



**UNIVERSITY OF THE PHILIPPINES  
OPEN UNIVERSITY**

**MASTER OF RESEARCH AND DEVELOPMENT MANAGEMENT**

**RANDY MANAPOL ARCANGEL**

**DEVELOPMENT OF THE RESEARCH AND DEVELOPMENT (R&D) AGENDA OF  
PHILIPPINE STATE COLLEGE OF AERONAUTICS (PhilSCA) FOR 2026-2030**

Special Problem Adviser:

**LEO MENDEL D. ROSARIO, PHD.  
Faculty of Management and Development Studies**

15/08/2025

Permission is given for the following people to have access this special problem, subject to the provisions of applicable laws, the provisions of the UPIPR policy and any contractual obligations:

Invention(I)	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Publication(P)	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Confidential(C)	<input type="checkbox"/> Yes or <input checked="" type="checkbox"/> No
Free(F)	<input checked="" type="checkbox"/> Yes or <input type="checkbox"/> No

Student's signature:

SP adviser signature:

## University Permission Page

### DEVELOPMENT OF THE RESEARCH AND DEVELOPMENT (R&D) AGENDA OF PHILIPPINE STATE COLLEGE OF AERONAUTICS (PhilSCA) FOR 2026- 2030

*“I hereby grant the University of the Philippines a non-exclusive, worldwide, royalty- free license to reproduce, publish and publicly distribute copies of this Academic Work in whatever form subject to the provisions of applicable laws, the provisions of the UP IPR policy and any contractual obligations, as well as more specific permission marking on the Title Page.”*

*“I specifically allow the University to:*

*Specifically, I grant the following rights to the University:*

- a. Upload a copy of the work in the theses database of the college/school/institute/department and in any other databases available on the public internet*
- b. Publish the work in the college/school/institute/department journal, both in print and electronic or digital format and online; and*
- c. Give open access to the work, thus allowing “fair use” of the work in accordance with the provision of the Intellectual Property Code of the Philippines (RepublicActNo.8293), especially for teaching, scholarly and research purposes.*

Randy Manapol Arcangel  
Signature over Student Name

**Acceptance Page:**

This Special Problem of **RANDY MANAPOL ARCANGEL** titled: “**DEVELOPMENT OF THE RESEARCH AND DEVELOPMENT (R&D) AGENDA OF PHILIPPINE STATE COLLEGE OF AERONAUTICS (PhilSCA) FOR 2026-2030**” is hereby accepted by the Faculty of Management and Development Studies, U.P. Open University, in partial fulfillment of the requirements for the degree Master of Research and Development Management.

**LEO MENDEL D. ROSARIO, PHD.**

Faculty In-Charge, RMDM 298 (Special Problem)

\_\_\_\_\_ Date

**LEO MENDEL D. ROSARIO, PHD.**

Program Chair

\_\_\_\_\_ Date

**FINAFLOR F. TAYLAN, DPFROST.**

Dean

Faculty of Management and Development Studies

\_\_\_\_\_ Date

## DECLARATION

This is to certify that:

- I. The special problem comprises only my original work towards the MRDM except where indicated in the Preface
- II. Due acknowledgment has been made in the text to all other material used
- III. The special problem is fewer than 25,000 words in length, exclusive of tables, maps, bibliographies and appendices

**RANDY MANAPOL ARCANGEL**

Name

## Biographical Sketch

Randy Manapol Arcangel is a statistician and data analyst with more than a decade of professional experience in survey questionnaire development, statistical reporting, data quality assessment, and advanced data analytics. Trained in ISO standards and Joint Commission International (JCI) accreditation, he possesses specialized expertise in research and development (R&D) management, data mining, market segmentation, policy development, and statistical modeling. He is also proficient in a wide range of statistical and data management tools including Microsoft Excel, E-Views, SAS, SPSS, MySQL, R-Studio, and Python.

Randy Manapol Arcangel earned a Bachelor of Science in Statistics, combining academic rigor with practical experience in analytics and research. Professional roles have included Senior Data Analyst (2022–2025, 2015–2020), Statistician (2011–2015), and Project Research Staff/Statistical Analyst (2009–2011). Across these positions, he has contributed to accreditation compliance, evidence-based policy formulation, and the design of research frameworks for both institutional and applied settings.

## **Acknowledgement**

The author sincerely extends profound gratitude to the PhilSCA Research and Development Director, Dr. Noel Navigar, for the unwavering support and encouragement throughout the conduct of this study. Heartfelt thanks are also given to the PhilSCA staff (coordinator) for their assistance and cooperation, which greatly facilitated the research process. The author likewise expresses appreciation to the University of the Philippines Open University (UPOU) for providing an enabling academic environment and valuable learning resources that enriched this work. Above all, the author is deeply grateful to Dr. Leo Mendel Rosario, his adviser, whose expert guidance, constructive feedback, and steadfast mentorship have been invaluable in the successful completion of this study.

## **Dedication**

This work is dedicated to the Philippine State College of Aeronautics (PhilSCA) and the University of the Philippines Open University (UPOU), whose commitment to academic excellence and research innovation has inspired the completion of this study. It is also devoted to my adviser, whose unwavering guidance and encouragement have been a source of strength, and to all the PhilSCA staff whose support made this endeavor possible. Above all, this is dedicated to my family and loved ones, whose patience, understanding, and faith have been my constant motivation.

## **Abstract**

This study aimed to develop the Research and Development (R&D) agenda of the Philippine State College of Aeronautics (PhilSCA) for the period 2026–2030 using thematic analysis of previous research outputs conducted in Philippine Aviation Research Conference (PARC) and proposed studies submitted by faculty members during workshop and conferences conducted last 2024 under the RDLead Program. Specifically, it evaluated the alignment of existing research with the 2021–2025 agenda, identified thematic overlaps and gaps, and proposed strategic priorities for the next cycle. Past institutional research from 2022–2024 and proposed studies 2024 was collected, coded, and mapped to the existing R&D agenda items per program. Research coverage status was computed to identify well-covered, moderately covered, and under-researched areas. Topics and proposed studies were clustered to program research agenda which covered 13 programs in the field of aviation research: Aviation Education, Aeronautical Communication, Aviation Tourism, Aviation Logistics, Aviation Security and Management, Aeronautical Engineering, Aircraft Maintenance Technology (AMT), Air Transportation, Avionics, Aviation Information Technology and Information Management, Aeronautical Management and Public Administration.

Findings revealed varying levels of alignment with the existing agenda. Some programs, such as Aircraft Maintenance Technology and Aviation Logistics, demonstrated strong coverage of technical and operational themes, while others, including Aeronautical Management and Public Administration, reflected gaps in governance, policy, and emerging digital aviation technologies. Thematic overlaps were evident in areas such as safety management, curriculum enhancement, and technical skill development, while critical gaps emerged in artificial intelligence

applications, digital learning platforms, sustainability, gender mainstreaming, and predictive analytics for aviation operations.

Based on these insights, the proposed R&D Agenda 2026–2030 emphasizes five strategic priorities: (1) program enhancement and curriculum innovation, (2) technological integration in aviation, particularly AI, IoT, and data analytics, (3) sustainability and environmental stewardship in aviation, (4) leadership, policy, and governance research, and (5) digital learning and pedagogical transformation. An implementation and continuous monitoring framework are recommended, highlighting program-level action planning, research management platforms, coverage tracking, annual reviews, capacity building and stakeholder engagement mechanisms to ensure sustainability.

This study concludes that while PhilSCA’s research outputs between 2022 and 2024 provided a foundation aligned with institutional priorities, significant opportunities remain to address underrepresented areas and anticipate future sectoral needs. Lessons learned emphasize the value of coverage analysis, stakeholder participation, and reflective practice in ensuring research agendas remain dynamic, inclusive, and responsive to global aviation challenges. The resulting agenda offers a forward-looking roadmap for strengthening research productivity, enhancing academic and industry collaboration, and positioning PhilSCA as a leader in innovative and sustainable aviation research in the Philippines.

*Keywords: PhilSCA, R&D Agenda, Thematic Analysis, Aviation Research, Gap Analysis, Continuous Improvement, R&D priorities*

## TABLE OF CONTENTS

Title Page	i
University Permission Page	ii
Acceptance Page	iii
Declaration	iv
Biographical Sketch	v
Acknowledgment	vi
Dedication	vii
Table of Contents	x
List of Tables	xi
List of Figures	xiii
ABSTRACT	viii
1. BACKGROUND/RATIONALE OF THE STUDY	1
2. PROBLEM STATEMENT	8
3. OBJECTIVES OF THE STUDY	9
4. SCOPE AND LIMITATIONS	10
5. SIGNIFICANCE OF THE STUDY	11
6. R&D MANAGEMENT FRAMING (REVIEW OF THEORETICAL R&D CONCEPTS RELATED TO THE TOPIC)	12
7. ENVIRONMENTAL CONTEXTUALIZATION (E.G. WORKPLACE ENVIRONMENT, CLIENT RELATIONSHIP)	25
8. METHODS (PROCESS DOCUMENTATION/DESCRIPTION)	27
9. FINDINGS, RECOMMENDATION, ISSUES AND CONCERNS, BEST PRACTICES, PLAN, PROPOSAL, AND DESIGN	30
10. CONCLUSION AND LESSONS LEARNED	115
REFERENCES	117
APPENDICES	
Appendix A. Summary of Findings & Recommendations (2022–2024)	123
Appendix B. College Research Agenda	127
Appendix C. Research Agenda by Institute and by Program	129
Appendix D. Certificate of Acceptance	142

## List of Tables

Table 1. Coverage Equity	21
Table 2. Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making	22
Table 3. Total number of Existing R&D Agenda Items vs. R&D Agenda with Research/Studies by program	32
Table 4: Bachelor of Science in Aviation Communication: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	36
Table 5: Bachelor of Science in Aviation Logistics: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	41
Table 6: Bachelor of Science in Aviation Tourism: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	47
Table 7: Bachelor of Science in Aviation Safety and Security Management: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	52
Table 8: General Education: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	57
Table 9: Bachelor of Science in Aeronautical Engineering Program: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	62
Table 10: Bachelor of Science in Aircraft Maintenance Technology: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	67
Table 11: Bachelor of Science in Air Transportation: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	71
Table 12: Aviation Electronics Technology: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	75
Table 13: Bachelor of Science in Aviation Information Technology: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	80
Table 14: Bachelor of Science in Aviation Information Management: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	85
Table 15: Master of Education in Aeronautical Management: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	90
Table 16: Master in Public Administration: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	96
Table 17: R&D Management Unit: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps	102

Table A1: Proposed R&D Agenda 2026–2030 Focus Based on Key Gaps Identified and Emerging Trends	123
Table B1: College R&D Agenda by Key Research Area	127
Table C1: R&D Agenda of the Institute of Liberal Arts and Sciences (ILAS)	129
Table C2: Program R&D Agenda of the ILAS	131
Table C3: R&D Agenda of the Institute of Engineering and Technology	133
Table C4: Program R&D Agenda of the Institute of Engineering and Technology (InET)	135
Table C5: R&D Agenda of the Institute of Computer Studies (ICS)	137
Table C6: Program R&D Agenda of the Institute of Computer Studies (ICS)	138
Table C7: R&D Agenda of the Institute of Graduate Studies (IGS)	139
Table C8: Program R&D Agenda of the Institute of Graduate Studies (IGS)	140
Table C9: R&D Agenda across the Program	141

## List of Figures

Figure 1. The four-phase cyclical framework for the development of the PhilSCA Research and Development (R&D) Agenda 2026–2030	16
Figure 2. Research and Development Agenda Process Flow	17
Figure 3. Distribution of Research Studies by Program, 2022 to 2024	31

# 1. BACKGROUND / RATIONALE OF THE STUDY

## 1.1 Research Agenda Setting in Higher Education

Research agenda setting serves as a strategic compass for higher education institutions (HEIs), directing academic activities, prioritizing resource allocation, and ensuring alignment with both institutional and societal goals. According to Zarate and David (2019), universities in the Philippines are increasingly expected to contribute to socio-economic development through well-defined research priorities that respond to industry needs and global standards. Cloete et al. (2011) emphasize that HEIs must strategically position their research not only for knowledge generation but also for social impact and innovation. Similarly, Hazelkorn (2011) underscores that a systematic and well-structured research roadmap enables meaningful knowledge creation, technological advancement, and contributions to sustainable national development.

In the Philippine context, HEIs are mandated to align their R&D agendas with national frameworks. The Department of Science and Technology's Harmonized National R&D Agenda (HNRDA) 2022–2028 identifies priority areas such as Industry, Energy, Emerging Technology, Disaster Risk Reduction, and Space Science that resonate with PhilSCA's aeronautical and aerospace focus (DOST, 2022). Earlier iterations of the HNRDA (2017–2022) similarly emphasized intelligent transport and sustainable energy, which remain highly relevant to aviation research (DOST, 2017). In parallel, the Commission on Higher Education (CHED) promotes research alignment through the National Higher Education Research Agenda (NHERA) and its RDE platforms, ensuring institutional research complements broader developmental goals (CHED, n.d.).

Globally, diverse methodologies have been adopted for agenda setting. The Delphi method has been widely used to consolidate expert consensus in technical fields (Okoli & Pawlowski, 2004). The Child Health and Nutrition Research Initiative (CHNRI) method offers a structured scoring system that can be adapted by HEIs for transparent prioritization (Rudan et al., 2014). The James Lind Alliance (JLA) model further stresses the importance of stakeholder engagement (JLA, 2021). To support evidence-based decision-making, agenda setters increasingly rely on systematic reviews (Page et al., 2021), bibliometric mapping using tools such as bibliometrix (Aria & Cuccurullo, 2017) and VOSviewer (Van Eck & Waltman, 2010), and qualitative thematic analysis (Braun & Clarke, 2006).

For a specialized institution such as the Philippine State College of Aeronautics (PhilSCA), agenda setting is particularly crucial to remain responsive to the evolving needs of the aviation sector and to position itself as a national leader in aeronautics education, research, and innovation. Aviation sector roadmaps also serve as important “demand signals.” For instance, ICAO’s Global Aviation Safety Plan (GASP 2023–2025) emphasizes safety performance targets and data-driven risk management (ICAO, 2023a). Likewise, ICAO’s Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) prioritize sustainable aviation fuels and lifecycle emissions analysis (ICAO, 2024a). ICAO’s Next Generation of Aviation Professionals (NGAP) initiative and competency-based training frameworks (ICAO, 2020) further highlight the need for institutions like PhilSCA to produce aviation professionals equipped with cutting-edge skills.

Recent studies also highlight the role of participatory approaches in agenda setting. Gudowsky (2021) emphasizes participatory foresight that integrates faculty, students, policymakers, and industry experts. Meyer et al. (2023) note the

importance of balancing institutional interests with broader societal needs. In the Philippines, CHED Memorandum Orders (CMOs) and the Philippine Higher Education Research Network (PHERNET) encourage consultations, workshops, and collaborative frameworks in agenda setting (CHED, 2020).

Finally, research agenda setting should be viewed as a continuous improvement process. Deming's PDCA (Plan–Do–Check–Act) cycle (1986) provides a framework to ensure research priorities are dynamic and responsive. Yurkofsky et al. (2020) affirm that iterative cycles of planning, evaluation, and reflection strengthen HEI research management. Balita (2021) highlighted that continuous improvement in Philippine HEIs is achieved through agenda reviews, benchmarking, and faculty capacity-building. For HEIs, integrating agenda setting with continuous improvement ensures sustainability, relevance, and responsiveness (WHO, 2020).

## **1.2 The Previous PhilSCA R&D Agenda 2021–2025 and Its Weaknesses**

The PhilSCA, as the country's premier higher education institution in aviation sciences, developed its Research and Development (R&D) Agenda for 2021–2025 through a participatory, multi-stakeholder process. The agenda was anchored on PhilSCA's strategic directions, CHED's research priorities, and global frameworks such as the Sustainable Development Goals (SDGs). Priority areas were clustered into domains such as aviation engineering and technology, policy and governance, safety and security, liberal arts, and education (PhilSCA, 2021).

While this agenda demonstrated methodological rigor, several weaknesses have been identified:

1. Implementation Gap – Limited evidence of translation into funded projects, publications, patents, or partnerships (Rosario, 2023).

2. Broad Domains, Limited Specificity – Expansive clusters without specific research questions or measurable targets (PhilSCA, 2021).
3. Resource and Infrastructure Constraints – Outdated laboratories and limited technology access constrained outputs (FindUniversity.ph, 2020).
4. Partial Alignment with Industry Needs – Some areas lacked direct linkage to PhilSCA’s aviation-centered mandate (PhilSCA BOT, 2021).
5. Overly Abstract Categories – Generic domains like “Liberal Arts and Sciences” lacked thematic focus.
6. Lack of Clear Prioritization Rules – The PRA–IRA–CRA hierarchy produced ambiguity in resource allocation.
7. Process-Heavy, Outcome-Light – Strong on consultations but weak in output targets and utilization benchmarks.
8. Insufficient Industry Linkages – Limited translation into applied pilots, partnerships, and technology transfer.
9. Weak Monitoring & Evaluation (M&E) – Absence of clear KPIs, mid-course reviews, and accountability frameworks.
10. Capacity Constraints – Typical SUC issues (funding, labs, faculty support) limited execution.

These gaps highlight the need to redevelop a more focused, implementable, and industry-responsive R&D agenda for 2026–2030.

### **1.3 The Need for a Redeveloped Agenda and Proposed Methodology for 2026–2030**

Globally, the aviation industry is experiencing rapid transformation driven by breakthroughs in artificial intelligence, automation, additive manufacturing, unmanned aircraft systems, and sustainable aviation fuels. At the same time, heightened regulatory focus on environmental sustainability, operational safety, and workforce development is reshaping industry priorities (IATA, 2023; ICAO, 2024). These shifts require academic institutions like PhilSCA to continually reassess and recalibrate their research directions to ensure continued relevance, innovation, and impact.

Given the rapid technological evolution and regulatory shifts in aviation, it is imperative for PhilSCA to recalibrate its R&D agenda for 2026 to 2030. The new agenda must build on existing strengths, address thematic gaps, and embrace emerging research domains guided by an evidence-based and forward-looking strategy that aligns with institutional goals, national development plans, industry demand, and the SDGs.

This study proposes a multi-pronged methodological framework for developing PhilSCA R&D Agenda 2026–2030:

1. **Thematic Analysis:** Thematic analysis offers a rigorous methodological framework for this update. By systematically analyzing research studies from 2022 to 2024 (Philippine Aviation Research Conference (PARC)) and proposed studies based on 2024 conference, this study will assess alignment with the previous agenda, surface recurrent themes and gaps, and reveal emerging research opportunities. This approach ensures the 2026 to 2030 agenda will be empirically grounded, strategically aligned, and responsive to evolving academic

and sectoral needs. A thematic evaluation of PhilSCA's research studies indicates meaningful strides in priority areas, including aviation safety management systems, additive manufacturing, sustainable aviation fuels, and gender mainstreaming-reflecting alignment with global and national priorities (Rosario et al., 2023). Nonetheless, critical gaps remain in underexplored domains such as multilingual pilot-controller communication, drone-based aircraft inspection technologies, aviation data science, predictive analytics for air traffic management, and advanced simulation systems (Rosario et al., 2023; ICAO, 2024).

2. **Coverage Equity Analysis:** Beyond mapping, a coverage equity analysis will be employed to assess how evenly research activities are distributed across programs, agenda clusters, and institutional priorities. This analysis ensures that no single domain is overrepresented at the expense of others, and that underrepresented fields (e.g., aviation communication, tourism, or logistics) are given renewed emphasis. Such equity-driven assessment aligns with the principles of balanced academic development and ensures inclusivity across disciplines (OECD, 2018).
3. **Balanced Research Portfolio:** A redeveloped agenda must reflect a balanced research portfolio, where institutional priorities, national development plans, international aviation standards, and the United Nations Sustainable Development Goals (SDGs) are harmonized. This portfolio approach ensures that PhilSCA research is strategically distributed across agenda and program, thereby addressing both academic advancement and industry needs. In practice, this requires integrating emerging areas such as artificial intelligence in aviation,

green technologies, digital infrastructures, and workforce development, while maintaining core research on safety, operations, and training (UNESCO, 2021).

By integrating thematic analysis, equity assessment, and portfolio balancing, the proposed methodology ensures that the PhilSCA R&D Agenda 2026–2030 will be holistic, future-oriented, and strategically aligned with institutional, national, and global priorities.

## 2. PROBLEM STATEMENT

While PhilSCA has achieved notable successes in R&D from 2021 to 2025 (Rosario et al., 2023), there are still critical thematic gaps that hinder the institution's ability to respond comprehensively to the demands of a technologically advanced, sustainable, and inclusive aviation industry. Without a structured and data-driven revision of the R&D agenda, these research gaps may persist, resulting in:

- Underutilized research capacity in emerging fields like artificial intelligence, blockchain, and unmanned aerial systems.
- Limited contribution to international aviation research priorities such as decarbonization, global value chain integration, and aviation cybersecurity.
- Insufficient policy-relevant research to influence national and ASEAN-level aviation regulations.
- Uneven coverage of research themes across programs, leading to missed opportunities for interdisciplinary collaboration.

### **3. OBJECTIVES OF THE STUDY**

This study aims to develop PhilSCA's R&D Agenda for 2026 to 2030 through thematic analysis of recent research outputs (i.e., PARC) and proposed studies.

Specifically, it will:

1. Evaluate the alignment of existing research with the 2021 to 2025 agenda;
2. Identify thematic overlaps and gaps to determine research coverage levels and underrepresented R&D agenda by program;
3. Propose strategic research priorities for the next cycle (i.e., priority R&D focus areas and enhancement strategies).

The output will be an updated, future-ready R&D agenda that strengthens PhilSCA's position in aviation research, enhances its contribution to innovation ecosystems, and supports national growth aspirations.

#### **4. SCOPE AND LIMITATIONS**

This study centers on formulating the new R&D agenda for the PhilSCA for 2026 to 2030, using a thematic analysis of completed (i.e., documented in the PARC database from 2022 to 2024) and proposed studies submitted by faculty members during workshop and conferences conducted last 2024 under the RDLead Program. It covers research across PhilSCA's institutes and programs within this timeframe.

The scope involves reviewing studies, identifying thematic coverage and gaps, and proposing priority research areas aligned with emerging aviation trends and national goals. Limitations include reliance on the PARC database and proposed studies during 2024 workshop, which were not reflected several completed studies in PARC, and ongoing or unpublished research activities. The thematic classification depends on available project documentation and may be influenced by researcher interpretation. Additionally, evolving aviation technologies and policy environments may introduce new priorities beyond the scope of current data. Resource and institutional constraints may affect the implementation of proposed studies, and external stakeholder input beyond validation consultations may not be fully integrated.

## 5. SIGNIFICANCE OF THE STUDY

This study provides critical insights by analyzing completed from the PARC 2022–2024 database and proposed research studies during 2024 workshop to strategically guide PhilSCA’s R&D agenda for 2026–2030. The evidence-based approach ensures that future research priorities address both institutional strengths and gaps, particularly in emerging fields like artificial intelligence, sustainability, and aviation policy.

The updated R&D agenda will support PhilSCA’s role as a leading institution in aeronautical education and research, fostering targeted capacity building, interdisciplinary collaboration, and impactful innovations. For faculty, students, industry partners, and policymakers, the study offers a roadmap to optimize research investments and align academic outputs with sectoral needs and Sustainable Development Goals. Ultimately, the agenda aims to enhance aviation safety, efficiency, inclusivity, and environmental stewardship in the Philippines and the broader ASEAN region.

## **6. R&D MANAGEMENT FRAMING (REVIEW OF THEORETICAL R&D CONCEPTS RELATED TO THE TOPIC)**

Research and Development (R&D) management is an interdisciplinary field focused on the planning, organization, direction, and control of research activities to foster innovation and competitive advantage (Trott, 2017). Effective R&D management requires the alignment of institutional capabilities with strategic objectives and external environmental demands, thereby maximizing impact and sustainability (Kang & Snell, 2009).

PhilSCA's R&D management aims to align research outputs with national development goals, global trends, and institutional mandates. In the context of this institution, R&D management ensures that research outputs contribute not only to academic excellence but also to aviation sector advancement and broader societal development. It plays a pivotal role in translating academic research into practical applications, influencing public policy, and fostering industry collaboration.

According to Rothwell and Zegveld (1985), R&D planning in public institutions should ensure the responsiveness of research to societal needs and technological trends. For PhilSCA, this means crafting an agenda that is not only scientifically sound but also socioeconomically relevant.

At its core, R&D management in academic settings is driven by strategic alignment with institutional missions and societal needs. According to Schilling (2020), research strategy should be aligned with dynamic capabilities - the ability of institutions to adapt their knowledge creation processes in response to technological, regulatory, and environmental shifts. This is particularly relevant for PhilSCA, where

the rapidly evolving aviation industry necessitates a responsive and anticipatory research agenda.

As PhilSCA aims to establish its R&D Agenda for 2026–2030, it is crucial to ground the process in established theoretical concepts that guide how R&D topics are identified, prioritized, and aligned with long-term goals.

To establish a sound foundation for determining PhilSCA's new R&D agenda, it is essential to explore theoretical frameworks that support effective R&D management, strategic prioritization, and data-driven decision-making. This section presents a review of key theories and models that frame the rationale and methodology of this study. The following concepts offer a management-based framework for determining and organizing the research agenda.

## **Institutional and Strategic Foundations of the Research Agenda**

### **A. Existing R&D Framework of PhilSCA**

Under its Strategic Plan 2021–2025, PhilSCA identified five research-related Key Result Areas (KRAs): an innovative research agenda; industry-revolutionizing research; productive publication services; knowledge incubation and commercialization; and enabled conditions for research dissemination. The Research & Development Center (RDC) was tasked by the Board of Trustees to formulate the R&D agenda, with explicit instructions to: (a) identify knowledge gaps; (b) map researchable areas; (c) assess the relevance of existing laws and programs; and (d) develop service-efficiency models, all while anchoring the agenda within PhilSCA's mandates of instruction, extension, and productivity (PhilSCA R&D Agenda for 2021 to 2025, 2023).

The agenda-setting unfolded in two phases: Phase 1, which involved content analysis of PhilSCA's Strategic Plan, Ambisyon 2040, the Philippine Development Plan, and the UN SDGs, alongside stakeholder consultations (CHED, CAAP, PAF); and Phase 2, which employed a participatory foresight approach-comprised of literature review, expert panels, thematic/content analysis, and Delphi surveys-to define specific research targets and priorities (PhilSCA R&D Agenda for 2021 to 2025, 2023).

These methods culminated in the creation of the Program Research Agenda (PRA), which was refined through two rounds of Delphi surveys with faculty and academic officials. This led to the formulation of the Institute Research Agendas (IRAs) and a consolidated College Research Agenda (CRA), reviewed by the Research Council and approved by the Board of Trustees (PhilSCA R&D Agenda for 2021 to 2025, 2023).

## **B. Framework for Development of R&D Agenda 2026 to 2030**

The development of an institutional research and development (R&D) agenda requires a strong grounding in research management theories and concepts that emphasize alignment, prioritization, and continuous improvement. Several models of research management highlight the need for cyclical processes where evidence-based data are analyzed, synthesized, and integrated into institutional strategies (Hazelkorn, 2011; OECD, 2015).

The proposed framework for PhilSCA's R&D Agenda 2026–2030 () is anchored in the principle of evidence-based agenda setting, which ensures that institutional priorities are drawn from systematic analysis of existing research outputs and proposed studies. Central to this process is thematic analysis, a method widely

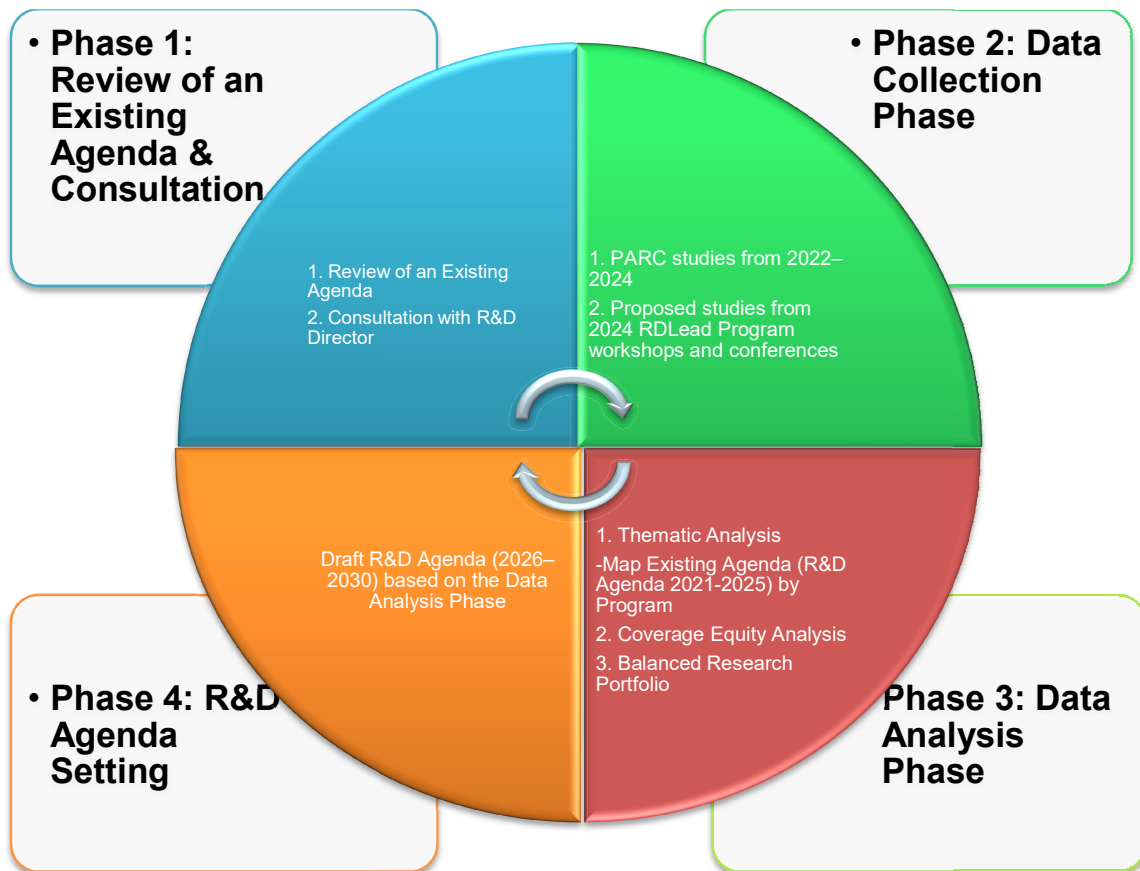
applied in agenda development to identify recurring themes, research coverage gaps, and areas of emerging importance (Braun & Clarke, 2006).

The framework illustrates a continuous improvement cycle comprising four interrelated phases: 1) Review of an Existing R&D Agenda and Consultation (2) Data Gathering and Mapping, where past (i.e., PARC studies from 2022–2024) and proposed research studies (i.e., 2024 RDLead Program workshops and conferences) are consolidated and linked to the existing agenda; (3) Data Analysis such as thematic analysis, coverage equity analysis, balanced research portfolio to identify strengths, gaps, and emerging trends; and (4) Draft R&D Agenda (2026–2030) based on the Data Analysis Phase as baseline and recommendation for final agenda (see Figure 2).

This cyclical design is consistent with the continuous improvement cycle in R&D management, ensuring that the agenda is not static but adaptive, responsive, and strategically aligned with aviation industry needs. By grounding the PhilSCA R&D agenda in both empirical evidence and theoretical concepts of research governance, the institution can sustain a research culture that balances academic inquiry with societal and industry relevance. This process ensures that the PhilSCA R&D Agenda 2026–2030 remains dynamic, evidence-based, and strategically aligned with both institutional capacity and global research directions.

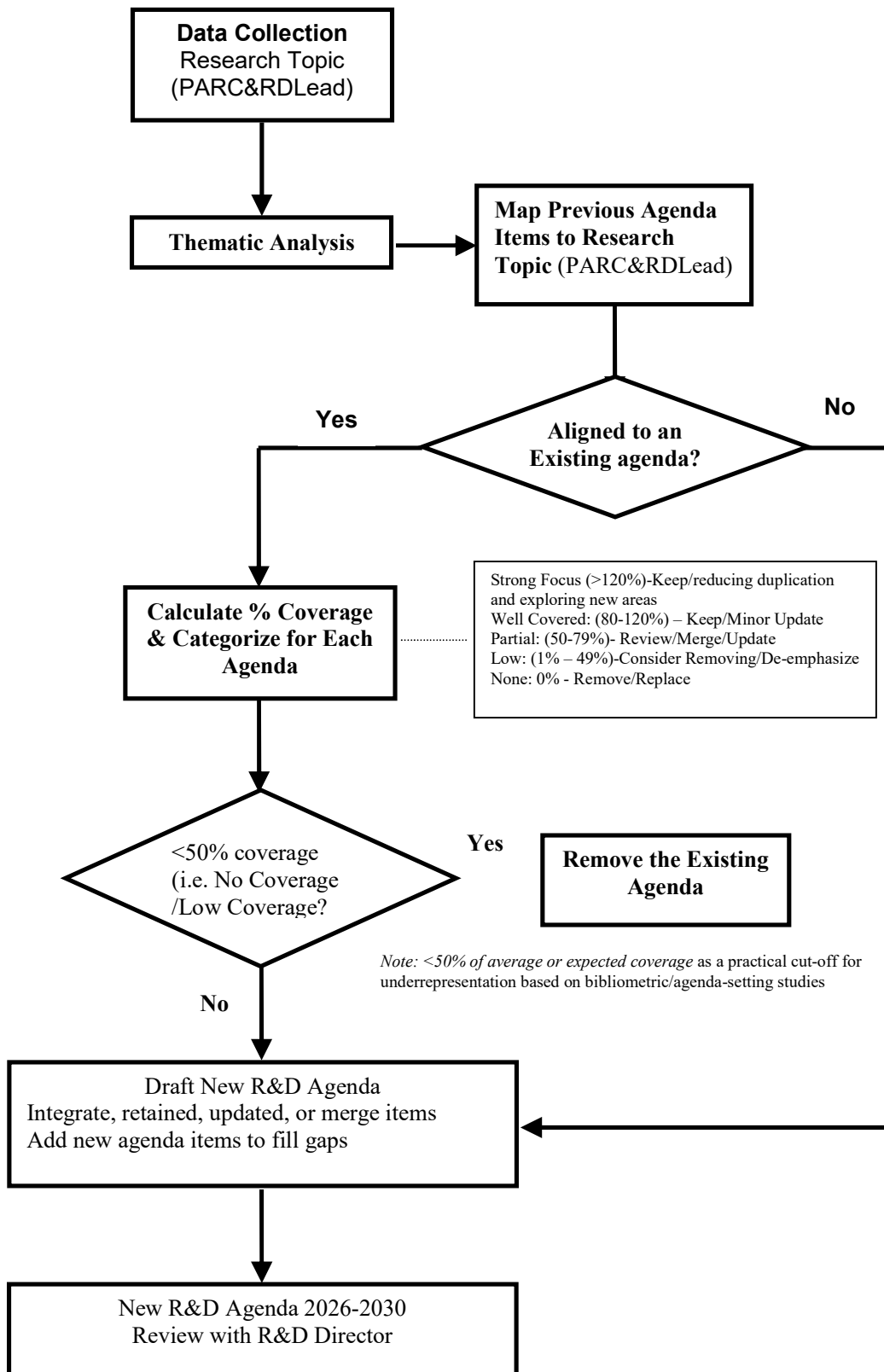
**Figure 1.**

The four-phase cyclical framework for the development of the PhilSCA Research and Development (R&D) Agenda 2026–2030



**Figure 2.**

Research and Development Agenda Process Flow



### **a. Review of an Existing R&D Agenda and Consultation**

The development of the PhilSCA R&D Agenda for 2026–2030 began with a systematic review of an existing agenda and consultation with stakeholder, particularly with the R&D Director, which served as the foundation for evidence-informed and strategically aligned research planning. This initial phase aimed to establish a foundational understanding of previous research priorities, identify gaps in coverage, and ensure alignment with the institution’s strategic objectives. This also serves as the foundation of the agenda-setting process, ensuring that subsequent data gathering, analysis, and drafting of new agenda are firmly rooted in institutional priorities and past performance. It reflects the principle that effective research management requires both retrospective evaluation and prospective alignment with strategic goals (OECD, 2015). The consultations with the R&D Director/SP adviser were conducted to gain insights into institutional priorities, challenges, and emerging research needs and for the review of findings relative to gap identification, priority settings, and guiding framework development (i.e., methodological approach for subsequent phases, including topic mapping, thematic analysis, and coverage assessment/priority settings).

### **b. Data Collection Phase**

Effective R&D management in HEIs relies on systematic data collection to ensure alignment between institutional goals, stakeholder needs, and emerging research trends (Zarate & David, 2019; CHED, 2017). Data collection constitutes a foundational step in the R&D lifecycle, providing the empirical basis for evidence-informed decision-making, gap analysis, and strategic prioritization of research initiatives (OECD, 2015).

The data collection phase involved gathering institutional research outputs from the PARC from 2022–2024, as well as proposed studies submitted during the 2024 RDLead Program workshops and conferences to ensure comprehensive coverage of aviation-related research. This multi-source approach allowed for the collation of both completed and prospective research initiatives, facilitating a holistic understanding of the institution’s research landscape.

Each research title and abstract was subsequently mapped to the existing R&D agenda items of PhilSCA programs. This mapping served multiple purposes: it established a baseline of coverage and relevance, identified redundancies or gaps in research focus areas, and provided an empirical foundation for evidence-based recommendations in the redevelopment of the R&D agenda for 2026–2030. By systematically collecting and organizing these data, PhilSCA ensures that its R&D management process remains strategic, responsive, and aligned with both institutional priorities and the broader socio-economic and technological needs of the aviation sector.

### **c. Data Analysis Phase**

#### **1. Priority-setting frameworks in R&D using Thematic Analysis:**

As part of priority-setting frameworks in R&D, the literature identifies several models for determining R&D priorities including thematic analysis. Thematic analysis, as applied in this study, offers a systematic way of identifying patterns and themes in existing research outputs, thereby informing agenda-setting decisions (Braun & Clarke, 2006). It allows for the integration of both bottom-up insights (from faculty and researchers) and top-down directives (from policy and strategic plans).

Thematic analysis (TA) is used to identify, analyze, and report patterns (themes) across a dataset in a way that is flexible, transparent, and replicable. TA converts discrete research outputs (thesis abstracts, project reports, published papers, conference papers, institutional research summaries) into actionable themes that (a) reveal coverage and gaps, (b) highlight emerging areas and cross-cutting priorities for 2026–2030, and (c) support strategic alignment with institutional mandates and national/global priorities (e.g., SDGs, aviation industry needs).

## **2. Coverage Equity**

The thematic results revealed uneven coverage, with certain areas such as aircraft maintenance and gender mainstreaming well-developed, while others such as multilingual communication and drone countermeasures remain neglected. This imbalance reflects the challenge of sustaining a balanced research portfolio, a principle drawn from the “portfolio management” approach in R&D, which advocates for diversification and equity to mitigate risks, avoid redundancy, and capitalize on emerging opportunities (Cooper, Edgett, & Kleinschmidt, 2001). By applying coverage equity principles, PhilSCA can optimize its research investments and avoid redundancy, ensuring that both mature and neglected domains are addressed in proportion to their relevance and importance.

This framework calculates the coverage of research across agenda items:

- Total Agenda Items (T) – all items that “should” be researched.
- Items with Research (R) – items that actually have research output during the review period.
- Coverage % –  $R \div T \times 100$  (or some normalized version).

The coverage % range and status labels indicate whether research effort is equitably distributed across all agenda items (see Table 1).

**Table 1**

*Coverage Equity*

<b>Coverage Range</b>	<b>Label</b>	<b>Equity Implication</b>
<b>0%</b>	No Coverage	No research conducted on the agenda item. High priority gap (i.e., Indicates neglected areas-equity gap in research attention).
<b>1–49%</b>	Low Coverage	Minimal research activity; agenda items underrepresented-equity concern/ needs significant attention.
<b>50–79%</b>	Partial Coverage	Moderate attention; some inequity if certain topics get less focus (i.e., some research present, but not enough to fully address the agenda item).
<b>80–120%</b>	Well Covered	Balanced coverage/ Adequate research coverage; aligns with equity principle-resources match priority/ maintain focus but can shift resources elsewhere.
<b>&gt;120%</b>	Strong Focus	High research activity/Overrepresentation; could indicate over-concentration-potential inequity if other areas are neglected/ may consider reducing duplication and exploring new areas.

The coverage equity will be an evaluation point in determining which new research and development agenda should be prioritized, maintained, or de-emphasized in the new R&D agenda.

### 3. Balanced Research Portfolio

To translate coverage equity into actionable decisions, the agenda items are filtered through a priority scale that accounts for both coverage status and strategic importance. This ensures that neglected but critical areas are elevated, while oversaturated domains are deprioritized to maintain balance (see Table 2).

**Table 2**

*Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making*

<b>Coverage Status</b>	<b>Action Rule</b>	<b>Assigned Priority Level</b>
<b>No Coverage (0%)</b>	Include if critical/emerging (urgent research gap); exclude if obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)	Very High/ Exclude
<b>Low Coverage (1–49%)</b>	Include if strategically important; exclude if peripheral or weakly aligned	High/ Exclude
<b>Partial Coverage (50–79%)</b>	Include; reinforce for maturity (i.e., requires ongoing development)	Medium
<b>Well Covered (80–120%)</b>	Include for maintenance, consolidation, or deepening (i.e., maintain or deepen research)	Low
<b>Strong Focus (&gt;120%)</b>	Include but de-emphasize to rebalance (i.e., maintain or deepen research)	Low/ Deprioritized

*Note: The framework aligns with portfolio management and multi-criteria decision-analysis (MCDA) approaches, where prioritization considers both coverage indicators and strategic importance (Karunanithi, Choudhury, & Roy, 2020; Abdel-Basset, Elhoseny, Gamal, & Smarandache, 2023).*

This overlay mechanism operationalizes coverage equity as both a diagnostic and prescriptive tool. Rather than excluding items solely because they lack coverage, the framework ensures that inclusion is guided by strategic relevance. In

this way, PhilSCA's 2026–2030 R&D agenda achieves a balanced portfolio: addressing gaps, maintaining strengths, and reallocating focus where necessary.

#### **d. R&D Agenda 2026–2030 Setting for PhilSCA**

The integration of thematic mapping, coverage equity analysis, and the overlay with the priority scale provides a structured basis for drafting the PhilSCA R&D Agenda for 2026–2030. This draft agenda reflects a balanced, equitable, and forward-looking research portfolio, ensuring that neglected but critical areas are elevated, strategically important domains are reinforced, and well-established fields are maintained without over-saturation.

The draft agenda prioritizes agenda items according to four tiers:

- Very High Priority – Areas with no or negligible prior coverage but with critical importance to the aviation sector and institutional goals. These represent urgent research gaps that must be addressed to ensure PhilSCA's leadership in aviation education and innovation, otherwise, exclude if obsolete/irrelevant (i.e., No scope/no institutional capacity/no stakeholder demand/no foreseeable growth).
- High Priority – Areas with low coverage yet possessing strategic relevance to policy, industry demands, and sustainable development. These areas require deliberate investment to avoid persistent underrepresentation, otherwise, exclude if peripheral or weakly aligned.
- Medium Priority – Areas with partial coverage that are developing but not yet mature. Continued reinforcement and expansion will enable these areas to evolve into balanced research domains.

- Low Priority – Areas that are already well covered or overemphasized. These remain in the agenda to ensure maintenance, consolidation, and knowledge deepening, but they will be allocated proportionally fewer resources to prevent redundancy.

This tiered structure ensures that the new agenda is both responsive and strategic. It responds to identified gaps by elevating neglected but critical themes such as multilingual communication in aviation and drone countermeasure technologies. It also ensures continuity in essential, well-established areas such as aircraft maintenance and gender mainstreaming in aviation, albeit at a lower priority to balance research distribution.

By adopting this approach, the PhilSCA R&D Agenda 2026–2030 becomes a living framework: one that not only reflects past performance but also positions the institution to anticipate emerging challenges, align with global trends, and contribute meaningfully to the Sustainable Development Goals (SDGs), national aviation priorities, and institutional excellence.

## **7. ENVIRONMENTAL CONTEXTUALIZATION**

### **7.1 Workplace Environment**

PhilSCA functions within a highly specialized educational and training ecosystem tailored for aviation and aeronautics. The institution fosters close collaborations between faculty, students, and aviation industry partners to support applied research and practical learning experiences (Philippine State College of Aeronautics, n.d.). Faculty members are expected to balance multiple roles such as teaching, research, extension services, and industry consultancy which can stretch resources but also enriches the research culture. Despite a committed workforce, challenges such as limited research funding, challenges in laboratory infrastructure, and restricted access to cutting-edge simulation and testing facilities hamper the full realization of R&D ambitions (Rosario et al., 2023). This underscores the need for strategic investments and partnerships to enhance resource availability.

### **7.2 Client Relationship**

PhilSCA's primary stakeholders include students, alumni, local and international aviation companies, regulatory authorities such as the Civil Aviation Authority of the Philippines (CAAP), International Civil Aviation Organization (ICAO), and International Air Transport Association (IATA), government agencies, and local communities (Philippine State College of Aeronautics, 2025; CAAP, 2024). The institution's R&D agenda is designed to serve these stakeholders by producing research that directly addresses pressing aviation challenges such as safety protocols, workforce development, environmental sustainability, and policy reforms (Rosario et al., 2023). Strengthening stakeholder engagement through collaborative

research projects and industry immersion initiatives can enhance the relevance and uptake of research outputs, thus promoting sustainable development and employability outcomes.

### **7.3 Broader Environmental Considerations**

The global and regional aviation sectors are facing increasing scrutiny to reduce carbon footprints, improve safety, and enhance operational efficiencies amid rapid technological changes (ICAO, 2024). These external pressures create a dynamic and complex environment in which PhilSCA's R&D must operate, requiring agility and foresight. Furthermore, socioeconomic factors-such as the need to promote gender equity and support micro, small, and medium enterprises (MSMEs) linked to aviation-add layers of social responsibility to the institution's research mandate (International Air Transport Association, 2023). Consequently, the R&D agenda 2026 to 2030 must be inclusive and comprehensive, incorporating technological, environmental, and socio-economic dimensions to sustain the institution's leadership role.

## **8. METHODS (PROCESS DOCUMENTATION / DESCRIPTION)**

This study employed a thematic analysis framework to systematically review and determine the new R&D agenda for PhilSCA for 2026–2030 based on PARC research studies from 2022–2024. The aim was to identify coverage levels, thematic gaps, and priority areas to inform the R&D agenda 2026–2030.

The following methodological steps were undertaken:

### **8.1 Data Collection**

Data collection involved compiling PARC research studies from 2022 to 2024 by faculty and research units across PhilSCA's institutes and academic programs and proposed studies based on conferences conducted in 2024. This comprehensive dataset included published papers, theses, project reports, and extension activities relevant to the institution's existing R&D agenda.

### **8.2 Thematic Categorization**

Thematic categorization was conducted using the institution's existing R&D agenda framework as a baseline. Research outputs were classified under predefined thematic categories aligned with program-specific priorities, such as Aircraft Maintenance Technology, Aviation Safety Management, Additive Manufacturing, Sustainable Aviation Fuels, Gender Mainstreaming, UAV Development, Aviation Policy, and Emerging Technologies, and etc. This process ensured that research themes were aligned with predefined thematic areas such as program enhancement, technology integration, policy engagement, and operational innovations mapped against the agenda by program.

### 8.3 Coverage Analysis

Coverage analysis was performed by calculating the percentage of completed research outputs relative to the total expected or targeted research items defined in the existing R&D agenda. Coverage was classified as no coverage (0%), low (1% – 49%), partial (50–79%), well covered (80% – 120%), or strong focus (>120%) to highlight thematic strengths and gaps.

### 8.4 Gap Identification

Themes with low or zero coverage were flagged as critical gaps signaling underrepresented or unexplored areas requiring further research attention/requiring targeted intervention, otherwise considered as irrelevant which can be discontinued due to no scope/no institutional capacity/no stakeholder demand to conduct the study.

### 8.5 Priority Level Legend

To prioritize the new agenda focus, the identified themes were classified using the following priority scale:

- **Very High:** Areas with no or zero prior coverage but of critical importance, demanding urgent research focus, otherwise, exclude if obsolete/irrelevant (i.e., No scope/no institutional capacity/no stakeholder demand/no foreseeable growth to conduct the study)
- **High:** Areas with low coverage but of strategic importance to the aviation sector and institutional goals, otherwise, exclude if peripheral or weakly aligned.

- **Medium:** Areas with moderate/partial coverage requiring continuous development and reinforcement.
- **Low:** Areas that are well-covered and require maintenance or deepening of existing research efforts.

### **8.6 Agenda Enhancement Proposal**

For each identified gap, a proposed research focus for 2026–2030 was developed. These proposals integrated emerging technologies, policy needs, sustainability imperatives, and global aviation trends to ensure forward-looking and responsive agenda formulation.

## **9. FINDINGS, RECOMMENDATION BASED ON FINDINGS, ISSUES AND CONCERNS, BEST PRACTICES, PLAN, PROPOSAL, AND DESIGN**

### **9.1 Findings**

The thematic analysis of PhilSCA's completed research outputs of PARC from 2022 to 2024 and proposal (2024 conferences) across various institutes and programs reveals a nuanced picture of research activity, thematic coverage, and gaps that inform the R&D agenda 2026–2030 formulation.

#### **9.1.1 Research Studies by Program**

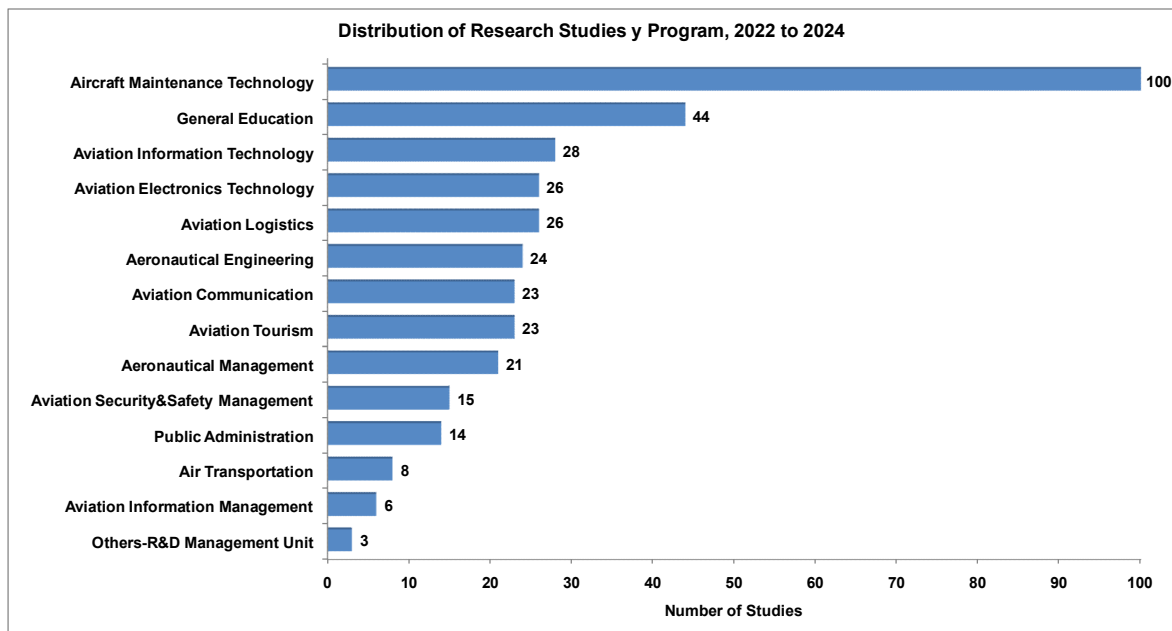
The thematic analysis of completed projects from the PARC 2022–2024 and proposed research (i.e., based on conferences 2024) dataset reveals a heterogeneous distribution of research focus areas across PhilSCA's academic programs.

##### **9.1.1.1 Concentration of Research**

Figure 3 illustrated the distribution of research studies by program, 2022 to 2024. The highest number of research studies conducted and reviewed was Aircraft Maintenance Technology (100) followed by General Education (44), Aviation Information Technology (28), Electronics Technology (26), Aviation Logistics (26), and Aeronautical Engineering. These areas dominate the research landscape at PhilSCA. Programs such as Others-Aviation Education/R&D unit (3), Public Administration (14), and Aviation Security & Safety (15) had relatively fewer studies, indicating under-researched domains.

**Figure 3.**

Distribution of Research Studies by Program, 2022 to 2024



### 9.1.1.2 Institutional Participation

Figure 3 showed that the Institute of Engineering & Technology (InET) led the R&D output, primarily due to strong contributions from Aircraft Maintenance and Aeronautical Engineering.

The Institute of Liberal Arts & Sciences (ILAS) had the second-highest output, heavily focused on General Education and Aviation Logistics. However, the Institute of Graduate Studies (IGS) and Institute of Computer Studies (ICS) showed moderate levels of research activity.

**Table 3**

*Total number of Existing R&D Agenda Items vs. R&D Agenda with Research/Studies by program*

<b>Institute</b>	<b>Program</b>	<b>Total Existing R&amp;D Agenda Items</b>	<b>R&amp;D Agenda with Research/Studies</b>	<b>Gap / Coverage Status</b>
ILAS	Aviation Communication	11	5	Partial Coverage
	Aviation Logistics	12	10	Partial Coverage
	Aviation Safety & Security	8	4	Partial Coverage
	Aviation Tourism	12	9	Partial Coverage
	General Education	10	7	Partial Coverage; 1 item gap
InET	Aeronautical Engineering	8	7	Moderate coverage
	Aircraft Maintenance Technology	6	5	Moderate coverage; 3 item gap (additional)
	Air Transportation	5	3	Partial coverage; 1 item gap (additional)
	Aviation Electronics Technology	2	2	Full coverage; 1 item gap (additional)
ICS	Aviation Information Technology (AIT)	8	6	Partial Coverage (2 items with no research)
	Aviation Information Management (AIM)	7	4	Partial Coverage (3 items with no research)
Master	Aeronautical Management (MEAM)	13	7	Partially Covered (6 items not yet researched)
	Public Administration (MPA)	8	3	Major Gaps (5 items with no research)

## **9.1.2 Mapping of Existing Studies to the Current R&D Agenda**

The assessment of research outputs from 2022 to 2024 across the programs of the PhilSCA provides a critical baseline for refining the institutional R&D Agenda for 2026–2030. Findings reveal uneven coverage of existing agenda items, with certain thematic areas showing strong saturation while others remain significantly underexplored (see Table 3). This distribution underscores the need to consolidate strengths in well-covered domains, address gaps in low-coverage and unstudied areas, and incorporate emerging trends that reflect the evolving demands of aviation education, industry, and global standards.

### **9.1.2.1 Institute of Liberal Arts and Sciences (ILAS)**

A total of 131 research studies from 2022 to 2024 across five programs (i.e., Aviation Communication, Logistics, Tourism, Security and Safety Management, and General Education) under Institute of Liberal Arts and Sciences (ILAS) were analyzed and systematically mapped against the institutional R&D agenda (2021–2025). Statistical analysis of coverage shows that while certain agenda areas are well-represented, others remain underexplored or entirely unaddressed. This uneven distribution highlights the need for a recalibrated research agenda for 2026–2030.

The following program was highlighted:

#### **9.1.2.1.1 Bachelor of Science in Aviation Communication**

**Statistical Summary:** A total of 23 recent studies in Aviation Communication were mapped against the existing institutional R&D agenda, with coverage varying significantly across agenda areas. The highest concentration was in Program Enhancement and Operational communication studies where 9 and 8 studies respectively resulted in high coverage rates (81.82% and 72.73%). These studies

Development of the Research and Development (R&D) Agenda of PhilSCA for 2026-2030 33

demonstrate PhilSCA's commitment to quality assurance, pedagogical development, and the integration of digital tools into aviation communication training. Low coverage was also observed in Pilot-Controller Miscommunication (1 study, 4.3%), Aviation English Proficiency Standards (3 studies, 13.0%), and Public Relations, Marketing Communication, and Marketing Management (2 studies, 8.7%). Conversely, six agenda areas showed no research coverage (0.00%), including corpus-based phraseology, accent/prosody optimization, aerodrome operations communication, voice communication subsystems, gender and development (GAD), knowledge management, and public relations (see Table 4).

### **Proposed R&D Agenda 2026–2030:**

Emerging trends such as AR/VR, gamification, adaptive learning, predictive analytics, and sociolinguistics-informed safety frameworks underscore the need to modernize aviation communication research. Thus, the proposed 2026–2030 agenda emphasizes:

1. Immersive and Technology-Enhanced Aviation Training - Integration of AR/VR, gamified learning, mobile applications, and simulation-based modules to enhance cognitive and operational competencies. The inclusion of immersive and motivational technologies should be expanded to strengthen training and employability skills.
2. Sociolinguistics and Multicultural Communication in Aviation - Incorporation of sociocultural and multilingual perspectives to improve pilot-controller communication and cabin crew interactions.
3. Professional Identity and English Proficiency - Development of context-sensitive English language standards and training that embed professional identity, soft

voice quality, and digital assessment tools.

4. Operational Safety and Human Systems Integration - Research on crew error mitigation, human-machine interaction, decision-making protocols, and specialized flight operations to ensure safe and efficient aviation operations.
5. Airport Communication and Linguistic Landscape Studies - Enhancement of airport branding, multilingual signage, and public communication strategies to improve passenger experience and cultural engagement.
6. Areas with zero/low coverage- This suggested to prioritize the agenda with zero/low coverage for the next cycle, otherwise, these areas are irrelevant due to no scope/no institutional capacity/no stakeholder demand to conduct the study which can be marked as obsolete.

**Table 4**

*Bachelor of Science in Aviation Communication: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022 –2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aviation Communication Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	9	Well-Covered	81.82%	Low	Cognitive factors, motivation, AR/VR, gamification , mobile-assisted learning, adaptive learning, digital flight planning tools	Integrate cognitive, motivational, and immersive educational technologies to enhance Aviation Communication training outcomes, curriculum effectiveness, and employability skills.
2. Investigation of Language-Related Pilot-Controller Miscommunication in terms of Utilization of Modal Verbs and Politeness Markers, Cultural Factors, and Readback Errors	1	Low Coverage	9.09%	High	Sociolinguistics, multicultural communication	Excluded (i.e., peripheral or weakly aligned)/Develop sociolinguistics-informed strategies to enhance pilot-controller communication and aviation safety
3. Corpus-based Linguistic Investigation of Standard and Non Standard	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional

Phraseology of Filipino Pilots and Air Traffic Controllers						capacity/no stakeholder demand/no foreseeable growth)
4. Optimization of Controller Instructions in terms of English Language Proficiency, Prosody, and Accent	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
5. Assessment, Program Development, and Minimum Standards Formulation on the English Language Proficiency for Filipino Aviation Professionals	3	Low Coverage	27.27%	High	AI-assisted assessment, adaptive learning, voice quality, professional identity	Excluded (i.e., peripheral or weakly aligned)/Implement adaptive, technology-assisted approaches to assess and improve aviation English proficiency, professional identity, and curriculum effectiveness.
6. Enhancement of Aerodrome Operations using Standard Communication (Triple One Concept)	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
7. Development of a Limited Voice Communication Subsystem of a Data-	0	No Coverage	0.00%	Very High	-	Initiate system design and prototyping for voice communication subsystems

Centric Link Media System for Air Traffic Service						
8. Enhancement of Operational and Technical Aspects of Aviation Communication in Meteorology, Flight Operations, Ramp Handling, and Organizational Interactions	8	Partial Coverage	72.73%	Medium	Predictive analytics, Human System Integration (HSI) integration, decision-support systems, specialized operations, human-machine interaction	Apply human factors, predictive analytics, and technology-assisted interventions to optimize ATC communication, operational safety, and specialized flight readiness
9. Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
10. Studies on Knowledge Management as Critical Component in Aviation Communication	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

11. Studies on Public Relations, Marketing Communication, and Marketing Management in Aviation Communication	2	Low Coverage	18.18%	High	Multilingual signage, cross-cultural airport communication, branding, passenger experience	Excluded (i.e., peripheral or weakly aligned)/Enhance airport communication and branding by optimizing multilingual signage, cross-cultural messaging, and user experience for passengers and aviation stakeholders
--	---	--------------	--------	------	--	---

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### **9.1.2.1.2 Bachelor of Science in Aviation Logistics**

#### **Statistical Summary:**

For the Bachelor of Science in Aviation Logistics, 26 studies were documented. Notably, Air Freight Services alone accounted for 12 studies (46.2%) and achieved full coverage (100.0%), reflecting strong alignment with industry-driven concerns for efficiency and resilience in the supply chain, while Optimization of Cargo Flow and Transport Routes had 4 studies (15.4%, 33.33% coverage). In contrast, Low coverage was observed in supply chain development (8.33%), transport route optimization (33.33%), market studies (16.67%), inter-island air shipping (8.33%), MSME linkages (8.33%), GVC studies (8.33%), data analytics (8.33%), and knowledge management (8.33%), all of which are high-priority areas. Additionally, no studies (0.0%) addressed Gender and Development (GAD) which can be excluded in the agenda maybe due to no scope/no institutional capacity/no stakeholder demand to conduct the study (see Table 5).

#### **Proposed R&D Agenda 2026–2030:**

For the next cycle, findings suggest that while digital logistics transformation and operational efficiency are well-studied, there is a pressing need to expand research into AI/blockchain-enabled supply chains, humanitarian and emergency logistics, sustainable and green logistics systems, and inclusive workforce development. Specific attention should also be directed toward SME integration into digital air cargo platforms, ensuring that local industries benefit from global aviation logistics for the R&D Agenda 2026 - 2030.

**Table 5**

*Bachelor of Science in Aviation Logistics: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aviation Logistics Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
2. Upgrading of Air Freight Services using Just in Time Logistics, Integrated/Centralized Warehousing and Transportation Terminals, Electronic Transactions, and Automated Shipment Information Systems	12	Well-Covered	100.00%	Low	Adoption of digital platforms, AI-assisted procurement, sustainable logistics, zero-waste design, resilient operations, IoT-enabled warehouses, green packaging, pandemic	Research on digital, AI-enabled, and sustainable practices to enhance operational efficiency, resilience, and environmental performance in air freight logistics

					response, hybrid workforce, adaptive operations	
3. Development of Air Cargo Supply Chain using Computer Integrated Manufacturing and Vertical Integration of Logistics Management Systems	1	Low Coverage	8.33%	High	Limited integration of AI and blockchain for 3PL inventory & importation efficiency	Excluded (i.e., peripheral or weakly aligned)/Optimize air cargo inventory and importation processes through AI, blockchain, and data-driven solutions for cost and operational efficiency
4. Optimization of the Flow of Goods, Air Cargo Loading, and Transport Routes	4	Low Coverage	33.33%	High	Integration of AI-assisted route planning, cognitive skill development, multimodal transport, crowd logistics, and operational analytics	Excluded (i.e., peripheral or weakly aligned)/Implement AI-assisted, human-centered, and multimodal strategies to optimize cargo flow, loading, transport routes, and last-mile delivery efficiency
5. Market Study of Air Cargo Services in terms Freight Forwarders, Cargo Integrators, and Consolidators	2	Low Coverage	16.67%	High	Emerging use of predictive analytics and data-driven decision-making	Excluded (i.e., peripheral or weakly aligned)/Research on leveraging analytics and service

6. Development Studies of Inter-island Air Shipping in Secondary and Tertiary Routes	1	Low Coverage	8.33%	High	in carrier selection and customer satisfaction Perishable agricultural goods, agri-food supply chain digitization	frameworks to improve air freight quality, customer satisfaction, and decision-making Excluded (i.e., peripheral or weakly aligned)/Enhance efficiency, reduce post-harvest losses, and integrate digital solutions in air shipping of perishable agricultural products
7. Studies on Aviation Supply Chain Management	2	Low Coverage	16.67%	High	Humanitarian logistics, flexible operations, employee competency, and crisis responsiveness	Excluded (i.e., peripheral or weakly aligned)/Develop flexible, responsive, and competency-driven supply chain strategies to support humanitarian and crisis operations
8. Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

9. Studies on Linkages between Aviation and Micro-, Small-, and Medium-Sized Enterprises (MSMEs)	1	Low Coverage	8.33%	High	Integration of SMEs into digital air cargo platforms and cross-border trade	Excluded (i.e., peripheral or weakly aligned)/Facilitate SME access to international markets through integrated air cargo solutions and digital platforms
10. Studies on Aviation and Global Value Chain (GVC)	1	Low Coverage	8.33%	High	Strengthening institutional role in global logistics, workforce development, and international collaboration	Excluded (i.e., peripheral or weakly aligned)/Enhance institutional contributions to global aviation logistics through education-industry linkages, workforce development, and partnerships
11. Studies on Data Science and Analytics in Aviation Logistics	1	Low Coverage	8.33%	High	Expansion of AI, IoT, predictive analytics, and real-time dashboards for performance optimization	Excluded (i.e., peripheral or weakly aligned)/Leverage AI, IoT, and analytics to improve operational performance and inventory management in aviation logistics

12. Studies on Knowledge Management as Critical Component in Aviation Logistics	1	Low Coverage	8.33%	High	CSR integration, employee engagement, ESG analytics for workforce commitment	Excluded (i.e., peripheral or weakly aligned)/Strengthen workforce commitment, engagement, and organizational performance through CSR and ESG-aligned knowledge management
---	---	--------------	-------	------	--	--

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### **9.1.2.1.3 Bachelor of Science in Aviation Tourism**

#### **Statistical Summary:**

In the Bachelor of Science in Aviation Tourism, 23 studies were mapped. The most researched areas were Service Quality and Passenger Engagement (11 studies, 47.8%, with coverage ranging from 41.67% to 50.00%), while Curriculum Development (3 studies, 13.0%, 25.0% coverage) and Community Engagement and Ecotourism (3 studies, 13.0%, 25.0% coverage) were only partially addressed. Meanwhile, ASEAN aviation market integration, and aviation-tourism linkages in community development remained critically underexplored. Importantly, data science, gender inclusivity, and knowledge management in tourism were also poorly represented or absent altogether. Critical gaps were also identified in research on aviation tourism instructional frameworks (0.00%), global value chain (0.00%), and knowledge management (0.00%), marked as very high priority, otherwise, irrelevant due to no scope/no institutional capacity/no stakeholder demand to conduct the study (see Table 6).

#### **Proposed R&D Agenda 2026–2030:**

Based on emerging trends, the 2026–2030 agenda should focus on incorporating AI-driven passenger analytics, predictive loyalty systems, and smart airport infrastructure research to enhance passenger experience and competitiveness. Tourism should be reframed to include aviation-inclusive development, airport-community linkages, and poverty reduction initiatives, a new research niche that integrates aviation with broader socio-economic impact.

**Table 6**

*Bachelor of Science in Aviation Tourism: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aviation Tourism Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	3	Low Coverage	25.00%	High	Skills mismatch, lack of industry co-creation, need for experiential learning labs	Excluded (i.e., peripheral or weakly aligned)/Redesign curriculum and establish smart learning laboratories to strengthen employability and align aviation tourism education with industry and government priorities
2. Case Studies on Air Transport Initiatives and Airline Passenger Engagement	5	Low Coverage	41.67%	High	Post-pandemic passenger analytics, digital complaint handling, inclusive aviation, crisis response	Excluded (i.e., peripheral or weakly aligned)/Strengthen passenger engagement strategies by integrating digital solutions, inclusivity measures, and crisis-resilient frameworks to boost aviation tourism trust and service quality

3. Formulation of Innovative Strategies in Low-Cost Carrier, Frequent Flyer Program, and Airline Service Quality for Improved Tourist Creation	6	Partial Coverage	50.00%	Medium	AI-driven loyalty, predictive analytics for disruptions, smart airport/passenger comfort solutions	Advance innovative service strategies in airports and airlines by adopting AI, predictive analytics, and smart infrastructure to enhance passenger experience and loyalty.
4. Impact Assessment of Air Transport Condition and Feasibility Studies on Regional Low-Cost Carrier Terminals for Philippine Tourism Development	1	Low Coverage	8.33%	High	Gap: sustainable airport-led tourism hubs	Excluded (i.e., peripheral or weakly aligned)/Position airports as sustainable quasi-destinations by developing facilities that integrate aviation, tourism, and local economic growth
5. Formulation of Innovative Strategies on ASEAN Single Aviation Market for Philippine Tourism Competitiveness and Development	1	Low Coverage	8.33%	Very High	Weak aviation-tourism linkages in national campaigns; AI-driven tourism marketing needed	Excluded (i.e., peripheral or weakly aligned)/Strengthen aviation-tourism competitiveness through AI-driven campaign analytics and integrated airline connectivity strategies
6. Community Engagement Research on Ecotourism Projects from Aviation-Tourism Sector	3	Low Coverage	25.00%	High	Weak integration of aviation in community	Excluded (i.e., peripheral or weakly aligned)/Advance community-based, eco-linked aviation tourism initiatives to

					development & sustainability certification	promote inclusivity, sustainability, and local empowerment
7. Development of Specific Instructional Framework for Aviation Tourism Research	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
8. Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	1	Low Coverage	8.33%	High	Inclusivity gaps, lack of cross-cultural diversity research	Excluded (i.e., peripheral or weakly aligned)/Promote gender and inclusivity research in aviation workforce to enhance passenger perception and workforce diversity
9. Studies on Linkages between Aviation and Micro-, Small-, and Medium-Sized Enterprises (MSMEs)	1	Low Coverage	8.33%	High	Need for economic impact assessment of aviation-MSME integration	Excluded (i.e. peripheral or weakly aligned)/Leverage aviation connectivity to boost local MSMEs through food tourism and airport-adjacent enterprises
10. Studies on Aviation and Global Value Chain (GVC)	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

11. Studies on Data Science and Analytics in Aviation Tourism	2	Low Coverage	16.67%	High	AI/IoT for hotels and inflight services; predictive analytics for passenger personalization	Excluded (i.e., peripheral or weakly aligned)/Harness data science, AI, and digital innovations to transform tourism hospitality and inflight services for smarter passenger experience
12. Studies on Knowledge Management as Critical Component in Aviation Tourism	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
New: Aviation-inclusive development, airport–community social responsibility, and aviation-driven poverty reduction	-	-	-	-	-	New: Aviation-inclusive development, airport–community social responsibility, and aviation-driven poverty reduction

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

#### **9.1.2.1.4 Bachelor of Science in Aviation Safety and Security Management**

##### **Statistical Summary:**

The Bachelor of Science in Aviation Safety and Security Management produced 15 studies. The largest share (7 studies, 46.7%) focused on Enhancement of Aviation Security Management Systems (87.5% coverage), indicating a mature research base in compliance and risk management, while New Normal Safety Challenges contributed 6 studies (40.0%, 75.0% coverage). Conversely, several critical gaps were identified in cybersecurity resilience, drone countermeasure technologies, gender mainstreaming, and knowledge management with 0% compliance, all of which can be very high-priority research areas, otherwise, these areas are irrelevant due to no institutional capacity/no stakeholder demand to conduct the study. Furthermore, simulation-based safety training (12.50%) and drone-assisted search and rescue (12.50%) were minimally explored, but present significant opportunities in strengthening aviation security capacity (see Table 7).

##### **Proposed R&D Agenda 2026–2030:**

Emerging trends underscore the integration of AI, IoT, blockchain-enabled tracking, drone-assisted operations, and geopolitical/environmental risk mitigation into aviation safety research. Thus, the proposed 2026–2030 agenda should prioritize the cybersecurity and IT resilience frameworks, drone countermeasure systems, AI-driven predictive risk management, and knowledge management for safety data platforms. Expanding to cover environmental sustainability in aviation safety (noise, emissions, and waste) and gender-responsive safety culture will also align PhilSCA with international safety imperatives.

**Table 7**

*Bachelor of Science in Aviation Safety and Security Management: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aviation Safety and Security Management Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	1	Low Coverage	12.50%	High	Simulation-based training, competency tracking	Excluded (i.e., peripheral or weakly aligned)/Implement competency-based aviation safety education programs integrating simulation and assessment technologies
2. Establishment of Cybersecurity Resilience in Air Transport Information Systems thru Vulnerability Assessment	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

3. Enhancement of Aviation Security Management with Assessment and Safety Management System, New Physical Threat Detection Methods and Testing, and New Risk Assessment and Management Strategies on Emerging Security Threats and Vulnerabilities	7	Well-Covered	87.50%	Low	AI-assisted training, IoT-based monitoring, blockchain tracking, predictive hazard systems	Deploy AI, IoT, and blockchain-enabled systems to enhance airport security, safety risk management, and cargo handling compliance
4. Development of New Technology for Aviation Safety and Security	1	Low Coverage	12.50%	High	Drone-assisted SAR, AI-based monitoring	Excluded (i.e., peripheral or weakly aligned)/Develop AI- and drone-assisted SAR operations protocols to optimize response times and operational efficiency
5. Development of Detection and Interception Technologies for Drone-Related Threats on Aviation Security	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

6. Identification of Challenges and Priorities in Aviation Safety and Security in the New Normal	6	Partial Coverage	75.00%	Medium	Geopolitical risks, environmental sustainability (noise, waste, light pollution), pandemic resilience	Develop aviation safety strategies addressing geopolitical risks, environmental sustainability, and pandemic resilience to strengthen long-term aviation safety systems
7. Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
8. Studies on Knowledge Management as Critical Component in Aviation Safety and Security Management	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### 9.1.2.1.5 General Education

#### Statistical Summary:

In General Education, covered the largest number of studies (44) in the Institute of Liberal Arts and Sciences (ILAS) making it the most active program. Technology-Aided Instruction and Teaching-Learning Practices were dominant, each with 9 studies (47.4% each, 90.0% coverage). Gender and Development (GAD) was also strongly represented with 15 studies (78.9%, 150.0% coverage) indicating robust engagement in gender and inclusivity research. These findings demonstrate a rapid adoption of digital and inclusive education approaches across PhilSCA's programs. However, significant gaps were identified in linguistics-related communication barriers (0.00%), MSME linkages (0.00%), and data science in aviation logistics and tourism (0.00%), all of which can be a very high-priority areas. Low coverage was also recorded in customer relationship studies (20.00%), curriculum enhancement (30.00%), student experience post-pandemic (20.00%), and knowledge management (40.00%) (see Table 8).

These results highlight a shift from traditional pedagogy to technology-enabled, equity-oriented, and interdisciplinary education. Also, emerging trends included interdisciplinary STEM integration, wellness-focused pedagogy, diaspora and sociolinguistic studies, and sustainability initiatives embedded in general education. Therefore, this program should pursue the R&D agenda 2026–2030:

- Interdisciplinary STEM integration and wellness programs,
- Sociolinguistic and diaspora-focused studies,
- Post-pandemic responsive curriculum design,
- Environmental sustainability initiatives in academic institutions, and

- Development of aviation research hubs through knowledge management systems.
- Also, no or low coverage areas must highly prioritize for the next cycle which is critically and strategically important, otherwise, these areas are irrelevant due to no institutional capacity/no stakeholder demand to conduct the study.

**Table 8**

*General Education: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Development of Technology-Aided Instruction in General Education for across Programs	9	Well-Covered	90.00%	Low	AI-driven portals, AR/VR labs, digital assessment, sustainability integration	Development of Technology-Aided Instruction, Digital Learning Platforms, and AR/VR tools in GE across aviation programs to enhance access, experiential learning, and sustainability
2. Studies on the Social Aspects of Airline Customer Relationships	2	Low Coverage	20.00%	High	Graduate employability, diaspora studies, cultural analytics	Excluded (i.e., peripheral or weakly aligned)/Conduct research on graduate employability and cultural/diaspora travel behavior to strengthen aviation education and customer relationship strategies

3. Studies on the Attitude and Practices in the Teaching-Learning Process of General Education Faculty and Aviation Students	9	Well-Covered	90.00%	Low	Blended learning, personalized strategies, adaptive analytics, civic education, soft skills integration	Strengthen teaching-learning practices, adaptive strategies, simulation/role-based learning, and civic/soft skills programs for aviation GE
4. Curriculum Enhancement of the General Education for Aviation Students	3	Low Coverage	30.00%	High	Interdisciplinary STEM integration, fitness/wellness inclusion	Excluded (i.e., peripheral or weakly aligned)/Enhance interdisciplinary STEM curriculum and equitable wellness programs for aviation GE
5. Studies on the Linguistics-related Factors that affect Aeronautical Communication	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
6. Studies on the Aviation Student Experience in General Education Laboratory class during New Normal	2	Low Coverage	20.00%	High	Post-pandemic motivation, demographic profiling	Excluded (i.e., peripheral or weakly aligned)/Promote student engagement and equity-oriented GE curriculum informed by demographics and post-pandemic learning experiences

7. Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	15	Strong Focus	150.00%	Low	Gender-sensitive curriculum, women in STEM, workforce policies, inclusivity, mental health (gender dysphoria)	Advance gender equality, inclusive curriculum, and women empowerment across aviation education, training, and industry
8. Studies on Linkages between Aviation and Micro-, Small-, and Medium-Sized Enterprises (MSMEs)	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
9. Studies on Data Science and Analytics in Aviation Logistics and Tourism	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
10. Studies on Knowledge Management as Critical Component in Aviation Communication, Logistics, Tourism, and Safety and Security Management	4	Low Coverage	40.00%	High	AI-driven research management, national research centers, agenda alignment	Excluded (i.e., peripheral or weakly aligned)/Strengthen knowledge management, research productivity, and national aviation research hubs to position PhilSCA as a research leader
New: Environmental sustainability (renewable energy technology in educational institutions)	-	-	-	-	-	New: Environmental sustainability (renewable energy technology in educational institutions)

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### **9.1.2.2 Institute of Engineering and Technology (InET)**

A total of 158 research studies under the Institute of Engineering and Technology (InET) were analyzed from 2022 to 2024 across four programs: Aeronautical Engineering, Aircraft Maintenance Technology, Air Transportation, and Aviation Electronics Technology. Statistical analysis shows that while certain programs are strongly represented, others remain underexplored, underscoring the need to recalibrate priorities for the 2026–2030 cycles.

#### **9.1.2.2.1 Bachelor of Science in Aeronautical Engineering**

##### **Statistical Summary:**

The Aeronautical Engineering program reviewed 24 studies from 2022 to 2024, distributed across eight existing R&D agenda areas. The results indicate that research coverage remains uneven, with most studies concentrated on aircraft design and simulation. The most concentrated efforts were in aircraft design and simulation technologies, where 9 studies were recorded, representing 112.5% coverage, demonstrating a strong emphasis on aerodynamic drag reduction, novel propulsion technologies, and composite structures. Similarly, UAV development, additive manufacturing, and aircraft engine test cell research each registered 4 studies (50% coverage), marking areas of partial but emerging relevance focusing on logistics, humanitarian response, and environmental monitoring. In contrast, agenda areas such as program enhancement, renewable energy, and aviation standards were underrepresented, each with only 1 study (12.5% coverage). Notably, techno-entrepreneurship in aviation had zero coverage (0%), highlighting a critical gap that warrants urgent attention, otherwise, this area is irrelevant due to no institutional capacity/no stakeholder demand to conduct the study (see Table 9).

## **Proposed R&D Agenda 2026–2030:**

Statistical distribution indicates that 37.5% of research outputs were concentrated in advanced aircraft systems and eco-efficiency themes, whereas only 12.5% addressed sustainability and regulatory innovation. Emerging trends highlight AI-driven computational fluid dynamics (CFD), biomimicry-inspired aero-structures, predictive maintenance systems, and hydrogen/clean propulsion technologies. The proposed agenda should prioritize (1) immersive AR/VR and AI-driven education for program enhancement, (2) sustainable UAV systems for agriculture, logistics, and humanitarian use, (3) renewable aviation energy sources, and (4) entrepreneurship-driven innovation ecosystems. This will ensure a balanced progression from mature technical domains to underexplored high-priority areas such as techno-entrepreneurship.

**Table 9**

*Bachelor of Science in Aeronautical Engineering Program: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aeronautical Engineering Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	1	Low Coverage	12.50%	High	AR/VR aero-simulations, AI tutoring systems	Excluded (i.e., peripheral or weakly aligned)/Advance aviation education through immersive AR/VR simulations, AI-powered learning systems, and mobile EdTech for curriculum modernization and workforce readiness
2. Design and Simulation of Commercial Aircraft Technologies for Surface Drag and Fuel Consumption Reduction using Aerodynamic Technologies	9	Well-Covered	112.50%	Low	Eco-efficiency (noise + drag), AI-CFD coupling, predictive maintenance, meta-materials, ion propulsion miniaturization	Promote eco-efficient aircraft design through AI-driven CFD, biomimicry-inspired aero-structures, predictive maintenance, and hybrid-electric propulsion for sustainable aviation.

3. Development of Unmanned Aerial Vehicle (UAV) with Multi-Rotor System, Vertical Take-Off and Landing (VTOL) Capability, Electric/Hybrid Propulsion, and Remotely Piloted Operation for Environmental Scanning, Humanitarian Assistance, Smart Farming, Remote Sensing, Mapping, Logistics Delivery, and Urban Mobility (e.g., Air Taxi)	4	Partial Coverage	50.00%	Medium	Precision AgriTech, UAV-aquaculture, clean UAV propulsion (hydrogen fuel cell), thermal imaging for livestock	Advance UAV innovation for smart farming, aquaculture, and humanitarian response, integrating clean propulsion systems and precision imaging technologies.
4. Development of Clean and Renewable Energy Sources for the Aviation Industry	1	Low Coverage	12.50%	High	Sustainable fuels for general aviation	Excluded (i.e., peripheral or weakly aligned)/Develop scalable alternative fuels and renewable energy systems to reduce emissions and support sustainable general aviation operations
5. Formulation of Contemporary Aviation Standards on Certification, Safety Audit, Compliance Monitoring, Airline Regulations, and Passenger Mass	1	Low Coverage	12.50%	High	Aviation environmental standards compliance	Excluded (i.e., peripheral or weakly aligned)/Strengthen regulatory frameworks for sustainable aviation through environmental compliance, certification, and global ICAO alignment

6. Studies on Introducing Additive Manufacturing of Aircraft Structures and Components	4	Partial Coverage	50.00%	Medium	Composite R&D capacity building, academia-industry collaboration, bio-composites, fire-safe binders	Expand additive manufacturing for aviation through bio-composites, recyclable filaments, and industry-academe collaboration for sustainable aerospace structures.
7. Development of Aircraft Engine Test Cell Facility	4	Partial Coverage	50.00%	Medium	Multi-fuel flexibility, digital twins, advanced DAQ, safety resilience	Modernize engine test cell infrastructure with advanced sensors, digital twins, and multi-fuel systems for safety, performance, and sustainability validation. Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
8. Studies of Techno-Entrepreneurship Models in the Aviation Industry	0	No Coverage	0.00%	NA	-	

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### **9.1.2.2.2 Aircraft Maintenance Technology Program**

#### **Statistical Summary:**

The Aircraft Maintenance Technology (AMT) program displayed the highest research productivity, with 100 recorded studies across seven agenda areas, supplemented by new thematic priorities from 2022 to 2024. Enhancement of the AMT program alone accounted for 24 studies (400% coverage), while materials research contributed 20 studies (333.3% coverage). Maintenance operations and sustainable fuels and materials each recorded 17 studies (283.3% coverage), demonstrating strong institutional focus. Additionally, digital inspection tools (3D scanning and digital twin) generated 10 studies (166.7% coverage). However, autonomous drone-based defect detection received no coverage (0%), which can be classified as very high priority, otherwise, irrelevant due to no institutional capacity/no stakeholder demand to conduct the study. A new agenda area such as AI-assisted visual inspection (2 studies) and reciprocating engine test-cell optimization (10 studies) was also observed (see Table 10).

#### **Proposed R&D Agenda 2026–2030:**

Future research should build on strengths in materials science and sustainability while addressing gaps in automation and inclusivity. The proposed agenda emphasizes (1) AI/VR-enabled training and predictive analytics in maintenance, (2) bio-composites, eco-lubricants, and ASTM-compliant sustainable materials, (3) IoT-enabled sensors, RFID integration, and field-portable inspection tools, and (4) autonomous inspection drones and machine-vision tools. Furthermore, mainstreaming gender and development (GAD) in AMT education and industry practices will be vital to ensure inclusivity and resilience of the maintenance Development of the Research and Development (R&D) Agenda of PhilSCA for 2026-2030 65

workforce. Also, visual detection of cracks and corrosion and reciprocating engine test-cell optimization are emerging areas considered as very high priority that require urgent research.

**Table 10**

*Bachelor of Science in Aircraft Maintenance Technology: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aircraft Maintenance Technology Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	24	Strong Focus	400.00%	Low	Predictive analytics in licensure, AI/VR for training, mobile logbooks, design thinking pedagogy, wellness & inclusivity gaps	Advance AMT education with AI, digital tools, and competency-based curriculum while addressing student wellness and inclusivity for future-ready graduates.
2. Development of Hand-Held 3D Scanning and Digital Twin for Visual Detection of Aircraft Defects and Tracking of Aircraft Component Life Cycle	10	Well-Covered	166.67%	Low	Trends: IoT-enabled sensors, RFID smart tracking, portable field tools	Strengthen aviation safety and efficiency through adoption of 3D scanning, digital twins, and IoT-enabled predictive maintenance tools.
3. Development of Autonomous Drone and Roof/Hangar Entrance Scanning with Machine Vision	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional

Algorithms for Aircraft Defect Detection (Scanning with Machine Vision)						capacity/no stakeholder demand/no foreseeable growth)
4. Development of Advanced Airframe Materials made from Sandwich Structured Composites, Hybrid Structures, and 3D Printed Components with Long-Lasting Durability and High Impact Resistance	20	Strong Focus	333.33%	Low	Biocomposites, self-healing composites, PLA eco-materials, circular economy; Gaps: non-structural applications, sustainability in manufacturing	Develop advanced, eco-friendly, and self-healing composite materials for durable and sustainable aviation applications.
5. Improvement of Maintenance Operations for Ageing Aircrafts, Water Impact of Rotorcrafts, and Human Factor Considerations	17	Strong Focus	283.33%	Low	Pandemic resilience, IoT-powered ground safety, predictive maintenance, safety culture; Gaps: brain-drain of AMTs, smart tools	Enhance ageing aircraft maintenance with predictive, IoT-powered tools and integrate workforce resilience and safety culture in aviation.
6. Development and enhancement of sustainable aircraft fuels, lubricants, sealants, resins, and 3D print aircraft components approved by Aviation Regulatory bodies and American Society for Testing and Materials (ASTM) Standards	17	Strong Focus	283.33%	Low	Trends: Biofuels from agri-waste, green corrosion inhibitors, bio-lubricants, eco-sealants; Gaps: limited adoption of natural sealants, NDT eco-materials	Advance sustainable aviation by developing biofuels, eco-lubricants, and ASTM-approved green composites to reduce emissions and enhance resilience.

New: Development of Visual Detection Technologies for Airframe Cracks and Corrosion for Maintenance and Repair Operation.	2	-	-	Very High	AI-assisted inspection, lifecycle tracking for defects	Advance maintenance efficiency through AI-powered visual detection and real-time monitoring of cracks and corrosion for sustainable aircraft upkeep.
New: To advance aircraft maintenance technology through the optimization, monitoring, and validation of reciprocating engine test cell facilities, focusing on fuel delivery, environmental compliance, structural and cooling systems, sensor and data acquisition technologies, operational efficiency, and the development of simulation and procedural best practices	10	-		Very High	IoT/edge sensors, fuel optimization, noise/emission compliance, thermal & structural safety, digital twin integration	Transform reciprocating engine test-cell facilities with digital twins, IoT sensors, AI-driven diagnostics, sustainable fuel compatibility, and environmentally compliant operations.
New: Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	-	-	-	-	-	New: Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### **9.1.2.2.3 Air Transportation Program**

#### **Statistical Summary:**

The Air Transportation program covered 8 studies across five agenda areas, reflecting comparatively low research productivity. The largest portion (4 studies, 50.0%) addressed aviation standards and policy (80.0% coverage), reflecting strong interest in safety audits, compliance monitoring, and regulatory frameworks. Program enhancement (1 study, 12.5%, 20.0% coverage) and ab initio flight training (2 studies, 25.0%, 40.0% coverage) received modest attention. However, critical agenda areas such as Performance-Based Navigation (PBN) and aerodrome operations had zero coverage (0%), which can be classified as very high priority areas, otherwise, irrelevant due to no institutional capacity/no stakeholder demand to conduct the study. Additionally, gender and development (GAD) research was newly introduced with 1 study, marking an initial but limited step toward inclusivity (see Table 11).

#### **Proposed R&D Agenda 2026–2030:**

Emerging themes underscore the need to integrate automation-manual proficiency balance, Crew Resource Management (CRM), and agile leadership training into curriculum development. The proposed agenda should focus on 1) strengthening gender mainstreaming to ensure broader workforce representation in aviation training and operations specifically the structured inclusion of women and underrepresented groups in aviation education and industry, and 2) strengthen national aviation resilience by aligning policies with safety, sustainability, liberalization, and modern fleet strategies, ensuring long-term competitiveness and compliance with global standards

**Table 11**

*Bachelor of Science in Air Transportation: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Air Transportation Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	1	Low Coverage	20.00%	High	Leadership competencies, CRM (Crew Resource Management), agile training design	Excluded (i.e., peripheral or weakly aligned)/Strengthen aviation education through the integration of agile leadership, CRM, and human factor competencies to prepare pilots for modern flight Operations
2. Evaluation of the Effectiveness of Ab Initio Flight Training in terms of Flight Simulator Specifications, Training Facilitation, and Competency-Based Assessment	2	Low Coverage	40.00%	High	Automation reliance vs manual proficiency; aptitude testing for pilot readiness	Excluded (i.e., peripheral or weakly aligned)/Advance ab initio flight training by integrating balanced automation-manual proficiency standards and competency-based pilot selection to ensure resilient pilot readiness

3. Formulation of Strategies for the Application of Performance-Based Navigation (PBN) using Global Navigation Satellite System (GNSS) for a Homogeneous Global Navigation Environment	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
4. Enhancing Aerodrome Operations thru Standard Communication System, Runway Micro texture Assessment, and Runway Visual Range Estimation	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
5. Formulation and Evaluation of Contemporary Aviation Standards on Certification, Safety Audit, Compliance Monitoring, and Airline Regulations	4	Well-Covered	80.00%	Low	Pandemic-related demand shocks; liberalization effects; sustainability through fleet modernization; compliance with CORSIA and SAF	Strengthen national aviation resilience by aligning policies with safety, sustainability, liberalization, and modern fleet strategies, ensuring long-term competitiveness and compliance with global standards.

New: Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	1	New	-	-	Lack of structured gender inclusion in aviation education and workforce	Promote inclusive participation of women and underrepresented groups in aviation education, training, and industry through structured gender mainstreaming policies.
---	---	-----	---	---	---	--

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

#### **9.1.2.2.4 Aviation Electronics Technology Program**

##### **Statistical Summary:**

The Aviation Electronics Technology program generated 26 studies, with outputs highly concentrated in both program enhancement and avionics systems design. Program enhancement alone accounted for 16 studies (800% coverage), indicated a significant institutional focus on curriculum modernization, pedagogical innovation, and employability pathways. Advanced CNS+A system design registered 9 studies (450% coverage), emphasizing avionics modernization, cybersecurity, and AI-enabled multimodal communications. A new theme on GAD mainstreaming recorded 1 study, reflecting the early stage of inclusivity efforts in avionics education (see Table 12).

##### **Proposed R&D Agenda 2026–2030:**

Emerging trends emphasize curriculum modernization, micro-credentials, digital pedagogy, VR/AR-based simulation, IoT sensor retrofits, and resilient aviation communication systems. Thus, the agenda for 2026–2030 should focus on (1) expanding cybersecurity and AI-driven avionics integration, (2) bridging training infrastructure gaps through digital badging and modular competency frameworks, (3) addressing spectrum management and resilience in CNS+A systems, and (4) mainstreaming gender-responsive pedagogy and mentorship to promote equitable workforce participation.

**Table 12**

*Aviation Electronics Technology: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

Existing Research and Development Agenda (2021 to 2025)	2022–2024 Research Count	<sup>1/</sup> Coverage Status	% Coverage	<sup>2/</sup> Priority Level	Emerging Trends	Proposed R&D Agenda 2026 to 2030
1. Enhancement of Aviation Electronics Technology Program in terms of Program Outcomes, Curriculum Updating for Outdated Courses and Subjects, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	16	Strong focus	800.0%	Low	<ul style="list-style-type: none"> <li>• Competency frameworks &amp; digital badging</li> <li>• Micro-credentials &amp; modular pathways</li> <li>• VR/AR, gamification, AI-assisted learning</li> <li>• Recruitment &amp; enrolment challenges</li> <li>• Training infrastructure gaps</li> <li>• Curriculum-industry alignment to Industry 4.0</li> </ul>	Advance avionics education through curriculum modernization, digital pedagogy, immersive simulation, and employability-driven competency frameworks.
2. Design of Advanced Integrated Communication, Navigation, and Surveillance and Avionics (CNS+A) Systems for Air Traffic Management (ATM)	9	Strong focus	450.0%	Low	<ul style="list-style-type: none"> <li>• Low-cost IoT retrofit sensors</li> <li>• Cross-domain tech (UAV/underwater drone)</li> <li>• Cybersecurity of aviation protocols</li> <li>• AI-enhanced multimodal comms</li> <li>• Human–AI interaction gaps</li> <li>• Spectrum management &amp; datalink resilience</li> </ul>	Strengthen aviation safety and efficiency by advancing integrated CNS+A technologies, emphasizing AI-enabled multimodal communication, resilient networks, and aviation cybersecurity.

New: Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	1	-		Very High	<ul style="list-style-type: none"> <li>• Lack of multi-site studies</li> <li>• Barriers to entry/retention</li> <li>• Gender-responsive pedagogy</li> <li>• Mentorship gaps</li> </ul>	Promote inclusive aviation workforce development through gender-responsive education, workplace equity strategies, and mentorship-driven participation of underrepresented groups.
---	---	---	--	-----------	--	--

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### **9.1.2.3 Institute of Computer Studies (ICS)**

A total of 34 research studies (see Table 10& 11) under the Institute of Computer Studies (ICS) were systematically mapped against the existing institutional R&D agenda (2021–2025). These studies covered two programs, namely Bachelor of Science in Aviation Information Technology (BS AvIT) and Bachelor of Science in Aviation Information Management (BS AIM). Statistical analysis of the coverage revealed uneven distribution across agenda items, with some domains showing robust alignment while others remained critically underexplored.

#### **9.1.2.3.1 Bachelor of Science in Aviation Information Technology (BSAIT)**

##### **Statistical Summary:**

Eight thematic agenda areas were analyzed under the BSAIT program. The results indicated that the Application of ICT in Aviation Education was the most productive focus area, with 10 studies (125.00% coverage), surpassing the expected agenda scope. This demonstrates that ICT-enabled educational ecosystems including digital identity systems, AI-driven accessibility solutions, and campus resource automation are already emerging as strong areas of research. Similarly, Enhancement of the Aviation Information Technology Program and the Development of IoT Platforms and Data Analytics for Passenger Experience were well-covered with 7 studies each (87.50% coverage), highlighting institutional strength in curriculum innovation and passenger-centered digital ecosystems.

By contrast, several agenda items remain low-coverage or unaddressed. The Development of Augmented Reality (AR) Technologies for Educational Resources and AR for MRO applications were each represented by only 1 study (12.50% coverage), while Blockchain and Automation Technologies had 2 studies (25.00% coverage). Development of the Research and Development (R&D) Agenda of PhilSCA for 2026-2030 77

coverage). Notably, two agenda areas received no coverage (0.00%): the Development of CAD Software for 3D Printing of Aircraft Structures and the Development of Intelligent Software for Airworthiness Certification and Flight Training Simulation. These gaps indicate very high priority research opportunities, particularly in the fields of additive manufacturing and AI-driven safety-critical simulation technologies, which remain unexplored (See Table 13).

### **Proposed R&D Agenda 2026–2030:**

Based on thematic analysis and agenda mapping, several emerging R&D priorities for 2026–2030 revealed. These include:

1. Digital Pedagogy and Instructor Competency Development
2. Immersive AR/VR and AI-powered Training
3. Smart Campus ICT Ecosystems
4. IoT-enabled Predictive MRO Systems
5. IoT and Data Analytics for Passenger Experience and Community Resilience
6. Blockchain and Automation for Institutional Governance

Overall, the analysis confirms that the upcoming 2026–2030 agenda requires expansion into more advanced, integrated, and sustainable ICT ecosystems. Future priorities should integrate digital pedagogy, AR/VR training, smart campus solutions, predictive IoT systems, resilient passenger experience platforms, and blockchain-enabled governance. Such directions will ensure that PhilSCA remains responsive to the technological transformations in aviation education, operations, and governance, while also contributing to the achievement of relevant SDGs. These initiatives will

ensure the program evolves beyond ICT integration toward digital transformation, predictive maintenance, and next-generation aviation workforce readiness.

**Table 13**

*Bachelor of Science in Aviation Information Technology: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aviation Information Technology Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	7	Well-Covered	87.50%	Low	Instructor digital competency, micro-credentialing, policy briefs not translated into curriculum	Advance aviation IT education through digital pedagogy, competency-based micro-credentialing, and policy-integrated curriculum frameworks to ensure workforce readiness in the aviation industry.
2. Development of augmented reality technologies for Educational Resources in Aviation subjects	1	Low Coverage	12.50%	High	Limited coverage; lacks AI/VR integration roadmap	Excluded (i.e., peripheral or weakly aligned)/Develop immersive AR/VR and AI-driven training simulations to revolutionize aviation education and service training

3. Application of Information and Communications Technology (ICT) in Aviation Education	10	Well-Covered	125.00%	Low	Emerging: digital identity, AI-driven accessibility, campus resource automation, govtech overlaps	Promote ICT-enabled aviation education ecosystems through secure identity systems, smart campus solutions, and inclusive assistive technologies.
4. Development of Augmented Reality Technologies for Maintenance and Repair Operations (MROs) in the Aviation Industry	1	Low Coverage	12.50%	High	Predictive AI-driven IoT roadmap needed	Excluded (i.e., peripheral or weakly aligned)/Advance aviation MRO through IoT-enabled predictive maintenance and AI-driven operational analytics
5. Development of Internet of Things (IoT) Platforms and Data Analytics Software to Enhance the Customer Experience of Air Passengers	7	Well-Covered	87.50%	Low	Some indirect fits (waste mgmt, flood alert, tracking). Gaps in resilience, sustainability, training aircraft tracking	Implement IoT-enabled passenger experience, mobility tracking, and resilience systems to enhance aviation services and community safety.

6. Development of Block Chain and Automation Technologies to Improve Aviation-Centric Services	2	Low Coverage	25.00%	High	Blockchain integration missing; mostly automation/governance workflows	Excluded (i.e., peripheral or weakly aligned)/Strengthen aviation governance through blockchain-enabled procurement, financial automation, and auditable institutional workflows
7. Development of Computer-Aided Design (CAD) Software for the 3D Printing of Aircraft Structures and Components	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
8. Development of Intelligent Software for Airworthiness Certification, Flight Training Simulation, and Virtual Testing Tools	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### 9.1.2.3.2 Bachelor of Science in Aviation Information Management (BSAIM)

#### Statistical Summary:

For the BSAIM program, seven thematic agenda areas were reviewed. The research output was relatively modest, with only 6 studies mapped between 2022 and 2024, indicating low coverage across most agenda areas.

The most researched agenda area was the Utilization of Data Analytics on Environmental Concerns of Airports, with 3 studies (42.86% coverage). These works focused on sustainability, airline operational optimization, and workforce skills gap mapping, reflecting the growing global emphasis on green aviation and sustainable airport management. Meanwhile, the Enhancement of the Aviation Information System Program, the Development of Airport Information Management Systems, and the Real-time Data Analytics System of Flight Information each had 1 study (14.29% coverage), reflecting limited but notable engagement with digital airport management and governance-focused ICT systems.

However, several critical agenda areas were completely unaddressed (0.00% coverage), namely:

- Development of Aviation Logistics Management Systems for Supply-Demand Monitoring.
- Formulation of System-Wide Information Management (SWIM) strategies for Net-Centric Air Traffic Management.
- Studies on Employability of AIM Graduates in the New Normal

These no-coverage areas carry a very high priority level, as they directly address pressing challenges in aviation logistics, airspace management, and workforce employability in a rapidly evolving post-pandemic industry context,

otherwise can be excluded due to irrelevant (i.e., No scope/no institutional capacity/no stakeholder demand to conduct the study (see Table 14).

### **Proposed R&D Agenda 2026–2030:**

Based on the mapping and gap analysis, the following R&D agenda are proposed for Aviation Information Management at PhilSCA for 2026–2030:

1. Digital Pedagogy and Smart Learning in Aviation ICT
2. Passenger-Centric Airport Information Systems
3. Aviation Governance and Digital Logistics Systems
4. Green Aviation Analytics and Workforce Foresight

The agenda should also prioritize (1) API-enabled procurement and inventory management system, (2) advancing SWIM use cases for Philippine airspace management, and (3) mapping AIM graduate competencies with micro-credentialing and OJT validation systems to improve employability in the post-pandemic aviation sector.

These priorities will drive the transition from foundational ICT adoption toward integrated digital ecosystems, transparency frameworks, and sustainable workforce development in aviation management.

**Table 14**

*Bachelor of Science in Aviation Information Management: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aviation Information System Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Graduate Employment, Pedagogical Development, and Educational Technology Utilization	1	Low Coverage	14.29%	High	LMS adoption, UX design, learning analytics integration	Excluded (i.e., peripheral or weakly aligned)/Advance digital pedagogy and smart learning ecosystems in aviation ICT education through LMS integration, user analytics, and competency-based training systems
2. Development of Airport Information Management System in terms of Airport Operations and Customer Service Delivery for Micro-Aviation Management	1	Low Coverage	14.29%	High	Passenger-centered AIMS, real-time personalization, accessibility	Excluded (i.e., peripheral or weakly aligned)/Develop passenger-centric airport information management systems that enhance travel experience through real-time, accessible, and personalized digital solutions

3. Development of Real-time Data Analytics System of Flight Information in terms of Aircraft Operation, Air Traffic, External Environment, and Cabin Passenger Service for Improved Flight Management	1	Low Coverage	14.29%	High	Aviation procurement systems for governance & transparency	Strengthen aviation governance and logistics through ICT-driven procurement, transparency tools, and real-time decision-support systems.
4. Utilization of data analytics on the environmental concerns of different airports	3	Low Coverage	42.86%	High	Expansion of analytics use: airport sustainability, airline ops optimization, aviation workforce skills gap mapping	Harness data analytics for environmental sustainability, airline efficiency, and aviation workforce development through skills gap mapping and competency frameworks.
5. Development of Aviation Logistics Management System for Monitoring of Supply-Demand Status	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
6. Formulation of Strategies for System-Wide Information Management (SWIM) for Net-Centric Air Traffic Management (ATM)	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)

7. Studies on the Airport and Airline Employability of AIM graduates in the new normal	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
--	---	-------------	-------	----	---	---

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

#### **9.1.2.4 Institute of Graduate Studies (IGS)**

A total of 35 research outputs from the Institute of Graduate Studies (IGS) were reviewed for the period 2022–2024. The analysis revealed a significant variation in coverage across agenda items, highlighting both strengths and critical gaps that will inform the proposed R&D agenda for 2026–2030.

##### **9.1.2.4.1 Master of Education in Aeronautical Management (MEAM)**

###### **Statistical Summary:**

For the MEAM program, a total of 21 studies were mapped across 13 agenda areas, yielding an overall agenda coverage of 38.46%. The results reflect low coverage in most areas and no coverage in several very high priority domains, signaling both opportunities and urgent needs for redirection.

The most researched agenda item was Enhancement of the Aeronautical Management Program in terms of outcomes, curriculum, policy engagement, pedagogy, and educational technology, with six studies (46.15% coverage). This indicates continuing attention to program relevance and modernization. Other areas with modest engagement include:

- Research on Aviation Education and Recurrence Training, Human Factors in MROs, and Advanced Air Transport Systems each recorded two studies (15.38%), indicating emerging interest but limited depth.
- Similarly, Economic, Management, and Policy Issues in the Air Transport Industry (three studies, 23.08%) and Aviation Standards and Safety Compliance (three studies, 23.08%) showed modest progress.

However, critical domains such as Correlational Studies between Aviation and Economics, Application of Aeronautical Aspects in Transportation, Aviation Security Management, Feasibility of Global MRO Facilities, Data Analytics in Aviation, and Tracer/Impact Studies of MEAM Graduates had zero coverage (0.00%). These zero-coverage areas can be very high priority and directly address pressing challenges in aviation economics, safety, digitalization, and workforce development, otherwise excluded due to irrelevance of study to be conducted (see Table 15).

**Proposed R&D Agenda 2026–2030:**

Based on the analysis, the proposed 2026–2030 R&D agenda for MEAM prioritizes competency-based training, simulation-enabled pedagogy, occupational health and resilience research, sustainable air transport digitalization, industry–academe collaboration, aviation economics, and gender and development (GAD) mainstreaming in aviation education and practice. Also, the lack of coverage in data analytics, security, and economic correlational studies underscores an urgent need for investment in digital transformation, AI-based aviation security, big data analytics, and tracer studies.

Collectively, these priorities position MEAM as a program that must transition from foundational program enhancement toward future-ready, inclusive, and digitally enabled aviation education and management research.

**Table 15**

*Master of Education in Aeronautical Management: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Aeronautical Management Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Pedagogical Development, and Educational Technology Utilization	7	Partial Coverage	58.33%	High	Competency-based continuing education; faculty development Kaizen; tech-enabled pedagogy; simulator-based curriculum modernization; scalable assessment integrity	Advance program quality and relevance through competency-based training, simulation-driven learning, faculty development frameworks, and digitally enabled pedagogy for future-ready aviation professionals.
2. Review of Issues in Aviation Education and Recurrence Training in Adopting in the New Normal	1	Low Coverage	8.33%	High	UPRT integration, simulator-based training gaps	Excluded (i.e., peripheral or weakly aligned)/Strengthen aviation training systems by integrating international standards, simulation-based recurrence training, and adaptive curricula aligned with ICAO and CAAP frameworks

3. Development and Management of Human-Operated Aviation Systems Specially in Maintenance and Repair Operations (MROs)	2	Low Coverage	15.38%	High	Occupational noise risks; mental health & resilience in MROs	Excluded (i.e., peripheral or weakly aligned)/Enhance safety and workforce resilience in MROs through research on occupational health, psychosocial risks, and human factors interventions
4. Design, Optimization, and Planning of Advanced Air Transportation Systems	2	Low Coverage	15.38%	High	Remote bag-drop & off-site passenger processing; digital operations (EFB integration, dispatch, meteorology data)	Excluded (i.e., peripheral or weakly aligned)/Develop smart and sustainable air transport solutions through digitalization, passenger-centric off-site processing, and operational data-driven optimization
5. Correlational Studies between Aviation and Economics	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
6. Comprehensive Study of Major Economic, Management, and Policy Issues in the Air Transport Industry	3	Low Coverage	23.08%	High	Historical-informed governance gaps; restructuring models; customer recovery & service strategies	Excluded (i.e., peripheral or weakly aligned)/Strengthen airline and airport competitiveness through governance reforms, resilience-building policies, and strategic customer recovery frameworks

7. Application of Aeronautical Aspects in Transportation	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
8. Formulation of Contemporary Aviation Standards on Certification, Safety Audit, Compliance Monitoring, Airline Regulations, and Passenger Mass	3	Low Coverage	23.08%	High	Digital SMS adoption; EMAS feasibility; standardized testing for competency	Excluded (i.e., peripheral or weakly aligned)/Elevate aviation safety and compliance through digital reporting systems, runway safety technologies, and standardized competency assessments
9. Enhancing Aviation Security Management with Systems Assessment and New Physical Threat Detection Methods and Testing	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
10. Feasibility study in Establishing a Globally Competitive Maintenance Rehabilitation Facility for Military and Commercial Aircrafts	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
11. Studies on Linkage Strategies with Other Schools and Industry	2	Low Coverage	15.38%	High	R&D collaboration gaps; aviation innovation ecosystems	Excluded (i.e., peripheral or weakly aligned)/Foster innovation ecosystems through research collaboration, industry

12. Data analytics of different Aviation Related Events and Activities	0	No Coverage	0.00%	NA	-	linkages, and joint R&D programs across aviation organizations and academia Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
13. Impact of the MEAM Program on the Employment, Career, and Professional Development of Graduates	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
New: Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry	1	-	-	Very High	Gender-sensitive recruitment, retention, inclusive HR, training modules	Mainstream gender and diversity in aviation education, training, and workplaces by developing inclusive HR policies, gender-sensitive curricula, and equitable workforce pathways.

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

#### **9.1.2.4.2 Master in Public Administration (MPA)**

##### **Statistical Summary:**

For the MPA program, 14 studies were mapped across eight agenda areas, corresponding to an overall coverage of 43.75%. In contrast to MEAM, the MPA program demonstrated strong coverage in institutional and regulatory frameworks, but several critical policy-related domains remained completely unaddressed.

The best represented area was the Development of Institutional, Legal, and Regulatory Framework for Air Transportation, with seven studies (87.50% coverage), classified as well-covered. These studies examined cross-agency collaboration, maritime–aviation integration, cybersecurity, AI surveillance, and digital procurement. Airport Administration Policies also showed significant engagement with six studies (75.00% coverage), classified as partial coverage, covering pandemic resilience, sustainability, smart transport systems, and HR modernization.

In contrast, areas such as Program Enhancement (one study, 12.50%) showed minimal engagement, while several critical domains including Impact Assessment of Domestic and International Air Laws, Taxation and Airfare Policies, Feasibility of Regional LCC Terminals, Slot Allocation and ASEAN Market Integration, and Tracer Studies on MPA Graduate Outcomes recorded zero coverage (0.00%). These uncovered areas represent critical policy gaps in taxation, affordability, competitiveness, and employability within the Philippine air transport sector (see Table 16).

## **Proposed R&D Agenda 2026–2030:**

Emerging trends emphasize digital resilience, aviation cybersecurity, green aviation policies, and strategic airport governance frameworks. Additionally, the newly identified themes of aviation cybersecurity policy and strategic aviation operations and national security are crucial, particularly in light of increasing cyber threats, cross-border coordination needs, and emergency preparedness.

Accordingly, the R&D agenda proposed 2026–2030 for the MPA program focuses on: (1) sustaining advances in legal and regulatory frameworks through digital and cybersecurity innovations; (2) expanding research into taxation, affordability, and competitiveness of air transport; (3) developing feasibility models for regional hub expansion; (4) strengthening governance and leadership through tracer and impact studies; and (5) addressing aviation cybersecurity and national security preparedness as new flagship priorities.

This agenda highlights the shift of the MPA program from a regulation-anchored research base to a more expansive, policy-driven, and future-proof focus, ensuring its graduates can lead in digital, economic, and security dimensions of aviation public administration.

**Table 16**

*Master in Public Administration: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

<b>Existing Research and Development Agenda (2021 to 2025)</b>	<b>2022–2024 Research Count</b>	<b><sup>1/</sup>Coverage Status</b>	<b>% Coverage</b>	<b><sup>2/</sup>Priority Level</b>	<b>Emerging Trends</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
1. Enhancement of Public Administration Program in terms of Program Outcomes, Curriculum Development, Policy Engagement, Quality Assurance, Pedagogical Development, and Educational Technology Utilization	1	Low Coverage	12.50%	High	Competency-based training, career progression pathways	Excluded (i.e., peripheral or weakly aligned)/Strengthen graduate-level aviation public administration education through competency-based training, specialized career pathways, and policy-driven curriculum innovation
2. Impact Assessment of Domestic and International Air Laws and Regulation as a Basis for Policy Formulation and Modification	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
3. Development of Institutional, Legal, and Regulatory Framework for Air Transportation	7	Well-Covered	87.50%	Low	Cross-agency collaboration, maritime/aviation security, AI in	Advance institutional, legal, and regulatory frameworks in aviation through digital

					surveillance, digital procurement, cybersecurity	transformation, cybersecurity resilience, cross-agency policy collaboration, and maritime-aviation integration.
4. Assessment and Enhancement of Airport Administration Policies	6	Partial Coverage	75.00%	Medium	Pandemic preparedness, sustainable operations, smart transport systems, HR modernization, green aviation	Enhance airport administration policies by integrating pandemic resilience, green aviation standards, smart transport systems, and human resource modernization for operational excellence.
5. Impact Assessment of Importation Tax, Airfare, and Air Freedom of Rights in the Philippine Air Transport Industry	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
6. Feasibility Studies on Regional Low-Cost Carrier Terminals in the Philippines	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder

7. Formulation of Innovative Strategies on Airport Slot Allocation and ASEAN Single Aviation Market of the Philippine Air Transport Industry	0	No Coverage	0.00%	NA	-	demand/no foreseeable growth)  Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
8. Impact of the MPA Program on the Employment, Career, and Professional Development of Graduates	0	No Coverage	0.00%	NA	-	Excluded: Obsolete/irrelevant (No scope/no institutional capacity/no stakeholder demand/no foreseeable growth)
New: Aviation cybersecurity policy, data integrity, digital resilience in air/maritime operations (Advance safety systems, threat mitigation, and crisis response frameworks)		-	-	-	-	New: Aviation cybersecurity policy, data integrity, digital resilience in air/maritime operations (Advance safety systems, threat mitigation, and crisis response frameworks)

New: Strategic Aviation Operations & National Security (operational readiness/support and emergency medical response, and strategic planning)-Development of strategic Aviation Operations & National Security (operational readiness/support and emergency medical response, and strategic planning)		-	-	-	-	New: Strategic Aviation Operations & National Security (operational readiness/support and emergency medical response, and strategic planning)-Development of strategic Aviation Operations & National Security (operational readiness/support and emergency medical response, and strategic planning)
---	--	---	---	---	---	---

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

### **9.1.2.5 R&D Management and Employability Analysis**

A total of three research studies covering a newly R&D agenda proposed in response to the evolving research ecosystem and institutional priorities at PhilSCA. Statistical mapping shows that although the number of studies was limited, their thematic relevance and potential impact are very high, highlighting critical areas for institutional development and strategic capacity building. Although these three studies represent a small portion of the total research output from 2022 to 2024, they highlighted critical strategic priorities for PhilSCA. Collectively, these domains underscore the need for institution-wide R&D management reforms and graduate outcome tracking, positioning PhilSCA to respond to evolving educational and aviation sector demands in 2026–2030 (see Table 17).

#### **9.1.2.5.1 Research Productivity Enhancement**

Research Productivity Enhancement domain focuses on strengthening the research capacity and output of aviation Higher Education Institutions (HEIs) through digital, interoperable, and measurable systems.

The program proposes the development of interoperable digital RIMS and benchmarking dashboards to systematically measure, plan, and enhance research productivity across PhilSCA campuses and with industry partners. By integrating data-driven decision-making, the institution can improve strategic resource allocation, monitor outputs, and foster collaborative research networks.

#### **9.1.2.5.2 Research Policy & Mentoring**

Another study addressed Research Policy and Mentoring, reflecting the institution's focus on evidence-based capacity building for faculty researchers. The

R&D Agenda 2026–2030 suggested that PhilSCA should implement a faculty research capacity program that leverages behavioral profiling to deliver targeted mentoring, micro-credentialing, and skills development. This approach aims to increase both research productivity and quality, ensuring that researchers are well-equipped to meet institutional and industry expectations.

#### **9.1.2.5.3 Employability Analysis**

One study on Employability Analysis focuses in addressing the critical link between education, skills acquisition, and workforce outcome. The agenda recommends establishing a continuous graduate employability analytics system, integrating tracer studies, employer surveys, and curriculum review. This system will enhance placement rates, identify emerging skill gaps, and ensure that academic programs remain relevant to labor market needs.

**Table 17**

*R&D Management Unit: R&D Agenda of PhilSCA for 2026–2030 based on 2022–2024 Research Coverage and Gaps*

Institute	Program	Existing Research and Development Agenda (2021 to 2025)	2022–2024 Research Count	<sup>1/</sup> Coverage Status	% Coverage	<sup>2/</sup> Priority Level	Emerging Trends	Proposed R&D Agenda 2026 to 2030
Others	R&D Management	New: Research Productivity Enhancement	1	-	-	Very High	Digital Research Management Platforms (RIMS), ORCID/altmetrics integration, automated portfolio dashboards, research data management (RDM) & FAIR principles, cross-HEI benchmarking, API-enabled dashboards.	Develop interoperable digital research management systems (RIMS) and benchmarking dashboards to measure, plan and enhance aviation HEI research productivity across campuses and with industry partners.
		New: Research Policy & Mentoring	1	-	-	Very High	Micro-credentialing & CPD for research skills, blended mentorship platforms, competency-based researcher	Implement an evidence-based faculty research capacity program using behavioral profiling to target skills training, mentoring and

							development, nudges & behavioral interventions for research engagement, research workflow automation.	micro-credentials that increase research outputs and quality.
		New: Employability Analysis	1	-	-	Very High	Skills mapping to occupational standards, longitudinal labor-market analytics, employer-skill gap surveys, digital credential tracing, regional deployment studies (rural/urban), industry partnership models, salary trajectories.	Establish a continuous graduate employability analytics system linking tracer data, employer surveys and curriculum review to improve placement rates and course relevance.

Note: <sup>1/</sup>Coverage Equity (see Table 1, page 31)

<sup>2/</sup>Overlay of Coverage Equity and Priority Scale for R&D Agenda Decision-Making (see Table 2, page 32)

## **9.2 Recommendation**

To ensure that the R&D Agenda 2026–2030 remains future-ready, globally aligned, and socially responsive, the following was recommended for continuous monitoring and improvement which will be integrated in Figure 1 (i.e., cyclical framework for the development of the PhilSCA R&D Agenda 2026–2030).

### **9.2.1 Validation & Stakeholder Consultation**

To ensure the robustness and applicability of the proposed PhilSCA R&D Agenda 2026–2030, it is recommended that the framework undergo a thorough process of stakeholder validation. This phase should involve consultations with academic units, faculty researchers, aviation industry representatives, regulatory bodies, and student leaders to assess the relevance, feasibility, and potential impact of the proposed research directions. Stakeholder engagement not only strengthens institutional ownership but also ensures that the agenda remains aligned with emerging industry demands, regulatory priorities, and national development goals. Feedback derived from these consultations will guide the refinement of research clusters, facilitate prioritization of critical themes, and foster stronger linkages between academic research and real-world aviation challenges.

### **9.2.2 Implementation and Continuous Monitoring**

The successful operationalization of the proposed PhilSCA R&D Agenda for 2026–2030 (see Appendix A: Summary of Findings & Recommendations) requires a strategic approach to implementation, continuous monitoring, and evaluation. Building on the thematic analysis of research outputs from 2022–2024 and proposed studies, this outlines strategies to ensure that priority areas, gaps, and emerging

trends identified across all programs are translated into actionable initiatives, measurable outcomes, and sustainable research productivity.

The implementation framework is designed to ensure alignment with institutional priorities, emerging industry trends, global aviation standards, and national development goals. Continuous monitoring mechanisms aim to track research coverage, quality, and impact, thereby supporting iterative refinement of the R&D agenda over the five-year period.

### **9.2.2.1 Strategic Implementation Approach**

#### **9.2.2.1.1 Program-Level Implementation**

##### **A. Institute of Liberal Arts and Sciences (ILAS)**

1. **Aviation Communication:** Initiatives will focus on integrating cognitive, motivational, and immersive educational technologies, including AR/VR, gamification, adaptive learning, and digital flight planning tools. The low-coverage areas such as pilot-controller miscommunication, corpus-based phraseology studies, accent adaptation, and operational standardization have to be prioritized through targeted research projects.
2. **Aviation Logistics:** Programs will emphasize AI-driven logistics optimization, sustainable supply chains, and integration of SMEs into global networks. No-coverage areas for instance gender mainstreaming and cross-cutting supply chain innovations has to be introduced through dedicated research collaborations and technology adoption projects.
3. **Aviation Tourism:** Curriculum modernization, experiential learning labs, community engagement in eco-tourism, and AI-driven tourism analytics has to be implemented to address skills gaps and industry-aligned outcomes.

4. **Aviation Safety and Security Management:** AI-assisted hazard systems, IoT-enabled monitoring, and cybersecurity resilience programs has to be implemented to strengthen aviation safety protocols.
5. **General Education:** Technology-aided instruction, blended learning, and gender-sensitive programs has to continue, with emphasis on digital literacy, civic engagement, and soft skills integration.

## **B. Institute of Engineering and Technology (InET)**

1. **Aeronautical Engineering:** Programs will prioritize eco-efficient aircraft design, AI-CFD integration, UAV development, clean propulsion systems, and additive manufacturing technologies.
2. **Aircraft Maintenance Technology:** High-focus areas including predictive maintenance, advanced composite materials, sustainable aviation fuels, and engine test cell optimization has to be operationalized through dedicated labs, pilot projects, and industry-academia partnerships.
3. **Air Transportation & Aviation Electronics Technology:** Programs has to be integrated agile leadership, crew resource management, AI-assisted avionics systems, and immersive training technologies to improve pilot readiness, operational safety, and employability.

## **C. Institute of Computer Studies (ICS)**

**Aviation Information Technology & Management:** Implementation will center on digital pedagogy, AI/IoT-enabled MRO systems, data analytics, blockchain solutions, and smart airport management systems. Key gaps in SWIM, graduate employability tracking, and AR/VR training platforms has to be addressed via pilot programs and collaborative research projects.

## **D. Institute of Graduate Studies (IGS)**

**MEAM & MPA Programs:** Continuous enhancement has to focus on simulation-driven competency-based education, aviation policy and governance research, strategic air operations, cybersecurity, and gender mainstreaming. Emerging gaps in economic studies, dual-use MRO facilities, and digital aviation operations has to be incorporated into graduate-level research projects.

## **E. Others – R&D Management**

Digital Research Management Platforms (RIMS), competency-based mentoring, and graduate employability analytics systems has to be implemented to institutionalize evidence-based decision-making, cross-campus benchmarking, and research productivity enhancement.

### **9.2.2.2 Continuous Monitoring Framework**

To ensure the R&D Agenda is systematically implemented and remains responsive to emerging trends, the following monitoring mechanism has to be adopted:

#### **1. Coverage Tracking**

Utilize the % coverage matrix to monitor progress against priority agenda items, identifying low-coverage and no-coverage areas for targeted interventions. An annual audit of research outputs has to classify each initiative under No Coverage, Low Coverage, Partial Coverage, Well-Covered, or Strong Focus to guide resource allocation.

## **2. Impact and Quality Assessment**

Integrate quantitative and qualitative indicators such as publication outputs, industry adoption, innovation prototypes, policy influence, and societal impact. Regular peer review, advisory committee evaluation, and benchmarking against international aviation research standards is proposed to ensure sustainability.

## **3. Digital Monitoring Tools**

Develop and deploy digital dashboards and research management systems for real-time monitoring of project status, funding utilization, and collaboration outcomes. Implement AI-assisted analytics to identify trends, gaps, and emerging opportunities across all programs and institutes.

## **4. Stakeholder Engagement**

Establish multi-level advisory boards comprising industry, government, and academic partners to provide continuous feedback and strategic guidance. Conduct periodic workshops, surveys, and focus group discussions with students, faculty, and industry practitioners to evaluate the relevance and applicability of ongoing research.

## **5. Adaptive Management**

Introduce iterative review cycles every 12 months to recalibrate research priorities based on evolving trends, emerging technologies, and national or global aviation developments. Ensure flexibility to integrate new R&D areas such as aviation-inclusive development, environmental sustainability, and cybersecurity as they gain strategic importance.

### **9.2.2.3 Policy and Operational Recommendations**

#### **9.2.2.3.1 Resource Optimization**

Prioritize funding and capacity-building for Very High and High priority agenda items with minimal or no coverage. Encourage inter-institute collaboration to leverage expertise and avoid duplication in Well-Covered or Strong Focus areas.

#### **9.2.2.3.2 Capacity Building**

Invest in faculty and staff training on AI, IoT, digital research management, and gender-responsive pedagogy. Develop specialized labs, simulation centers, and digital infrastructure to support hands-on research implementation.

#### **9.2.2.3.3 Knowledge Management**

Establish institutional repositories, digital dashboards, and data-sharing protocols to improve knowledge dissemination, research visibility, and collaborative innovation. Also, integrate FAIR principles for data management and promote cross-institutional benchmarking to enhance research productivity.

#### **9.2.2.3.4 Sustainability and Inclusion**

Embed gender mainstreaming, inclusivity, and environmental sustainability considerations into all R&D projects and program-level initiatives. Track measurable outcomes such as graduate employability, SME integration, and community engagement to ensure socially responsible impact.

### 9.3 Issues and Concerns

The thematic review of research outputs from 2022–2024 and the mapping against the R&D Agenda 2021–2025 revealed several recurring issues and concerns that must be addressed to ensure effective implementation of the R&D Agenda 2026–2030:

- **Uneven Research Output across Programs:** The uneven distribution of research output highlights disparities among programs, with some institutes producing high volumes of work, while others show limited engagement, potentially due to resource constraints or capacity gaps. There is a notable underrepresentation of data science, AI, and cybersecurity research-areas which is critical to future aviation safety and operational resilience.
- **Low Research in High-Impact Areas:** Many strategically important domains such as AI-driven communication, blockchain in logistics, UAV-based safety technology, and sustainable aviation fuel remain underdeveloped.
- **Technology Integration Gaps:** Rapid advancements in AI, AR/VR, IoT, and blockchain have not been fully incorporated into the research agenda.
- **Graduate Program Underperformance:** Master's-level research coverage remains low in policy, economics, and industry-integrated capstones.
- **Resource Limitations:** Limited funding and insufficient access to specialized laboratory facilities may constrain the institution's ability to expand research into emerging and technology-intensive fields
- **Monitoring and Evaluation Gaps:** Lack of systematic monitoring tools and performance indicators made it difficult to assess coverage, quality, and impact of ongoing research. Also, there is no structured adaptive

management framework existed to incorporate emerging trends and changing priorities dynamically.

## **9.4 Best Practices**

The thematic analysis highlighted several best practices that can guide the implementation and continuous improvement of the R&D Agenda:

### **1. Digital Research Management Platforms**

- Utilizing RIMS and dashboard systems improved tracking of research outputs, collaboration, and productivity in some pilot programs.
- AI-assisted analytics and data visualization tools facilitated real-time monitoring and trend identification.

### **2. Interdisciplinary Collaboration**

- Programs that integrated multiple institutes, such as Aircraft Maintenance Technology with Engineering and Aviation IT, produced higher-impact research.
- Joint projects encouraged knowledge transfer, skill development, and alignment with industry needs.

### **3. Competency-Based Graduate Programs**

- Implementation of simulation-based and hands-on training modules enhanced graduate readiness and employability.
- Research aligned with competency frameworks ensured practical outcomes relevant to aviation operations and policy.

### **4. Stakeholder-Centric Research**

- Engagement with government agencies, aviation authorities, and industry partners strengthened research relevance and applicability.

- Collaborative projects enabled access to real-world datasets, facilities, and mentorship opportunities.

## **5. Iterative Review and Adaptive Planning**

- Programs that incorporated annual review cycles and benchmarking against global aviation trends successfully adapted their research focus to emerging needs.
- Regular review/audits of research coverage allowed proactive mitigation of gaps.

### **9.5 Plan, Proposal, and Design**

To operationalize the 2026–2030 R&D Agenda, a structured plan and design framework is proposed based on this study:

#### **9.5.1 Implementation Plan**

##### **9.5.1.1 Program Prioritization**

- Focus resources on very high and high priority areas with no or low coverage, such as AI-based aviation operations, UAV technologies, digital MRO systems, and environmental sustainability initiatives.
- Maintain ongoing support for well-covered areas to reinforce research excellence while avoiding duplication.

##### **9.5.1.2 Resource Allocation and Capacity Building**

- Develop specialized labs, simulation centers, and digital infrastructure to enable hands-on research.
- Provide targeted faculty development programs on emerging aviation technologies, digital pedagogy, and research management.

### **9.5.1.3 Cross-Institute Collaboration**

- Create inter-institute research clusters to foster interdisciplinary innovation and reduce isolated research efforts.
- Encourage co-supervised graduate projects and collaborative pilot programs with industry partners.

### **9.5.1.4 Monitoring, Evaluation, and Adaptive Management**

- Develop and deploy digital dashboards for real-time tracking of research outputs, coverage, and impact metrics.
- Establish annual review cycles with advisory boards and industry stakeholders to recalibrate research priorities dynamically.

## **9.5.2 Proposal Design**

### **9.5.2.1 Project-Based Research Framework**

- Organize research projects as modular, theme-aligned initiatives with defined outputs, KPIs, and timelines.
- Incorporate both theoretical and applied research components to ensure academic rigor and industry relevance.

### **9.5.2.2 Stakeholder Integration**

- Embed continuous stakeholder engagement through workshops, surveys, and co-development of research outputs.
- Facilitate internships, pilot programs, and knowledge exchange mechanisms to increase societal and industry impact.

### **9.5.2.3 Sustainability and Inclusivity**

- Integrate gender mainstreaming, environmental sustainability, and inclusivity principles into all project proposals.
- Track measurable indicators such as graduate employability, community impact, and industry adoption.

## 10. CONCLUSION AND LESSONS LEARNED

The thematic analysis determined a comprehensive insight of PhilSCA's current R&D landscape and provides a data-driven foundation for planning the institution's research priorities from 2026 to 2030. While the institution has achieved commendable progress in several high-impact domains, the uneven distribution of research efforts and the underexplored emerging technologies indicates the need for strategic realignment.

Key lessons learned from this study emphasize the imperative of strategic alignment wherein research priorities must be regularly reviewed against evolving industry trends, national development agendas, and global aviation imperatives to remain relevant and impactful. The study also highlights the importance of inclusivity in research, advocating for deliberate attention to underrepresented but critical areas such as gender studies, economic policy, and emerging technologies like AI and blockchain.

Capacity building emerges as a foundational necessity, with a clear mandate to strengthen faculty expertise, improve research infrastructure, and cultivate collaborative networks that span academia, industry, and government. These efforts will not only bridge current gaps but also future-proof PhilSCA's research ecosystem against rapid technological disruptions.

Continuous improvement drives sustainability wherein, implementing an iterative cycle of assessment, gap analysis, priority setting, and evaluation to ensure that the R&D agenda remains dynamic and aligned with the fast-changing aviation landscape.

Lastly, fostering a collaborative culture anchored on strong partnerships is vital to translating research into practice and policy. Industry-academia-government

synergy will enable PhilSCA to serve as a pivotal hub for innovation, regulation, and workforce development in the aviation sector.

By embracing a thematic, evidence-based approach, PhilSCA is well-positioned to close existing research gaps and spearhead transformative changes in aviation education, technology, and policy from 2026 to 2030.

## REFERENCES

- Abdel-Basset, M., Elhoseny, M., Gamal, A., & Smarandache, F. (2023). A multiple criteria methodology for priority-based portfolio selection. *Socio-Economic Planning Sciences*, 87, 101582. <https://doi.org/10.1016/j.seps.2023.101582>
- Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959–975. <https://doi.org/10.1016/j.joi.2017.08.007>
- Balita, C. (2021). Continuous improvement in Philippine higher education research management. *Philippine Journal of Educational Measurement*, 12(2), 45–60. Available via ResearchGate
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- CHED. (n.d.). Research, development and extension in higher education. Commission on Higher Education. <https://ched.gov.ph/research/>
- CHED. (2020). Higher Education Development Plan 2011–2022. Commission on Higher Education, Philippines. Retrieved from <https://ched.gov.ph> (policy documents guiding research thrusts in HEIs).
- Civil Aviation Authority of the Philippines (CAAP). (2024). Annual report 2023. <https://caap.gov.ph/reports/2023-annual>

- Cloete, N., Maassen, P., & Bailey, T. (2011). *Universities and economic development in Africa*. Cape Town: CHET. <https://www.chet.org.za/books/universities-and-economic-development-africa>
- Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2001). Portfolio management for new product development: Results of an industry practices study. *R&D Management*, 31(4), 361–380. <https://doi.org/10.1111/1467-9310.00183>
- Deming, W. E. (1986). *Out of the crisis*. MIT Press. (Introduces PDCA cycle applied to quality and continuous improvement).
- Deming, W. E. (1986). *Out of the crisis*. MIT Press. <https://mitpress.mit.edu/9780262535946/out-of-the-crisis/>
- Gudowsky, N. (2021). Limits and benefits of participatory agenda setting for research and innovation. *European Journal of Futures Research*, 9(8). <https://doi.org/10.1186/s40309-021-00177-0>
- DOST. (2017). *Harmonized National R&D Agenda (HNRDA) 2017–2022*. Department of Science and Technology. <https://www.dost.gov.ph/knowledge-resources/downloads/category/239-hnrda-2017-2022.html>
- DOST. (2022). *Harmonized National R&D Agenda (HNRDA) 2022–2028*. Department of Science and Technology. <https://dost.gov.ph/knowledge-resources/downloads/category/345-hnrda-2022-2028.html>
- Hazelkorn, E. (2015). *Rankings and the reshaping of higher education* (2nd ed.). Palgrave Macmillan. <https://doi.org/10.1057/9781137446671>

International Air Transport Association (IATA). (2023). Aviation environmental sustainability report. <https://www.iata.org/en/publications/environmental-sustainability-report/>

International Civil Aviation Organization (ICAO). (2024). Global aviation safety plan 2024. <https://www.icao.int/safety/Pages/gasp.aspx>

ICAO. (2020). Procedures for Air Navigation Services — Training (PANS-TRG, Doc 9868, 3rd ed.). International Civil Aviation Organization. <https://store.icao.int/en/pans-trg-doc-9868>

ICAO. (2023a). Global Aviation Safety Plan (GASP), 2023–2025 edition (overview). International Civil Aviation Organization. <https://www.icao.int/safety/GASP/Pages/default.aspx>

ICAO. (2024a). CORSIA eligible fuels — Sustainability criteria and certification schemes. International Civil Aviation Organization. <https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Eligible-Fuels.aspx>

ICAO. (n.d.). Next Generation of Aviation Professionals (NGAP). International Civil Aviation Organization. <https://www.icao.int/safety/ngap/Pages/default.aspx>

James Lind Alliance. (2021). The JLA guidebook (v10). James Lind Alliance. <https://www.jla.nihr.ac.uk/jla-guidebook/>

Kang, S. C., & Snell, S. A. (2009). Intellectual capital architectures and ambidextrous learning: A framework for human resource management. *Journal of Management Studies*, 46(1), 65–92. <https://doi.org/10.1111/j.1467->

6486.2008.00778.x

Karunanithi, A. T., Choudhury, A. K., & Roy, J. (2020, March). Project prioritization for portfolio selection using MCDA. In Proceedings of the International Conference on Industrial Engineering and Operations Management. IEOM Society. <https://www.ieomsociety.org/ieom2020/papers/808.pdf>

Mazzucato, M. (2018). The entrepreneurial state: Debunking public vs. private sector myths. Penguin.

Meyer, J. L., Waterman, C., Coleman, G. A., & Strambler, M. J. (2023). Whose agenda is it? Navigating the politics of setting the research agenda in education research–practice partnerships. *Educational Policy*, 37(1), 122–146. <https://doi.org/10.1177/08959048221131567>

Okoli, C., & Pawlowski, S. D. (2004). The Delphi method as a research tool: An example, design considerations and applications. *Information & Management*, 42(1), 15–29. <https://doi.org/10.1016/j.im.2003.11.002>

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>

Philippine State College of Aeronautics. (2025). Citizen's charter 2025. <https://www.philsca.edu.ph/wp-content/uploads/2025/04/PhilSCA-Citizens-Charter-2025.pdf>

Philippine State College of Aeronautics. (n.d.). Vision and mission. <https://www.philsca.edu.ph/vision-mission/>

Philippine State College of Aeronautics. (n.d.). Research and development center strategic plan 2021–2025.

[https://philasca.academia.edu/Departments/Research\\_and\\_Development\\_Center/Documents](https://philasca.academia.edu/Departments/Research_and_Development_Center/Documents)

Rosario et al. (January 2023). Philippine State College of Aeronautics (PhilSCA) Research and Development Agenda for 2021-2025.

<https://www.researchgate.net/publication/366964317>

Rosario et al. (January 2023). 1st Philippine Aviation Research Conference (PARC 2022) Book of Abstracts.

[https://www.researchgate.net/publication/366953690\\_1st\\_Philippine\\_Aviation\\_Research\\_Conference\\_PARC\\_2022\\_Book\\_of\\_Abstracts](https://www.researchgate.net/publication/366953690_1st_Philippine_Aviation_Research_Conference_PARC_2022_Book_of_Abstracts)

Rudan, I., Yoshida, S., Chan, K. Y., Sridhar, D., Wazny, K., Nair, H., & Campbell, H. (2014). Setting health research priorities using the CHNRI method: IV. Key conceptual advances. *Journal of Global Health*, 4(1), 010507.

<https://doi.org/10.7189/jogh.04.010507>

The W. Edwards Deming Institute – PDSA Overview (n.d.).

<https://deming.org/explore/pdsa/>

Trott, P. (2012). Innovation management and new product development .

[https://www.iust.ac.ir/files/pe/files/im\\_and\\_npd\\_paul\\_trott\\_compressed.pdf](https://www.iust.ac.ir/files/pe/files/im_and_npd_paul_trott_compressed.pdf)

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523–538.

<https://doi.org/10.1007/s11192-009-0146-3>

World Health Organization. (2020). Shaping the research agenda. WHO. Retrieved from <https://www.who.int/our-work/science-division/research-for-health/optimizing-research-processes/shaping-the-research-agenda>

Yurkofsky, M. M., Peterson, A. J., Mehta, J. D., Horwitz-Willis, R., & Frumin, K. M. (2020). Research on continuous improvement: Exploring the complexities of managing educational change. *Review of Research in Education*, 44(1), 403–433. <https://doi.org/10.3102/0091732X20907363>

Zárate, R., & David, C. C. (2019). Higher education research agenda setting in the Philippines: Current trends and challenges. *Philippine Social Science Journal*, 2(1), 15–25. <https://doi.org/10.52006/main.v2i1.41>

## APPENDICES

### APPENDIX A. SUMMARY OF FINDINGS AND RECOMMENDATIONS

**Table A1**

*Proposed R&D Agenda 2026–2030 Focus Based on Key Gaps Identified and Emerging Trends*

Institute	Program	Key Gaps Identified	Emerging Trend	Proposed R&D Agenda 2026–2030 Focus
<b>ILAS</b>	<b>BS Aviation Communication</b>	Limited coverage in pilot-controller miscommunication, corpus-based phraseology, accent/prosody optimization, English proficiency, operational communication, gender integration, knowledge management, marketing communication	Incorporate cognitive/motivational strategies, immersive tech (AR/VR, gamification), AI-assisted assessment, sociolinguistics-informed safety, human factors, gender-inclusive workforce initiatives	Aviation communication optimization using cognitive, immersive, and gender-responsive approaches; AI-powered phraseology, knowledge management, operational analytics
	<b>BS Aviation Logistics</b>	Program enhancement, SME linkages, gender inclusion, global value chain, data analytics, knowledge management	Digital logistics, AI-assisted operations, sustainable supply chains, humanitarian logistics, SME integration	AI-powered and sustainable logistics, SME integration, knowledge management, gender-responsive workforce

<b>InET</b>	<b>BS Aviation Safety &amp; Security Management</b>	<b>BS Aviation Tourism</b>	Curriculum alignment, instructional framework, gender/diversity studies, MSME linkages, global value chain, knowledge management	Experiential learning labs, AI-enabled tourism services, community engagement, inclusive practices	Aviation-inclusive development, eco-tourism, AI-enhanced service quality, gender-inclusive workforce
		<b>General Education</b>	Linguistics in aeronautical communication, MSME linkages, data analytics, knowledge management	Technology-aided instruction, adaptive teaching, gender-sensitive curriculum, civic/soft skills integration	Technology-enhanced GE, inclusive teaching, data-driven workforce support, gender equality initiatives
		<b>BS Aviation Tourism</b>	Cybersecurity resilience, drone threat detection, gender inclusion, knowledge management	AI/IoT monitoring, blockchain-enabled safety, predictive hazard systems, human factors interventions	Advanced aviation safety/security tech, AI monitoring, cybersecurity, gender-responsive workforce
	<b>BS Aircraft Maintenance Technology</b>	<b>BS Aeronautical Engineering</b>	Emerging UAV designs, renewable energy adoption, techno-entrepreneurship	AI-assisted CFD, eco-efficient aircraft design, predictive maintenance, hybrid-electric propulsion	Sustainable aircraft design, UAV innovation, renewable energy, aviation entrepreneurship
			Autonomous defect detection, engine test-cell optimization, gender inclusion	AI/VR training, 3D scanning, digital twins, eco-friendly materials, predictive maintenance	Visual defect detection, sustainable AMT, predictive maintenance, gender-inclusive workforce
		<b>BS Aircraft Maintenance Technology</b>	Autonomous defect detection, engine test-cell optimization, gender inclusion	AI/VR training, 3D scanning, digital twins, eco-friendly materials, predictive maintenance	Visual defect detection, sustainable AMT, predictive maintenance, gender-inclusive workforce

	<b>BS Air Transportation</b>	Performance-based navigation, aerodrome operations, gender inclusion	CRM, agile leadership training, automation vs manual proficiency, runway safety	Modern flight operations, runway & communication safety, inclusive pilot training
	<b>Aviation Electronics Technology</b>	Gender inclusion in aviation electronics	Competency frameworks, immersive AR/VR simulation, curriculum-industry alignment	Competency-driven avionics education, AI-enabled CNS+A systems, inclusive workforce development
<b>ICS</b>	<b>BS Aviation Information Technology</b>	AR/VR integration, blockchain adoption, CAD for 3D printing, intelligent software for certification	Digital pedagogy, IoT-enabled MRO, predictive analytics, governance automation	AI/VR aviation IT training, IoT-enabled MRO, blockchain governance, inclusive aviation ICT
	<b>BS Aviation Information Management</b>	Airport info management, SWIM implementation, graduate employability studies	LMS integration, analytics-driven decision support, real-time passenger experience	Smart airport systems, SWIM-enabled ATM, data-driven workforce development

IGS	MEAM	Economic studies, aviation standards, MRO innovation, graduate impact, gender inclusion	Simulation-based learning, competency-based training, human factors research, digital pedagogy	Competency-driven MEAM, simulation-based training, aviation economics, inclusive workforce development
	MPA	Aviation law/regulations, importation/airfare studies, regional hubs, graduate impact	Cross-agency collaboration, cybersecurity, sustainable airport administration, ASEAN integration	Aviation cybersecurity, strategic operations, national security integration, inclusive governance
Others	R&D Management	Research productivity, policy & mentoring, employability analytics	Digital research platforms, micro-credentialing, labor-market analytics	Digital R&D management, faculty capacity building, employability-driven research alignment

**Note:** Areas with zero/low coverage can be considered as obsolete wherein these areas are irrelevant due to no scope/no institutional capacity/no stakeholder demand/ no foreseeable growth to conduct the study.

## APPENDIX B. COLLEGE RESEARCH AGENDA (CRA)

**Table B1**

*College R&D Agenda by Key Research Area*

College R&D Agenda	Focus Area	Proposed R&D Agenda 2026 to 2030
<b>Key Research Area 1: Aviation Policy, Leadership, and Governance</b>	1. Aviation Education and Training Enhancement	Advance future-ready aviation education through AI/VR, competency-based learning, and inclusive curriculum to strengthen global workforce competitiveness.
	2. Aviation Safety, Security, and Resilience	Develop AI- and IoT-enabled safety systems, blockchain-based compliance, and resilience strategies to address evolving risks, including pandemics and geopolitical threats.
	3. Emerging Aviation Management Strategies	Innovate in digital governance, cybersecurity, and adaptive aviation operations to strengthen organizational resilience and leadership capacity.
	4. Contemporary Standards, Laws, and Regulatory Frameworks	Shape policy innovation by aligning with global standards, promoting sustainability, and driving cross-agency collaboration for regulatory excellence.
<b>Key Research Area 2: Engineering, Technology, and Sustainable Aviation</b>	1. Next-Generation Aircraft Design & Propulsion	Pioneer eco-efficient aircraft and UAV innovations using AI-driven design, biomimicry, and hybrid-electric propulsion.
	2. Airframe Failure Detection Technologies	Enhance predictive maintenance through IoT-enabled 3D scanning, digital twins, and advanced diagnostics for improved airframe reliability.
	3. Advanced Airframe Materials	Advance research in bio-composites, self-healing, and recyclable 3D-printed structures for sustainable aircraft engineering.

	4. Sustainable Aviation Technologies	Lead green aviation transitions through biofuels, eco-lubricants, renewable energy integration, and UAV clean propulsion systems.
	5. Advanced Avionics System Design	Strengthen avionics innovation with AI-enabled communication, cybersecurity systems, and integrated CNS+A solutions.
	6. Digital Transformation in Aviation	Drive digital aviation ecosystems through IoT passenger systems, predictive analytics, and smart operations for efficiency and sustainability.
<b>Key Research Area 3: Liberal Arts, Sciences, and Human Factors in Aviation</b>	1. Gender and Development(GAD) in Aviation	Promote inclusivity by embedding gender-sensitive curriculum, women-in-STEM initiatives, and equity-focused policies across aviation programs.
<b>Key Research Area 4: Environment, Industry, and Aviation Development</b>	1. Air Transport Competitiveness	Enhance global competitiveness by integrating smart passenger experience, predictive disruption management, and digital logistics systems.
	2. Corporate Aviation Development	Foster aviation-inclusive growth by linking airports, tourism, and community development to national economic strategies.
	3. Sustainable Aviation Technologies	Lead green aviation transitions through biofuels, eco-lubricants, renewable energy integration, and UAV clean propulsion systems.

## APPENDIX C. RESEARCH AGENDA BY INSTITUTE AND BY PROGRAM

**Table C1**

*R&D Agenda of the Institute of Liberal Arts and Sciences (ILAS)*

R&D Agenda Item	Proposed R&D Agenda 2026 to 2030
<b>1. Aviation Program Innovation and Enhancement</b>	Advance aviation education programs through curriculum innovation, immersive technologies (AR/VR, gamification), and employability-focused outcomes.
<b>2. Digital and Sustainable Aviation Logistics</b>	Develop AI-enabled, IoT-powered, and sustainable logistics systems to strengthen resilience, operational efficiency, and green supply chain practices.
<b>3. Passenger Experience and Airline Service Innovation</b>	Transform passenger services through AI-driven loyalty, predictive analytics, and smart airport solutions that enhance travel experience and resilience.
<b>4. Aviation Communication</b>	Apply human factors, predictive analytics, and technology-assisted interventions to optimize ATC communication and specialized flight readiness
<b>5. Aviation Safety, Security, and Risk Resilience</b>	Deploy AI, IoT, and blockchain-enabled systems, alongside simulation and drone-assisted protocols, to enhance airport safety, security risk management, and pandemic- and geopolitical-resilient aviation operations.
<b>6. Innovative General Education and Learning Technologies</b>	Elevate general education through AI-driven portals, AR/VR learning labs, adaptive analytics, and the integration of civic education, sustainability, and soft skills.
<b>7. Gender and Development (GAD) in Aviation Education and Industry</b>	Promote gender equality, inclusivity, and mental health in aviation education and industry by mainstreaming GAD policies and empowering women in STEM.

<b>8. Aviation Renewable and Environmental Sustainability</b>	Advance renewable energy adoption, environmental sustainability, and green technologies in aviation education, operations, and airport infrastructure.
<b>9. Aviation-Community Development and Social Responsibility</b>	Strengthen aviation’s role in inclusive growth, airport–community partnerships, and aviation-led poverty reduction and social responsibility programs.

**Table C2**

*Program R&D Agenda of the Institute of Liberal Arts and Sciences (ILAS)*

Program	Proposed R&D Agenda 2026 to 2030
<b>Bachelor of Science in Aviation Communication</b>	<ol style="list-style-type: none"> <li>1. Integrate cognitive, motivational, and immersive educational technologies to enhance Aviation Communication training outcomes, curriculum effectiveness, and employability skills.</li> <li>2. Apply human factors, predictive analytics, and technology-assisted interventions to optimize ATC communication, operational safety, and specialized flight readiness</li> </ol>
<b>Bachelor of Science in Aviation Logistics</b>	<ol style="list-style-type: none"> <li>1. Research on digital, AI-enabled, and sustainable practices to enhance operational efficiency, resilience, and environmental performance in air freight logistics</li> </ol>
<b>Bachelor of Science in Aviation Tourism</b>	<ol style="list-style-type: none"> <li>1. Advance innovative service strategies in airports and airlines by adopting AI, predictive analytics, and smart infrastructure to enhance passenger experience and loyalty.</li> <li>2. New: Aviation-inclusive development, airport–community social responsibility, and aviation-driven poverty reduction</li> </ol>

<b>Bachelor of Science in Aviation Safety and Security Management</b>	<ol style="list-style-type: none"> <li>1. Deploy AI, IoT, and blockchain-enabled systems to enhance airport security, safety risk management, and cargo handling compliance</li> <li>2. Develop aviation safety strategies addressing geopolitical risks, environmental sustainability, and pandemic resilience to strengthen long-term aviation safety systems</li> </ol>
<b>General Education</b>	<ol style="list-style-type: none"> <li>1. Development of Technology-Aided Instruction, Digital Learning Platforms, and AR/VR tools in GE across aviation programs to enhance access, experiential learning, and sustainability</li> <li>2. Strengthen teaching-learning practices, adaptive strategies, simulation/role-based learning, and civic/soft skills programs for aviation GE</li> <li>3. Advance gender equality, inclusive curriculum, and women empowerment across aviation education, training, and industry</li> <li>4. New: Environmental sustainability (renewable energy technology in educational institutions)</li> </ol>

**Table C3**

*R&D Agenda of the Institute of Engineering and Technology (InET)*

<b>R&amp;D Agenda Item</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
<b>1. Aviation Program Enhancement</b>	Advance aviation education by integrating AI, VR/AR, and competency-based curricula, while addressing student wellness, inclusivity, and industry alignment for globally competitive graduates.
<b>2. Remotely Piloted Aircraft Systems (RPAS / UAV)</b>	Drive UAV innovation for smart farming, aquaculture, logistics, and humanitarian response by integrating VTOL, hybrid propulsion, precision imaging, and clean energy systems.
<b>3. Contemporary Aviation Standards, Safety, and Policy Resilience</b>	Strengthen aviation resilience by aligning safety standards, certification, and policy reforms with CORSIA, SAF adoption, liberalization effects, and pandemic preparedness.
<b>4. Aircraft Engine Test Cell Modernization</b>	Modernize aircraft engine test cell facilities with digital twins, IoT sensors, multi-fuel compatibility, and sustainable compliance systems to enhance safety, efficiency, and environmental resilience.
<b>5. Airframe Safety, Failure Detection, and Predictive Maintenance</b>	Strengthen aviation safety through digital twins, 3D scanning, IoT-enabled inspection, and AI-assisted predictive maintenance for ageing and next-generation aircraft.
<b>6. Advanced Airframe Materials and Additive Manufacturing</b>	Develop advanced eco-friendly composites, self-healing materials, and recyclable 3D-printed structures through academe–industry collaboration for sustainable aerospace.
<b>7. Sustainable Aviation Fuels, Lubricants, and Eco-Materials</b>	Advance sustainable aviation by developing biofuels, eco-lubricants, ASTM-approved sealants, and recyclable aviation materials to reduce emissions and enhance resilience.

<b>8. Advanced Avionics and Integrated CNS+A Systems</b>	Enhance air traffic management through AI-enabled CNS+A technologies, resilient datalinks, IoT retrofits, and cybersecurity frameworks aligned with Industry 4.0.
<b>9. Gender and Development (GAD) in Aviation Education</b>	Promote inclusive aviation education and workforce development by mainstreaming gender-responsive pedagogy, structured equity policies, and mentorship-driven participation.

**Table C4**

*Program R&D Agenda of the Institute of Engineering and Technology (InET)*

Program	Proposed R&D Agenda 2026 to 2030
<b>Bachelor of Science in Aeronautical Engineering Program</b>	<ol style="list-style-type: none"> <li>1. Promote eco-efficient aircraft design through AI-driven CFD, biomimicry-inspired aero-structures, predictive maintenance, and hybrid-electric propulsion for sustainable aviation.</li> <li>2. Advance UAV innovation for smart farming, aquaculture, and humanitarian response, integrating clean propulsion systems and precision imaging technologies.</li> <li>3. Expand additive manufacturing for aviation through bio-composites, recyclable filaments, and industry–academe collaboration for sustainable aerospace structures.</li> <li>4. Modernize engine test cell infrastructure with advanced sensors, digital twins, and multi-fuel systems for safety, performance, and sustainability validation.</li> </ol>
<b>Bachelor of Science in Aircraft Maintenance Technology</b>	<ol style="list-style-type: none"> <li>1. Advance AMT education with AI, digital tools, and competency-based curriculum while addressing student wellness and inclusivity for future-ready graduates.</li> <li>2. Strengthen aviation safety and efficiency through adoption of 3D scanning, digital twins, and IoT-enabled predictive maintenance tools.</li> <li>3. Develop advanced, eco-friendly, and self-healing composite materials for durable and sustainable aviation applications.</li> </ol>

	<ol style="list-style-type: none"> <li>4. Enhance ageing aircraft maintenance with predictive, IoT-powered tools and integrate workforce resilience and safety culture in aviation.</li> <li>5. Advance sustainable aviation by developing biofuels, eco-lubricants, and ASTM-approved green composites to reduce emissions and enhance resilience.</li> </ol> <hr/> <ol style="list-style-type: none"> <li>6. New: Transform reciprocating engine test-cell facilities with digital twins, IoT sensors, AI-driven diagnostics, sustainable fuel compatibility, and environmentally compliant operations.</li> <li>7. New: Mainstreaming Gender and Development (GAD) in Aviation Education, Training, and Industry</li> </ol>
<b>Bachelor of Science in Air Transportation</b>	<ol style="list-style-type: none"> <li>1. Strengthen national aviation resilience by aligning policies with safety, sustainability, liberalization, and modern fleet strategies, ensuring long-term competitiveness and compliance with global standards.</li> <li>2. New: Promote inclusive participation of women and underrepresented groups in aviation education, training, and industry through structured gender mainstreaming policies.</li> </ol>
<b>Aviation Electronics Technology</b>	<ol style="list-style-type: none"> <li>1. Advance avionics education through curriculum modernization, digital pedagogy, immersive simulation, and employability-driven competency frameworks.</li> <li>2. Strengthen aviation safety and efficiency by advancing integrated CNS+A technologies, emphasizing AI-enabled multimodal communication, resilient networks, and aviation cybersecurity.</li> <li>3. New: Promote inclusive aviation workforce development through gender-responsive education, workplace equity strategies, and mentorship-driven participation of underrepresented groups.</li> </ol>

**Table C5***R&D Agenda of the Institute of Computer Studies (ICS)*

<b>R&amp;D Agenda Item</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
<b>1. Aviation IT Program Innovation</b>	Advance aviation IT education through digital pedagogy, competency-based micro-credentialing, and policy-integrated curriculum frameworks to ensure future-ready aviation professionals.
<b>2. ICT-Enabled Aviation Ecosystems</b>	Promote ICT-driven aviation education and operations through secure digital identity, smart campus automation, govtech-enabled transparency, and inclusive assistive technologies
<b>3. Internet of Things (IoT) for Aviation and Community Resilience</b>	Promote ICT-enabled aviation ecosystems via secure identity systems, smart campus solutions, inclusive assistive technologies, and integrated learning environments.
<b>4. Data Analytics for Aviation Governance and Sustainability</b>	Harness real-time data analytics for flight operations, procurement transparency, environmental sustainability, airline efficiency, and aviation workforce skills gap mapping.

**Table C6**

*Program R&D Agenda of the Institute of Computer Studies (ICS)*

<b>Program</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
<b>Bachelor of Science in Aviation Information Technology</b>	<ol style="list-style-type: none"><li>1. Advance aviation IT education through digital pedagogy, competency-based micro-credentialing, and policy-integrated curriculum frameworks to ensure workforce readiness in the aviation industry.</li><li>2. Promote ICT-enabled aviation education ecosystems through secure identity systems, smart campus solutions, and inclusive assistive technologies.</li><li>3. Implement IoT-enabled passenger experience, mobility tracking, and resilience systems to enhance aviation services and community safety.</li></ol>
<b>Bachelor of Science in Aviation Information Management</b>	<ol style="list-style-type: none"><li>1. Harness data analytics for environmental sustainability, airline efficiency, and aviation workforce development through skills gap mapping and competency frameworks.</li></ol>

**Table C7**

*R&D Agenda of the Institute of Graduate Studies (IGS)*

<b>R&amp;D Agenda Area</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
<b>1. Aviation Program Innovation &amp; Pedagogical Excellence</b>	Elevate the quality and relevance of graduate aviation education through competency-based training, simulation-driven pedagogy, and continuous faculty development.
<b>2. Air Laws and Regulations</b>	Strengthen institutional, legal, and regulatory frameworks in aviation through digital transformation, cybersecurity, and cross-agency collaboration.
<b>3. Aviation Safety, Security &amp; Compliance Systems</b>	Elevate aviation safety by integrating digital compliance monitoring, cybersecurity resilience, runway safety technologies, and crisis response systems.
<b>4. Airport Administration</b>	Advance airport governance by embedding pandemic resilience, sustainable operations, smart transport systems, and workforce modernization.
<b>5. Gender, Diversity &amp; Inclusion in Aviation</b>	Integrate gender equality and inclusivity into aviation curricula, HR policies, and workforce pathways to foster equitable opportunities.
<b>6. Strategic Aviation Operations, National Security &amp; Innovation Ecosystems</b>	Strengthen national aviation readiness through cybersecurity, emergency response research, and collaborative industry–academia R&D ecosystems.

**Table C8**

*Program R&D Agenda of the Institute of Graduate Studies (IGS)*

Program	Proposed R&D Agenda 2026 to 2030
<b>Master of Education in Aeronautical Management</b>	<ol style="list-style-type: none"> <li>1. Advance program quality and relevance through competency-based training, simulation-driven learning, faculty development frameworks, and digitally enabled pedagogy for future-ready aviation professionals.</li> <li>2. New: Mainstream gender and diversity in aviation education, training, and workplaces by developing inclusive HR policies, gender-sensitive curricula, and equitable workforce pathways.</li> </ol>
<b>Master in Public Administration</b>	<ol style="list-style-type: none"> <li>1. Advance institutional, legal, and regulatory frameworks in aviation through digital transformation, cybersecurity resilience, cross-agency policy collaboration, and maritime-aviation integration.</li> <li>2. Enhance airport administration policies by integrating pandemic resilience, green aviation standards, smart transport systems, and human resource modernization for operational excellence.</li> <li>3. New: Aviation cybersecurity policy, data integrity, digital resilience in air/maritime operations (Advance safety systems, threat mitigation, and crisis response frameworks)</li> <li>4. New: Development of strategic Aviation Operations &amp; National Security (operational readiness/support and emergency medical response, and strategic planning)</li> </ol>

**Table C9**

*R&D Agenda across the Program*

<b>Focus Area</b>	<b>Proposed R&amp;D Agenda 2026 to 2030</b>
<b>Research Productivity Enhancement</b>	Develop interoperable digital research management systems (RIMS) and benchmarking dashboards to measure, plan and enhance aviation HEI research productivity across campuses and with industry partners
<b>Research Policy &amp; Mentoring</b>	Implement an evidence-based faculty research capacity program using behavioral profiling to target skills training, mentoring and micro-credentials that increase research outputs and quality.
<b>Employability Analysis</b>	Establish a continuous graduate employability analytics system linking tracer data, employer surveys and curriculum review to improve placement rates and course relevance.

## APPENDIX D. CERTIFICATE OF ACCEPTANCE



Republic of the Philippines  
**PHILIPPINE STATE COLLEGE OF AERONAUTICS**  
Piccio Garden, Villamor, Pasay City

### CERTIFICATE OF ACCEPTANCE

This is to certify that the **Special Problem** entitled:

**“Development of the Research and Development (R&D) Agenda of Philippine State College of Aeronautics (PhilSCA) for 2026-2030”**

has been officially accepted by the Philippine State College of Aeronautics(PhilSCA) as part of the research requirements and institutional collaboration supporting the College’s strategic research, innovation, and development directions.

This Special Problem, submitted by **Mr. Randy M. Arcangel**, a student of the Master of Research and Development Management program at the University of the Philippines Open University (UPOU), is hereby recognized as a valuable contribution toward the formulation of the PhilSCA’s Research and Development Agenda 2026-2030.

Issued this 19th day of September, 2025 at the Philippine State College of Aeronautics, Pasay City, Philippines.

**Approved and Accepted by:**

**DR. NOEL R. NAVIGAR**

Director, Office of Research and Development  
Philippine State College of Aeronautics