentoring sessions, and short-term visits were designed to enhance the capabilities of ACU's TTO staff.

The impact of this effort was achieved by enhancing research support services, guided by the expertise and assistance required to navigate complex processes, and ensure alignment with funding agency guidelines and institutional policies. Türkiye's higher education research ecosystem was strengthened by activities designed to share best practices, fostering an environment conducive to scholarly advancement.

Keywords Research Support Services, Best Practice Sharing, Research Management, Academic Impact, Academic Competencies

INTRODUCTION

Universities are key drivers of innovation, and their technology transfer offices (TTOs) serve as crucial intermediaries between academic research and industry needs. These offices facilitate partnerships, manage intellectual property rights, and support the commercialization of research outputs. By fostering an environment that encourages collaboration and entrepreneurship, TTOs contribute significantly to regional and national economic development while reinforcing the research capacity of their host institutions.

Recent studies show the significance of a robust administrative framework in nurturing high-quality research outcomes. For example, Soares and Torkomian [1] explore the impact of TTO employees' individual capabilities on the technology transfer process, addressing a significant gap in the literature. This study examines how officers with particular capabilities influence the early and late stages of the transfer process. TTO employees must perform a range of tasks effectively, which requires a diverse set of soft and hard skills. This study explores the impact of TTO staff members' individual capabilities on the technology transfer process (p. 2).

The Turkish National Technology Transfer Ecosystem Report (2022), prepared by University-Industry Collaboration Centers Platform (ÜSİMP) [2] indicates that TTOs in Türkiye differ in structure and mission, depending on the services they provide. These differences are mostly attributed to the varying expertise of the TTO staff (p. 11). In terms of the use of research funds, national projects (230 out of 304, a 75% success rate) were

supported at a higher level than international projects (46 out of 127, a 36% success rate). ÜSİMP's [3] findings on TTO expert staff engagement and job satisfaction indicate that only 49% of TTO experts were actively engaged, while 51% did not feel engaged (which of 20% reported as very low engagement) level.

The highest engagement was observed among staff members older than 55, while the lowest engagement rates occurred in the 25-and-under and 30–34 age brackets. The investigation identified career development limitations as a primary reason for low satisfaction, with specific challenges including the absence of performance management systems and inadequate salaries (p. 8). Furthermore, the study noted that TTO experts with undergraduate degrees exhibited the lowest engagement, while those with PhDs demonstrated the highest engagement.

TTOs have reported a wide range of challenges, including weak institutionalization, unclear procedures, poorly defined workloads, insufficient documentation, limited career opportunities, inexperienced staff, and inadequate digitalization (p. 10). According to the Turkish Ministry of Industry and Technology (2021) [4], one of the primary goals of a TTO's activities is to increase research funds (p. 5), and taking a more active role in the international fund ecosystem was identified as a key area for improvement (p. 7). One of the report's recommendations, which aligns with the focus of this study, was that TTOs should have specialized human resources focused on procuring international funding.

The book "Teknoloji Transfer Ofisleri" ([5], which is based on technology transfer offices in Türkiye from conceptualization through governance, emphasizes the importance of recognition and the visibility for TTOs. In addition, it suggests practices to improve fund management capabilities.

To address TTOs' challenges and support TTO experts in providing enhanced services for researchers, ACU initiated the GEMSTONE project, which was funded by the European Union under Horizon Europe Research and Innovation Programme-Twinning scheme The project was initiated to enhance research support services at ACU by upgrading the competencies and efficiency of personnel in the TTO (also referred to as the Research Support Office), addressing disparities in research support between ACU and Sweden's Lund University (ULUND). The project proposal emphasized the challenges ACU faces in producing competitive research compared to ULUND, and identified a gap in the TTO staff's expertise with respect to project applications, management, technology transfer, and intellectual property. Through the project, ACU's research support office was strengthened by refining researcher support services and upgrading the staff's soft skills through various means, including competency and skill matrixes, surveys, and training.

METHODS

APPROACH AND PLAN

We adopt a case study approach here, as it allows for an exhaustive examination of the capacity-building process within a single institution, namely ACU's TTO. In the social sciences, a case study done by Yin [6] enables a detailed exploration of a specific "bounded system" that comprehensively investigates its unique organizational context, stakeholders, and processes .

This section provides a detailed explanation of the case study method. In this study, the TTO's capacity-building activities were viewed as an integrated system with interdependent modules (e.g., project management, IP management, and funding applications). By integrating qualitative (e.g., semi-structured interviews and focus groups) and quantitative (e.g., questionnaires and performance metrics) data collection methods, the study captures the intricacies of organizational change, providing nuanced insights into staff competencies, institutional resources and administrative procedures.

Our case study design allows for a comprehensive investigation of the TTO's operational structure, staff skill levels, and stakeholder interactions, offering contextual richness that would have been obscured in a broad comparative analysis involving multiple institutions. We employed a range of data collection techniques (i.e., surveys, interviews, and focus groups) to triangulate the findings. This methodological triangulation enhances the validity of the conclusions regarding capacity-building outcomes and staff development.

The practical and action-oriented nature of the study is also a notable strength. Our objective was not solely theoretical; we sought to implement and evaluate interventions (e.g., trainings, mentoring programs, and short visits) to enhance research management services. The case study method facilitated the ongoing assessment of these interventions, allowing researchers to capture real-time feedback and observable shifts in practice. The transferability

of insights is as follows: While the study focuses on a single institution, the processes by which ACO's TTO improved its capacities offer lessons for other universities or research offices with similar structural or developmental contexts.

By using a case study approach, the TTO's research team gained a comprehensive understanding of how capacity-building measures influence performance, staff engagement, and organizational workflows. This methodological approach allowed us to capture the intricate dynamics at play within a singular yet instructive setting, thereby generating findings that are both contextually grounded and analytically robust.

DESIGN AND DATA COLLECTION

We first examined the structure of the TTO office, also referred to as the Research Support Office, as the central target of all capacity-building activities. We explored each operational module's stated objectives and its existing mechanisms for supporting researchers. We clarified the institutional context within which the TTO functions and outlined the diverse challenges of its various staff members, ranging from senior to junior personnel. These challenges were then considered in relation to the broader aims of the GEMSTONE project, underlining the significance of a well-defined organizational structure for facilitating research services and ensuring effective project management.

Next, we introduced the main objectives of the capacity-building activities implemented under the GEMSTONE project, emphasizing their crucial role in strengthening the TTO's ability to secure funding, manage intellectual property, and foster collaborations. These aims were then mapped against the identified needs of the TTO staff. A detailed description followed a needs assessment process conducted by administering questionnaires to the ACU TTO team, and through semi-structured interviews designed to uncover both overt and latent challenges in research support practices. These investigations informed the development of an action plan that was described and implemented through short visits and a structured mentoring program. Each step of the plan addressed the identified capacity gaps, such as insufficient project management know-how, limited international fund-tracking strategies, or inadequate networking with industry partners.

The subsequent section, entitled "Findings" presents the outcomes and experiences derived from these capacity-building efforts. These were organized into four main headings, with each one capturing a distinct aspect of the TTO's development. We obtained relevant data through participant feedback, workshop evaluations, and practical applications of the new skills and procedures.

Our conclusion provides a concise summary of our general findings and offers a perspective on the capacity-building process. Finally, we emphasize that all of the data used in this study was collected from questionnaires directed to the ACU TTO team, semi-structured interviews with key personnel, and reports documenting the interventions and trainings that shaped the TTO's transformation.

PROCESS OF THE STUDY

STRUCTURE OF ACU TECHNOLOGY TRANSFER OFFICE

The TTO at ACU is responsible providing research services, structured under seven modules that address several research support activities. In accordance with the TTO's fundamental mission to increase awareness among researchers and stakeholders regarding support mechanisms and research opportunities, and offer guidance on intellectual and industrial property rights, technology transfer, and entrepreneurship, the following modules were implemented as integrated services.

MODULE 1: Promotion and Dissemination of Fund Programs – aims to raise awareness and provide guidance for researchers about national and international research funding opportunities.

MODULE 2: Project Management Services – supports the development and operational management of funded research projects.

MODULE 3: University-Industry Collaboration Consultancy – encourages R&D collaboration between universities and industry.

MODULE 4: Intellectual Property (IP) Management and Licensing Services – established to handle IP rights and commercialization processes for ACU researchers' output.

MODULE 5: Entrepreneurship and Incorporation Activities – promoted through the Incubation Center to support entrepreneurial endeavors.

MODULE 6: Prototype Development and Biodesign Services – executed at the Biodesign Center to address the prototyping and design of medical devices that meet the demands of hospitals, medical personnel, academics, and entrepreneurs.

MODULE 7: The Test and Analysis Unit – established to fulfill test and analysis requests from companies, including validation and verification tests mandated by the Turkish Medicines and Medical Devices Agency.

These comprehensive research support services ensure that projects are thoroughly guided from the pre-application phase through the post-approval process while strengthening industrial and academic collaborations and seamlessly integrating research outputs into commercial and clinical environments.

Although the term TTO is used throughout this article, we acknowledge that this designation coincides with what is commonly referred to as a "Research Support Office." In academic institutions, the Research Support Office extends beyond traditional technology transfer functions, covering a broad spectrum of services that facilitate and enhance research activities. Consequently, all references to the TTO as outlined in the previous sections are intended to reflect the broader scope of the Research Support Office.

GEMSTONE Project methodology steps

As part of the GEMSTONE project, five fundamental steps were identified to guide the appropriate methods and development approaches.

The first step was to conduct an initial *assessment* of ACU's current organizational capacity through supporting research. This assessment included an analysis of existing policies, procedures, and practices related to research management and administration, conducted using qualitative and quantitative approaches. Data were collected from ACU TTO staff and researchers, and through collaborative communication with ULUND Research Support Services.

After the assessment phase was completed, attention was directed toward *identifying*, which involved pinpointing the differences between the ACU and ULUND to be addressed. These gaps were predominantly related to the competencies and skills of the TTO staff, ACU's organizational resources and infrastructure, and the structured administrative procedures required to secure grants and manage projects in accordance with international standards. After identifying these needs, a capacity-building plan was developed in consultation with the ULUND Research Support Staff and Fondazione ICONS. This plan was guided by the findings from the *mapping analysis* and included specific objectives and timelines, with clearly defined responsibilities assigned for each activity.

During the *implementation phase,* the capacity-building plan was operationalized through a range of activities, including training programs, workshops, mentoring sessions, and coaching opportunities. These efforts were designed to strengthen the competencies of TTO staff and refine the organizational mechanisms that underpin research support services.

Finally, *monitoring and evaluation* processes were implemented to ascertain whether the desired outcomes outlined in the original proposal had been achieved. This follow-up relied on both quantitative and qualitative methods, including surveys, interviews, and focus groups, to provide a comprehensive view of the effectiveness of the capacity-building strategy.

Capacity-building Objectives of the GEMSTONE Project

A three-phase process, designed within the GEMSTONE project to achieve the goal of strengthening the TTO office's capacity, was created with three main objectives.

-Objective 1: Assess current organizational capacity

For Objective 1, a detailed mapping of the competencies and skills represented among the research support staff was conducted to identify how policies and practices in research management and administration were applied at both ACU and ULUND. This included generating a competency and skills matrix to document the range of expertise possessed by the ACU TTO staff. To ascertain the gap between the ACU and ULUND, discussions were held with

the ULUND Research Services Manager about the ULUND team's skills, competencies, and operational framework. Similar insights were obtained from the TTO manager at ACU, who defined the roles, responsibilities, and expected competencies for each position within the TTO. The project team discussed and standardized each identified competency and created a questionnaire to capture the TTO staff's perceptions of their own capabilities. Furthermore, several focus group meetings were held with ACU TTO staff to gather qualitative input regarding their roles and expectations in collaborating with ULUND. All collected data, including both quantitative and qualitative, were analyzed and incorporated into this case study.

After the initial matrix and focus group analysis had been completed, the second stage commenced by inviting ACU researchers—through e-mail outreach—to fill out a questionnaire designed to evaluate their experiences with and assessments of the ACU TTO's services. This step provided additional insight into the everyday challenges the research community was facing and highlighted areas where capacity gaps were most pronounced.

In the third stage of the assessment, ULUND's research management and administration policies were reviewed by examining policy documents related to its broader research strategies. This analysis was reinforced by an online (virtual) meeting involving research support staff from both universities to discuss the best practices currently employed at ULUND and explore how these methods could be effectively transferred to ACU. These dialogs informed the resulting recommendations for enhancing research support capacity and efficiency and establishing a foundation for targeted capacity-building activities aimed at bridging the identified gaps.

-Objective 2: Identifying weaknesses, knowledge, and skills gaps and best practices

To achieve Objective 2, the analyses and assessment results obtained from the work to satisfy Objective 1 were presented to the project consortium and the relevant stakeholders at both ACU and ULUND. These findings guided a thorough examination of the organizational capacity gaps that emerged from the earlier mapping phase, shedding light on the differences between the structures and operations of the TTOs at ACU and ULUND. Emphasis was placed on understanding which shortfalls demanded attention to enhance ACU's organizational capacity, particularly in terms of its TTO's skillsets and competencies. These gaps were grouped under two principal themes: the university's organizational resources and infrastructure, and its structured administrative procedures. Concentrating on these areas provided insights into how the existing framework could be improved to more closely align with the successful practices observed at ULUND. Through this collaborative process, concrete steps were developed to address specific institutional and procedural elements that interfered with the ACU TTO's ability to more effectively support and manage research.

-Objective 3: Increase the TTO's capacity

A capacity-building plan was developed to address the organizational gaps identified through the mapping analysis, in close consultation with the ULUND Research Support Staff and ICONS. This included training sessions, mentoring opportunities, and short-term visits designed to benefit ACU personnel engaged in research support services, with the goal of strengthening the specific skill sets highlighted in the gap analysis. A phased implementation plan was then conducted to ensure that staff members could acquire relevant competencies and apply them to their daily tasks. Workshops, coaching activities, and targeted seminars were held to improve the knowledge base of ACU researchers and TTO staff, focusing on best practices in grant writing, project management, and international funding mechanisms.

After the plan had been implemented, monitoring and evaluation efforts were conducted to verify that the anticipated outcomes outlined in the proposal were achieved. Quantitative and qualitative tools—including surveys, interviews, and focus group discussions—were used to gauge improvements in staff capabilities and organizational readiness. A self-evaluation questionnaire was administered to ACU TTO personnel 18 months after the plan was implemented to capture any changes in perceived competencies, confidence levels, and new strengths or weaknesses. The follow-up phase clarified whether the training and support measures had effectively contributed to achieving the desired impact, particularly regarding skills development in line with international benchmarks.

Other evaluations, including 1- and 24-month questionnaires, were distributed to TTO employees, asking them to assess their competencies individually and as a team. Level 3 was defined as the expected standard of proficiency, and data collected through these questionnaires was incorporated into visualizations that illustrated progress over time (Table 1). By combining the initial and follow-up results into a unified graph, shifts in competencies became readily apparent, allowing stakeholders to gauge the effectiveness of the interventions and determine which areas of organizational capacity required further attention. This iterative cycle of planning, implementation, and

evaluation fostered continuous improvements in ACU's research support infrastructure, thus fortifying the TTO's role in advancing the university's broader research objectives.

Implementing the Capacity-Building Effort within the Scope of the GEMSTONE Project at ACU

Questionnaires to TTO Staff

Questionnaires were administered to TTO staff to obtain insights into their competencies, professional challenges, and perceptions of their day-to-day tasks and broader operational goals. This method was selected as it allowed for the collection of both quantitative and qualitative data as well as a systematic assessment of how staff perceptions aligned with the capacity-building objectives. The findings helped to more precisely identify knowledge gaps and informed evidence-based improvements, strengthening the TTO's capability to support research initiatives effectively.

In this section, we use radar charts to illustrate the distribution of scores from the questionnaire and to facilitate an in-depth understanding of capacity-building outcomes. We use the Python programming language and the matplotlib plotting library (v3.8.0) to generate customized graphical representations. Within this library, we use the pyplot module to plot and connect data points, producing the polygonal shape that is characteristic of radar charts. The charts were customized by adjusting axis limits, modifying labels and colors, and inserting legends and annotations, to enhance readability and interpretability. This provides a clearer view of skill and competency levels among TTO staff, enabling the project team to identify areas of progress and opportunities for further enhancement.

The graphics and charts are displayed for each Dimension. In these figures, the one on the left represents individual scores, and the one on the right reflects team scores.

-Dimension 1

Dimension 1 **(Figure 1 & 2)** shows varying degrees of self-perceived competence among the ACU TTO's staff and TTO Manager with respect to research infrastructure, human resources, tools, and the overall ecosystem. While planning process abilities were considered robust, the team was primarily viewed as capable of laying the groundwork rather than fully implementing and developing necessary procedures. This finding suggests that despite a high level of knowledge and awareness, additional efforts are needed to translate planning into practical outcomes**.**

-Dimension 2

Dimension 2 **(Figure 3 & 4)** reveals a significant discrepancy between the self-assessments of individual employees and the collective assessments of their teams. This discrepancy pertains to funding information and project management. TTO employees did not rate themselves as highly competent in these areas, yet they believed the team's performance surpassed expectations. This discrepancy indicates a compensatory dynamic in which collective efficacy offsets individual weaknesses. The results signal the value of maintaining strong team cohesion and collaborative practices while simultaneously addressing the skill deficits identified at the individual level**.**

-Dimension 3

In Dimension 3 **(Figure 5 & 6)**, managing funds, financial resources, and human resources were seen as areas of considerable strength by both managers and TTO employees. The self-perception of competence was high, and the team was consistently evaluated as having a strong foundation in these essential functions. The presence of a reliable framework for financial and resource management underscored the importance of capitalizing on existing expertise to reinforce TTO operations more broadly**.**

-Dimension 4

In Dimension 4 **(Figure 7 & 8)**, which focuses on university-industry collaboration, TTO employees did not perceive themselves as particularly proficient on an individual basis. Nevertheless, they regarded the team as functioning at a satisfactory level. However, the TTO Manager considered himself fully competent in one subfield and at the expected standard in the others. These disparities highlight the importance of targeted training for individual staff members, despite the collective competence attributed to the team**.**

-Dimension 5

Dimension 5 **(Figure 9 & 10)**, which focused on the management of intellectual property (IP) rights, also identifies a discrepancy between individual and collective competency ratings. TTO employees evaluated their personal skills as being below the expected reference level but perceived the team's collective proficiency as being in accordance with the standard. This discrepancy suggests that although institutional processes for IP management appear to be adequate, individual staff members would benefit from additional opportunities to enhance their expertise in this critical domain**.**

-Dimensions 6 and 7

Dimensions 6 and 7 **(Figure 11 & 12 & 13 & 14)** reveal that entrepreneurship and biodesign activities were seen as less pertinent to TTO employees' day-to-day responsibilities. Nevertheless, the staff maintained a positive evaluation of the team's capacity in these areas, to a certain extent. A willingness to engage, coupled with limited direct involvement, suggests the potential for enhancement if these domains were to be given greater prominence. The existing level of awareness establishes a foundation for potential expansion within entrepreneurship and biodesign support functions**.**

-Dimension 8

Within Dimension 8 **(Figures: 15-1 & 15-2, 15-3 & 15-4, and 15-5 & 15-6)**, which comprises 27 subdomain qualifications on professional skills and attitudes, notable variations were detected. TTO employees considered themselves more competent in some sub-areas than others, but team-based evaluations showed lower scores in specific domains. This pattern suggests that even though certain employees may excel individually, the TTO staff as a whole does not demonstrate the same level of proficiency. As a result, targeted interventions were proposed to enhance professional competencies and improve attitudes across the range of sub-domains**.**

Semi-Structured Interviews

We conducted semi-structured interviews to obtain more nuanced insights into the specific objectives and context of capacity-building activities implemented at ACU's TTO. The choice of semi-structured interviews was justified by the flexibility this method provides, as it allows interviewers to follow a predetermined guide with the flexibility to explore issues that may emerge spontaneously during a conversation. This flexibility ensures that participants' experiences, perspectives, and concerns are captured in a manner that would not be achievable through strictly structured or entirely unstructured interview formats. Additionally, participants are afforded the opportunity to elaborate on topics they consider significant. This enabled us to access more in-depth reflections on TTO employees' roles, the challenges they encounter, and the perceived outcomes of capacity-building interventions. Using an open-ended dialog framework within the semi-structured interview process enhanced the richness of the dataset, supporting the reliability of our thematic analysis.

After the conclusion of the interviews, the audio recordings were meticulously transcribed during the familiarization phase. This procedure ensured accurate data handling and facilitated close attention to linguistic nuances and contextual elements that were pivotal in capturing each participant's perspective. Subsequently, we adopted an open coding approach to identify words and concepts indicative of recurring patterns or salient ideas. During this phase, units of meaning were identified, labeled, and assigned initial codes that reflected their distinctive

content. Using these codes revealed latent and explicit themes in the participants' discussions about their experiences with the TTO's capacity-building activities and the resulting shifts in institutional practices.

Following the initial open coding, we employed axial coding to identify relationships among the codes. This procedure entails integrating individual codes into broader categories by examining how they intersect and interact. For example, we categorized codes of perceived skill deficits in specific domains of project management under overarching themes encompassing training, mentorship, and resource allocation. By establishing connections between codes in this manner, a coherent representation of the participants' experiences and perspectives on capacity-building processes emerged. This stage also clarified and refined the categories, eliminating redundancies and ensuring that the conceptual structure captured the essence of the interviews.

Finally, we developed and examined the various themes arising from these categories using a thorough review process. Each theme was evaluated for internal consistency, alignment with the coded data, and relevance to the research objectives. This thematic analysis produced insights into how the TTO staff perceived the strengths and limitations of the interventions designed to strengthen research support capacity. For example, certain themes highlighted variations in how different team members adapted to new administrative procedures, while others drew attention to shifts in the understanding of roles and responsibilities within collaborative projects. The interplay between individual skills development and collective team dynamics emerged as a recurring motif, illustrating the complexity of organizational change within the TTO.

Mentoring and Training Program

A mentoring and training program was implemented under the GEMSTONE project to strengthen the capacities of ACU's TTO staff, in alignment with the tiered plan previously outlined for senior, intermediate, and junior personnel. This initiative was refined and expanded through collaborations with ICONS and ULUND, thus bridging the earlier framework with new opportunities for international knowledge exchange and enhanced research support services. Integrating short visits, on-site sessions, and case-based mentoring has enabled the TTO staff to acquire profound insights into Horizon Europe's operational requirements and other external funding mechanisms, in addition to the day-to-day functions of effective project management.

A mentoring and training framework was devised to address the specific needs of the TTO staff. This plan, based on a tiered structure that distinguishes between senior, intermediate, and junior staff, was formulated in close collaboration with project partners. Its primary objectives were threefold: first, to strengthen staff capabilities in navigating diverse funding programs; second, to clarify essential procedures for research administration; and third, to promote effective institutional policies to optimize the grant process. Despite variations in individual responsibilities, a shared emphasis on understanding Horizon Europe and other international funding mechanisms supported the comprehensive approach.

ICONS played a pivotal role by offering external training opportunities, resources, and events that supplemented the goals delineated in the original plan. ICONS periodically shared podcasts, factsheets, and checklists with TTO staff and the GEMSTONE Project Manager to consolidate and broaden the knowledge base developed during formal sessions. On October 6, 2023, an ICONS representative delivered a teaching session at ACU, introducing key aspects of the Horizon Europe program. On 3 July 2024, an ICONS representative delivered a teaching session at ACU, explaining the financial statements and audit process in the Horizon Europe program. After these sessions, individual discussions were held with TTO representatives to better understand each staff member's professional needs, existing skill sets, and aspirations. These discussions helped to refine the plan ensuring a close match between the staff's actual requirements and the training content offered by ICONS and other partners.

- Senior Staff Members

Senior staff members were asked to enhance their familiarity with the specialized competencies of various university teams and units. It was deemed essential that these staff members learn to detect collaboration and funding opportunities, both internally and externally, and foster meaningful connections that could lead to strategic partnerships. In addition, the need to effectively promote the university's strengths in networking contexts, such as brokerage events, was highlighted. The Horizon Europe program was introduced to the group with a particular emphasis on increasing the impact of funding applications. The plan devotes a section to establishing clear roles and policies throughout the grant lifecycle, and suggests that by focusing on efficiency and effectiveness, these senior

personnel will be better positioned to provide leadership and oversight to the TTO, thereby reinforcing institutional expertise.

- Intermediate Staff Members

Intermediate staff members were mentored to enhance their knowledge of European and global programs pertinent to the objectives of the TTO. The plan emphasized understanding the structure of Horizon Europe and other potential funding mechanisms, including detailed eligibility requirements. Practical training was provided on searching for grants and navigating dedicated digital tools and platforms, such as the Funding and Tenders (F&T) portal. The program fostered the capacity to comprehensively evaluate funding applications and track and monitor project progress so that any deviations could be addressed promptly and in collaboration with appropriate stakeholders. A substantial proportion of the training program emphasized the significance of effective project meetings, equipping these staff members with the management skills needed to support project goals from inception to completion.

- Junior Staff Members

Training for junior staff members encompassed an introduction to the broader landscape of European and global funding options, with particular emphasis on the foundational elements of Horizon Europe and other critical funding avenues, including how to recognize eligibility criteria. In addition, the training provided step-by-step guidance on interpreting the structure of funding applications, along with practical instructions in using essential tools and platforms like F&T. Developing an understanding of project workflow, from preliminary grant searches to final closeout activities, was prioritized. While monitoring project progress was addressed in a fairly general manner, junior staff members acquired the fundamental knowledge needed to offer reliable support within the TTO's overall mission of facilitating research innovation.

- GEMSTONE Project Manager

The GEMSTONE Project Manager was included in the mentoring program, expanding the capacity-building plan beyond its original scope. This helped to comprehensively address the complexities of international project management, enriching the training content made available to both senior and junior TTO staff. Through structured interactions with the Project Manager, participants gained insights into cross-institutional collaborations, resource allocation, and specific administrative and financial requirements associated with multi-layered funding mechanisms. Introducing these managerial dimensions supported a more cohesive learning environment, as the project manager's day-to-day experiences and strategic oversight provided a practical framework for interpreting theoretical lessons. The TTO team increased their knowledge of funding programs and research administration, an gained a broader understanding of how these processes align with international project governance standards. The mentoring program further solidified institutional capacities and bridged potential gaps between operational tasks and high-level management strategies by leveraging the project manager's expertise.

By delineating the training objectives in this way, the mentoring program ensured that personnel at different stages of professional development were equipped to contribute to the TTO's overall mandate. Senior staff members strengthened their ability to steer institutional policies and cultivate strategic networks; intermediate staff developed practical competencies for managing projects in real time; and junior staff secured a critical foundation in key administrative and organizational procedures. This structured approach ensured that the TTO's capacity-building objectives were integrated into daily operations, thereby reinforcing the office's role in supporting research excellence at ACU.

Short-Term Visits to ULUND and ICONS

A series of short-term visits to ULUND and ICONS were organized for the ACU research support services staff with the aim of enhancing specific competencies. These visits focused on digital solutions, research funding systems, protecting IP, investments, university-industry collaboration, commercialization agreements, incubation, and data management in research. These visits were overseen by Research Funding Advisor at ULUND, and the program was tailored to the professional focus of each participating staff member, thereby facilitating a direct exchange of expertise between the two institutions. Through this immersion in ULUND's operational framework, the ACU team was exposed to established strategies, tools, and best practices that informed improvements in the research support services at ACU.

During these visits, the participants engaged in discussions about ULUND's internal processes for monitoring research tasks, including the use of digital platforms for tracking deadlines, managing resources, and reporting project outcomes. The discussions emphasized learning how ULUND staff structured internal research funding systems, from application procedures to post-award management, illustrating an integrated approach that supports both established and emerging research projects. Intellectual property and commercialization mechanisms were explored in depth, providing ACU's TTO staff with practical insights into drafting contracts and licensing terms, and strategies for attracting investment.

The program also included a thorough examination of university-industry collaborations, focusing on initiating, sustaining, and evaluating such partnerships at ULUND. This component elucidated institutional policies that foster knowledge transfer, entrepreneurial ventures, and market-driven research initiatives. Participants observed incubation processes that identify the stages at which academic concepts are refined, evaluated, and prepared for external funding, or spun off to establish separate enterprises. At the same time, data management strategies were investigated to ensure compliance with regulatory requirements and optimize the collection, storage and dissemination of research output. Each visit spanned multiple days, as outlined in the plan, and was aligned with the capacity-building objectives described in the GEMSTONE project. TTO staff members, including managers, specialists in business development, and project management personnel, participated in these exchanges according to their roles and professional development priorities. The program included opportunities for hands-on engagement and case-based discussions in which the visiting staff analyzed concrete scenarios drawn from their ongoing assignments at ACU. By comparing ULUND's methods of addressing similar challenges, participants clarified how theory translates into practice and how certain approaches could be adapted to ACU's institutional environment.

This series of short visits to ULUND and ICONS to provided ACU staff members with direct exposure to research administration practices at an internationally recognized institution. These visits were organized in alignment with the original three-tier training framework but were adapted to meet particular needs identified during the assessment of TTO staff competencies. Interactions with ULUND and ICONS research support professionals enabled the ACU TTO to observe and discuss best practices in grant application processes, collaborative partnerships, and integrating data protection guidelines. These interactions reinforced the structured approach proposed in the initial plan.

FINDINGS

-Finding #1: Overarching Objectives and Outcomes

The principal aim of the GEMSTONE project was to capture an accurate picture of ACU's TTO and to identify areas in need of improvement to strengthen the university's research capacity. This goal was achieved through a combination of methods that included examining current TTO operations, consultations with GEMSTONE project partners, and a comparison of best practices. The outcomes were quantifiable, providing insights into organizational needs and paving the way for targeted interventions.

As part of the project, it was observed that research services at ULUND were conducted by a Research Funding Office, which differed from the TTO structure at ACU. The distinction between the two was primarily manifested in the scope of services offered, with ULUND's Research Funding Office operating in alignment with the functions covered by Modules 1 and 2 of ACU's TTO. This comparison showed that ULUND's organizational design and operational focus concentrated on identifying and managing funding opportunities, whereas ACU's TTO encompassed a broader range of activities.

Briefings and administrative training were provided to various governing bodies in the university that are linked to the TTO's workflow. This facilitated a more seamless collaboration across different administrative units as overlapping responsibilities and parallel objectives were clarified. This interoffice alignment was found to positively impact the TTO's potential to better support ACU's institutional research goals.

-Finding #2: TTO Composition and Modular Structure

The ACU TTO comprises 10 expert staff members who operate in seven modules. The existence of these distinct modules demonstrates the multifaceted nature of research support services, which range from project management and intellectual property services to industry collaborations. Maintaining specialized teams for each module enabled the TTO to offer a comprehensive suite of services that address researchers' diverse needs. This

modular framework also clearly delineated various responsibilities, enabling more effective coordination and task assignment across units.

There was a marked shift in the nature and volume of project profiles supported by the TTO before and after the capacity-building activities. Operational workflows for international funds were found to be more structured, and TTO staff had received specialized training in relevant procedures. Researchers were also more aware of the TTO's services and expressed eagerness to access and leverage international funding opportunities. Furthermore, there was a discernible alignment between institutional policies and official documentation and international standards, and the university's overarching research vision became more attuned to global fund management practices.

-Finding #3: Communication and Awareness-Raising Efforts

Within the scope of the project, the TTO's roles and responsibilities were communicated to a targeted group of ACU researchers on a continuous basis. This was achieved through meetings, electronic bulletins, emails, and social media channels, to ensure that all researchers were aware of the support and resources available to them. This strategy of repeated outreach proved crucial for establishing continuous engagement as it extended beyond a single event and fostered an ongoing dialog between the TTO and the potential beneficiaries of its services. By sustaining these communication efforts, the TTO strengthened its visibility and relevance within ACU's broader research ecosystem.

We observed a substantial foundation in specific areas of the TTO's operations, particularly the management of funds and the coordination of financial and human resources. However, certain arenas, such as university-industry cooperation, managing intellectual property rights, and cultivating professional skills and attitudes, were identified as areas for further development. Targeted training and structured development initiatives were identified as ways to address individual deficiencies and enhance team performance in these domains.

We identified a general increase in self-awareness, encompassing both motivation and recognition **(Figure 8).** Visibility for the TTO staff increased among in-house researchers and other university offices, as well as in inter-institutional networks such as EARMA. This broader acknowledgment of the TTO's expertise and contributions fostered a climate of mutual respect and facilitated a more proactive engagement with potential collaborators.

Establishing explicit targets for the TTO within the projects heightened the interest in developing internal research initiatives. Involvement in such projects increased motivation levels, particularly when senior management provided consistent institutional and individual support. This support was found to be essential for sustaining staff dedication, advancing project outcomes, and enhancing the overall momentum of capacity-building efforts.

We found that the TTO's role gained recognition after mapping outcomes were disseminated through promotional events, announcements, and meetings. This enhanced visibility contributed to an expanded awareness of the TTO's objectives and functions, both within the ACU and among external stakeholders. The data collected during the mapping process provided a solid foundation for outreach efforts, effectively positioned the TTO as a key facilitator of research excellence.

-Finding #4: Enhancement of Professional and Soft Skill Skills

The fourth finding indicates that TTO staff members enhanced their skills both in terms of professional knowledge (e.g., expertise about research methodologies, grant-writing procedures, and data management) and their soft skills (e.g., communication abilities, networking capabilities, and empathetic listening). Improving these soft skills enabled staff members to better understand researchers' needs, recommend more appropriate research pathways, and employ social media tools to connect with specialized audiences. The enhanced interaction with the research community contributed to more accurate problem identification, improved service delivery, and a heightened ability to adapt to evolving project demands.

The ACU TTO staff exhibited a strong predisposition toward teamwork. Individual self-awareness regarding competencies was noted to be high; however, the collective trust placed on the team exceeded the perception of individual competence. This finding underscores the presence of a collaborative culture within the TTO, where challenges are addressed collectively and responsibility is distributed in a manner that capitalizes on the collective strengths of the staff, as opposed to relying solely on individual expertise.

The TTO has become a focal point of attention at ACU as a result of its research capacity-building activities. This heightened prominence has been endorsed by both the TTO staff and the university Rectorate, which support the continuation and expansion of development measures. A steady increase in the number of international fund applications was noted, underscoring the growing engagement of ACU researchers in global collaborations.

Concurrently, membership in COST Actions exhibited an upward trend, reflecting the parallel expansion of the institution's project consortium networks. Furthermore, connections among TTOs across different universities were strengthened through new meetings and brokerage events, indicating an enlarged scope of collaborative possibilities.

CONCLUSION

The GEMSTONE project was developed to address existing gaps in ACU's TTO operations, communication channels, and skills development. By integrating the findings discussed here, the TTO services, combined with tailored enhancements of the staff's professional and soft skills, resulted in a more responsive and agile infrastructure to support ACU's research initiatives. The multifaceted approach described here established a foundation for sustained improvements in ACU's research capacity and strengthened its potential for broad collaborations.

The findings of the questionnaires used in our data gathering showed the TTO team was already competent in managing funds, financial resources, and human resources. However, other areas such as university-industry cooperation, securing intellectual property rights, and certain professional competencies had room for improvement. The TTO implemented targeted training and development programs to address individual skill deficits and enhance collective performance to ensure that future research support activities would benefit from a well-rounded, skilled team. All observations related to these dimensions presented herein are aligned with the qualitative findings of the initial focus group; this Conclusion section provides a concise summary of the outcomes.

By combining the findings derived from semi-structured interviews with questionnaires and focus group discussions, we were able to construct a comprehensive picture of the ways in which capacity-building efforts influenced the TTO's operations. Our approach allowed us to clearly identify the TTO team's strengths and challenges while accounting for the nuanced nature of the TTO staff's perspectives. The interviews captured sentiments regarding evolving competencies, the sometimes uneven distribution of new responsibilities, and the dynamic interplay between policy adjustments and day-to-day practices.

Using semi-structured interviews along with a structured thematic analysis process allowed us to gain a comprehensive and context-rich understanding of how the TTO's structure and operations affect its capacity-building. The insights obtained through open coding, axial coding, and theme formulation allowed us to identify areas where capacity-building initiatives had been successful and areas requiring additional support or strategic realignment. The results of our study emphasize the importance of continuous reflection and feedback in shaping capacity-building measures that are sustainable over the long term. This underscores the importance of an iterative, evidence-based approach to developing and refining research support services.

The use of real-world case studies to apply fundamental lessons derived from training sessions was a recurrent theme. Staff members were encouraged to present realistic challenges they encounter in their day-to-day tasks, helping to translate the theoretical knowledge imparted by ICONS and ULUND experts into actionable solutions. Discussions of these cases occurred in a supportive environment, enabling participants to learn collectively and witness first-hand the applicability of new strategies and procedures. This iterative form of learning helped to maintain alignment with the original plan's objective of enabling the TTO staff to integrate advanced competencies into their professional routines.

Combining the ICONS-led training sessions, on-site visits to LUND, and a mentoring approach based on case studies enabled the TTO to successfully implement a capacity-building plan that was designed to address the varying roles and expertise levels of its various staff members. The mentoring program, comprising layers of senior, intermediate, and junior staffers, along with the additional involvement of the GEMSTONE Project Manager, was guided by a unifying logic focused on refining existing practices, promoting strategic thinking and reinforcing a culture of collaboration. This synergistic effort was anchored in a previously proposed tiered plan that was enriched and adapted according to ACU's evolving needs. The result is a TTO that is more robust and versatile, and capable of managing complex research projects and international partnerships.

Incorporating the series of short-term visits to ULUND and ICONS into the Project reinforced the previously outlined mentoring plan, in which senior, intermediate and junior staff members were provided with targeted training. The on-site experiences built upon the foundational knowledge gained through earlier workshops, webinars, and remote sessions, creating a cohesive learning pathway. Each participant was encouraged to share newly acquired perspectives upon returning to ACU, thereby generating a multiplier effect that benefited the entire research support

team. Over time, these exchanges promoted a robust and interconnected research ecosystem, as lessons learned abroad were integrated into day-to-day administrative processes, project workflows, and strategic planning at ACU.

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