Leibniz
Gemeinschaft

Der Senat

15. Juli 2025

Stellungnahme zum Leibniz-Institut für Agrartechnik und Bioökonomie, Potsdam (ATB)

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Vorbemerkung

Die Einrichtungen der Forschung und der wissenschaftlichen Infrastruktur, die sich in der Leibniz-Gemeinschaft zusammengeschlossen haben, werden von Bund und Ländern wegen ihrer überregionalen Bedeutung und eines gesamtstaatlichen wissenschaftspolitischen Interesses gemeinsam außerhalb einer Hochschule gefördert. Turnusmäßig, spätestens alle sieben Jahre, überprüfen Bund und Länder, ob die Voraussetzungen für die gemeinsame Förderung einer Leibniz-Einrichtung noch erfüllt sind.[1]

Die wesentliche Grundlage für die Überprüfung in der Gemeinsamen Wissenschaftskonferenz ist regelmäßig eine unabhängige Evaluierung durch den Senat der Leibniz-Gemeinschaft. Die Stellungnahmen des Senats bereitet der Senatsausschuss Evaluierung vor. Für die Bewertung einer Einrichtung setzt der Ausschuss Bewertungsgruppen mit unabhängigen, fachlich einschlägigen Sachverständigen ein.

Vor diesem Hintergrund besuchte eine Bewertungsgruppe am 10. und 11. September 2024 das ATB in Potsdam-Bornim. Ihr stand eine vom ATB erstellte Evaluierungsunterlage zur Verfügung. Die wesentlichen Aussagen dieser Unterlage sind in der Darstellung (Anlage A dieser Stellungnahme) zusammengefasst. Die Bewertungsgruppe erstellte im Anschluss an den Besuch den Bewertungsbericht (Anlage B). Das ATB nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 15. Juli 2025 auf dieser Grundlage die vorliegende Stellungnahme. Der Senat dankt den Mitgliedern der Bewertungsgruppe und des Senatsausschusses Evaluierung für ihre Arbeit.

1. Beurteilung und Empfehlungen

Der Senat schließt sich den Beurteilungen und Empfehlungen der Bewertungsgruppe an.

Das Leibniz-Institut für Agrartechnik und Bioökonomie betreibt anwendungsorientierte Grundlagenforschung mit dem Ziel, den Wandel hin zu einer nachhaltigen, biobasierten Kreislaufwirtschaft zu unterstützen. Dazu werden neue Technologien und Managementstrategien zur Produktion von Biomasse und deren Nutzung in Agrar-, Lebensmittel- und Energiesystemen entwickelt. Die Arbeiten des ATB sind interdisziplinär und in angemessenem Umfang auch auf Infrastrukturleistungen und Transferaktivitäten ausgerichtet.

Nach einer kritischen Evaluierung 2013/2014 wurde ein umfassender Reformprozess eingeleitet, durch den sich das ATB in den Folgejahren sehr gut entwickelte. Großes Potenzial sah der Senat 2018 in einer konzeptionellen Modernisierung, mit der man anstrebte, über die Agrartechnik hinaus die neuen Themengebiete Bioökonomie, Agrarinformatik und Mikrobiologie aufzugreifen. Nach dem Ausscheiden des Wissenschaftlichen Direktors Ende 2017 dauerte es längere Zeit, bis im Oktober 2020 eine Nachfolgerin ins Amt trat. Die Position wurde zusammen mit der HU Berlin besetzt; damit ist die ATB-Leitung erstmals gemeinsam berufen. Das von der neuen Direktorin verantwortete **wissenschaftliche Konzept** rückte den Leitbegriff Bioökonomie in den Mittelpunkt und erweiterte auch dank Erhöhungen der institutionellen Förderung die bestehende agrartechnische Expertise um neue agrarinformatische und

[1] Ausführungsvereinbarung zum GWK-Abkommen über die gemeinsame Förderung der Mitgliedseinrichtungen der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e. V.

mikrobiologische Kompetenzen. Dies führte zu strukturellen Veränderungen im Zuschnitt der methodisch ausgerichteten Abteilungen. Sie arbeiten eng in fünf neu zugeschnittenen Programmbereichen zusammen, über die das Bioökonomie-Konzept inhaltlich sehr überzeugend entfaltet wird. Damit die angestrebte Profilierung in der internationalen Forschung erreicht werden kann, muss der sehr gut begonnene Prozess der strategischen Schwerpunktsetzung in den Abteilungen und Programmbereichen fortgesetzt werden. Die Bezeichnungen der Programmbereiche sollten mit dem Ziel einer Präzisierung überdacht werden.

Die Tätigkeiten des Instituts führen zu wichtigen **Forschungsergebnissen** im gesamten Spektrum von der Grundlagen- bis zur angewandten Forschung, die bereits erheblich sichtbarer veröffentlicht werden als im Zeitraum vor der letzten Evaluierung. Es besteht aber noch Potenzial, mit Publikationen international eine breitere Reichweite zu erlangen. Seit 2021 wird am ATB der Leibniz-Innovationshof für nachhaltige Bioökonomie (InnoHof) aufgebaut, eine **Infrastruktur**, die vom Institut betrieben und von vielen wissenschaftlichen Einrichtungen genutzt wird. Zur Sicherstellung des **Transfers** von Ergebnissen in die Anwendung verfolgt das ATB regelmäßig einen ko-kreativen Ansatz, mit dem der Privatsektor (Industrie, landwirtschaftliche Betriebe) frühzeitig in Projekte einbezogen wird. Dabei konzentriert sich das Institut auf technologische Lösungen bis hin zur Demonstration von Prototypen in relevanten Umgebungen. Das hat erfreulicherweise bereits zu drei Spin-off-Unternehmen geführt. Auch in Beratungsgremien ist das ATB aktiv. Alle fünf Programmbereiche werden als „sehr gut“ bewertet.

Zur **Weiterentwicklung** des Instituts unter dem Leitbegriff Bioökonomie hat das ATB sinnvolle Prioritäten gesetzt. Das Konzept zur <u>Diversifizierung und Individualisierung</u>, das auf technologische Lösungen beispielsweise im Pflanzenbau und in der Tierhaltung abzielt, basiert auf sehr gut etablierten Kompetenzen. Das Themenfeld <u>Mikrobiom-Biotechnologie und -management</u> wird ab 2025 mit zusätzlichen Mitteln der institutionellen Förderung gestärkt, die Arbeiten zu <u>Digitalisierung und Systemmodellierung</u> werden gemeinsam mit Partnereinrichtungen in Niedersachsen aufgebaut. Das Institut und die Universität Osnabrück haben dazu unter anderem mit umfangreichen Drittmitteln ein Joint Lab an der Schnittstelle von Agrarwissenschaften und Künstlicher Intelligenz eingerichtet. In den kommenden Jahren will das ATB diesen systemwissenschaftlichen Ansatz an den beiden Standorten zu einem *FutureLab for Bioeconomic Transformation* ausweiten. Dafür wurde bei der GWK eine Institutserweiterung beantragt, die derzeit in dem dafür vorgesehenen Verfahren begutachtet wird.

Das ATB ist seit der letzten Evaluierung deutlich gewachsen, was auf zusätzliche Mittel der **institutionellen Förderung** (zwei Sondertatbestände ab 2021 bzw. 2025) und gestiegene **Drittmittelerträge** zurückzuführen ist. Das Institut wirbt sehr erfolgreich Mittel für anwendungsorientierte Arbeiten ein, insbesondere beim BMEL. Entsprechend der eigenen Drittmittelstrategie sollten nun auch vermehrt Förderungen für Forschungsprojekte erzielt werden, sowohl auf nationaler als auch europäischer Ebene. Mit Blick auf DFG-Förderungen wird erwartet, dass zumindest Projektförderungen in Höhe der Abgabe erzielt werden, die dem ATB die Teilnahme an den DFG-Verfahren ermöglicht. Das ATB verfügt über eine hervorragende wissenschaftliche Infrastruktur an Labor- und Feldversuchsflächen. In den letzten Jahren hat das Land Brandenburg umfangreiche Mittel für Bau- und Modernisierungsmaßnahmen bereitgestellt. Außerdem finanziert das Land den InnoHof bis 2026 mit insgesamt 25 M€, für dessen weitere Finanzierung derzeit verschiedene Modelle geprüft werden.

Im **Vorstand** wurde 2023 mit der Berufung einer neuen Administrativen Direktorin eine Doppelspitze etabliert. Die Wissenschaftliche und die Administrative Direktorin arbeiten erfolgreich zusammen. Der Wissenschaftliche **Beirat**, dem auch Mitglieder aus der Industrie angehören, unterstützt die Arbeit des Instituts sehr engagiert und konstruktiv.

Die Zahl der wissenschaftlich **Beschäftigten** am ATB stieg von 87 (2016) auf zuletzt 121. Das Institut bietet ihnen ein attraktives Umfeld. Die Maßnahmen zur Karriereentwicklung wurden aktualisiert und müssen nun Wirkung entfalten. Wie bei der letzten Evaluierung empfohlen, sind jetzt deutlich mehr Promovierende in die Arbeiten des Instituts einbezogen, viele von ihnen aus dem Ausland. Ihre Förderung wurde weiter strukturiert, was nun auch dazu führen sollte, dass die Promotionsdauer auf die vom Institut angestrebten durchschnittlich vier Jahre gesenkt wird. Auf wissenschaftlichen Leitungspositionen sind am ATB gleich viele Frauen wie Männer tätig. Insgesamt, insbesondere unter den Promovierenden, sind Frauen jedoch leicht unterrepräsentiert. Das Institut sollte auch hier die selbst gesetzte Zielquote von 50 % erreichen.

Seit der letzten Evaluierung hat das ATB die Zahl der gemeinsamen Berufungen auf insgesamt sechs verdoppelt. Neben den drei Berliner Universitäten wird jetzt sinnvollerweise auch mit der Universität Potsdam zusammengearbeitet. In den letzten Jahren wurden Verbindungen zur Universität Osnabrück geknüpft, mit denen das ATB Expertise im Bereich Systemwissenschaften und Künstliche Intelligenz erschlossen hat. Zudem sind die spezifischen landwirtschaftlichen Produktionsgegebenheiten in Niedersachsen für die Untersuchungen des ATB von hohem Interesse. Die beiden Partner möchten die Zusammenarbeit nun ausbauen (s.o.). Das Institut bringt sich sehr aktiv in die Leibniz-Gemeinschaft ein, es ist an mehreren europäischen Forschungs- und Infrastrukturverbünden beteiligt und **kooperiert** mit zahlreichen Unternehmen. Auf internationaler Ebene gibt es eine Vielzahl von Projekten und personellen Verflechtungen, wie gemeinsame Publikationen belegen. Auf dieser Grundlage wird empfohlen, einige im Sinne des neuen wissenschaftlichen Konzepts strategisch besonders vielversprechende Partnerschaften weiterzuentwickeln und durch institutionelle Kooperationsvereinbarungen auf eine dauerhafte Basis zu stellen.

2. Zur Stellungnahme des ATB

Der Senat begrüßt, dass das ATB beabsichtigt, die Empfehlungen und Hinweise aus dem Bewertungsbericht bei seiner weiteren Arbeit zu berücksichtigen.

3. Förderempfehlung

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das ATB als Einrichtung der Forschung und der wissenschaftlichen Infrastruktur auf der Grundlage der Ausführungsvereinbarung WGL weiter zu fördern.

27 August 2024

Annex A: Status report

Leibniz Institute for Agricultural Engineering and Bioeconomy, Potsdam (ATB)

Contents

1. Key data, structure and tasks

Key data

Year established:	1992 (refoundation)
Admission to joint funding by Federal and *Länder* Governments:	1992
Admission to the Leibniz Association:	1997
Last statement by the Leibniz Senate:	2018
Legal form:	Non-profit association (*eingetragener Verein*)
Responsible department at *Länder* level:	Ministry of Science, Research and Culture (MWFK)
Responsible department at Federal level:	Federal Ministry for Food and Agriculture (BMEL)

Total budget (2023)

€ 13.6m institutional funding

€ 10.8m revenue from project grants

€ 0.3m revenue from services

Number of staff (31 December 2023)

121 individuals in “research and scientific services”

87 individuals in “science supporting staff (laboratories, technical support etc.)”

41 individuals in “science supporting staff (administration)”

Mission and structure

<u>Statutory mission</u> (ATB statutes §2 (2-4)):

“The purpose of the association is to promote science and research. To fulfil this purpose, ATB conducts research with the aim of creating the basis for sustainable bioeconomic production systems. To this end, ATB develops and integrates new technologies and management strategies for knowledge-based, site-specific production of biomass and its utilisation for food, as bio-based products and energy sources – from basic research to application. [...]

Within the scope of its statutory purpose and tasks, ATB engages in knowledge and technology transfer."

<u>Structure/organisation</u>

ATB is structured into six method-oriented scientific **departments**, which organise the personnel and infrastructural resources: Agromechatronics, System Process Engineering, Sensors and Modelling, Technology Assessment, Microbiome Biotechnology, Data Science in Bioeconomy

The departments interact in five **programme areas** (PAs), aimed at specific application fields, namely Diversified Crop Production, Individualised Livestock Production, Healthy Foods, Multifunctional Biomaterials, Integrated Residue Management.

The activities are supported by four **central infrastructures**: the Leibniz Innovation Farm for Sustainable Bioeconomy, the Fieldlab for Digital Agriculture, the Central IT and Data Management, as well as the Central Analytics Laboratory.

2. Overall concept and core results

ATB follows a mission-oriented research approach to provide methods, processes and technological solutions for complex global challenges such as climate change adaptation and mitigation, biodiversity preservation and reduction of natural resource depletion. The aim is to support the transformation towards a circular, sustainable and diverse bioeconomy that produces healthy food for all, operates based on renewable materials and facilitates the realisation of a „One Health" concept for humans, animals and the environment. ATB distinguishes the five following bioeconomy sub-domains in its programme areas (PAs) (see chapter 7 for details):

- PA **Diversified Crop Production** develops knowledge, methods and tools (including robotics and advanced control systems for machines and implements) to manage complex and diverse crop cultivation.
- PA **Individualised Livestock Production** develops and integrates sustainable solutions for livestock production into bioeconomic systems for global food and nutrition security with low negative environmental impact and improved animal health and welfare.
- PA **Healthy Foods** focusses on fundamental research in order to optimise and develop product-specific sensor and control systems as well as process designs for future food systems for improved product quality, and resource efficiency e.g. by incorporating the holistic use of alternative protein sources.
- PA **Multifunctional Biomaterials** develops novel resources based on agricultural biomass, increases the diversity of biomass utilisation, plant components and waste streams, and deepens the understanding of process fundamentals in all steps of biomass processing and conversion to biobased products.
- PA **Integrated Residue Management** enhances the understanding, modelling, and knowledge-based control of complex residue conversion processes. It develops new technologies and pathways for residue supply, treatment, and utilisation and their environmental and economic assessment.

ATB develops contributions through fundamental and application-oriented research within and across the PAs to solve the challenges mentioned above. Innovation within the PAs is driven via three Innovation Fields described in Chapter 3.

Core Results

Research

In the period 2021–2023, ATB researchers contributed to ∅ 218.3 publications per year, of which 147 (67%) were published in peer-reviewed journals (see Appendix 2 for details).

ATB refers to the following as most important results of its knowledge and application-oriented research since the last evaluation:

1. The paper „From seed to seed: the role of microbial inheritance in the assembly of the plant microbiome" revealed that plants inherit genetic information and a diverse microbiome through their seeds. It bridges the gap between genetics and microbiology, offering prospects for scientific advancement and practical applications in agriculture and environmental conservation. (Trends in Microbiology 31, PAs Diversified Crop Production, Healthy Foods)

2. For the study "Greenhouse gas emissions from broiler manure treatment options are lowest in well-managed biogas production", ATB's system model, BIORIM, was applied for the first time to compare different residue treatment options using its advanced interdependencies and uncertainties parameters. It analysed direct and indirect greenhouse gas emissions of four manure treatment options before field application: storage, composting, anaerobic digestion in a biogas plant and production of biochar. Applying the BIORIM approach revealed that biogas production from broiler manure leads to the lowest emissions in most of the analysed cases. The results were published by practice-oriented magazines for farmers and the poultry industry. (Journal of Cleaner Production 280, PAs Diversified Crop Production, Healthy Foods)

3. Research on sodium alginate-kaolin beads for removing methylene blue from water led to the paper "Intelligent modeling and experimental study on methylene blue adsorption by sodium alginate-kaolin beads". This research addresses the need for efficient, cost-effective water purification, offering a solution to aqueous pollution. Advanced analytical techniques and computational models optimised adsorption, including regression analysis, genetic programming, and artificial neural networks. Future applications include extracting alginate from algae and seaweed grown at ATB for environmental and agricultural uses. In line with the bioeconomy mission, this reduces chemical fertiliser use and minimises nutrient leaching. (International Journal of Biological Macromolecules 186, PAs Multifunctional Biomaterials, Integrated Residue Management)

4. The paper "Valorizing pasta industry wastes by the scale up and integration of solid-state and liquid-submerged fermentations" investigated pasta waste as a potential fermentation substrate. ATB researchers produced amylase in a self-designed tray bioreactor, which allowed the hydrolysis and fermentation steps to be scaled up and carried out on a pilot scale. Due to the process efficiency and activity of the enzyme, only a small amount (100 g) of wheat bran was needed to achieve high yields during hydrolysis. The results obtained with the crude enzymes were comparable to those previously obtained with commercial cocktails. They showed that enzymes from on-site production and integration into fermentation processes are promising for the valorisation of food waste. (Bioresource Technology 391, PAs Multifunctional Biomaterials, Integrated Residue Management)

5. The Fruit-bearing capacity is introduced using LiDAR-derived leaf area, weather data, and temperature-dependent physiological leaf and fruit variables to estimate the fruit size at harvest for each tree in commercial apple production. The article "Modeling of Individual Fruit-Bearing Capacity of Trees Is Aimed at Optimizing Fruit Quality of *Malus x domestica* Borkh. 'Gala'" presents the feedback loop to use the model output in crop load

management for two growing seasons. The work points out the benefit of precise plant sensor data for enhancing the percentage of marketable fruit. (Frontiers in Plant Science 12, PAs Diversified Crop Production, Healthy Foods)

6. The study "Effect of pulsed electric fields on cricket *(Acheta domesticus)* flour: Extraction yield (protein, fat and chitin) and techno-functional properties" evaluated functional properties of pulsed electric fields treatment for food applications from alternative food bio-resources with techniques developed in the ATB Innovation Laboratory for Proteins. The treatment for extracting protein, fat and chitin showed potential for valorising house cricket biomass, increasing protein and fat extraction yields by over 18% and 40%, respectively. The results were achieved by an international team and initiated within the European SUIT4Food project (ERASMUS+). (Innovative Food Science and Emerging Technologies 76, PA Healthy Foods)
7. The ERA-Net project MilKey identified targeted solutions for sustainable dairy production systems (DPS) in key European areas, which were – among others – published in the paper "DEXi-Dairy: an ex-post multicriteria tool to assess the sustainability of dairy production systems in various European regions". ATB researchers developed an ex-post multi-criteria assessment tool that adopts a holistic approach across the three sustainability dimensions. With this tool, it is now possible to (i) better describe the main challenges faced by European DPS, (ii) point out synergies and trade-offs across sustainability dimensions, and (iii) contribute to the identification of GHG and N mitigation strategies at the farm level. DEXi-Dairy can suggest targeted optimisation measures for crucial European regions. Results indicate that specific farming systems tend to achieve a higher sustainability score than others and hence could serve as benchmarks for further analyses. (Agronomy for Sustainable Development 43, PAs Individualised Livestock Production, Diversified Crop Production, Integrated Residue Management)

Research Infrastructure

As a highlight result in the development of research infrastructures, ATB mentions InnoHof:

8. Since 2021, ATB has developed the **Leibniz Innovation Farm for Sustainable Bioeconomy** (InnoHof) in collaboration with currently 22 Leibniz institutes, 10 universities and 7 non-university partners. Funding is provided through a seed money investment grant of 25 m€ by the state of Brandenburg for 2021–2026. These funds are used to build a state of the art biorefinery at pilot scale and to broaden technology development in crop production and livestock production next to the Teaching and Research Station for Animal Breeding and Husbandry in Groß Kreutz, which has a longstanding cooperation with ATB. InnoHof links research from lab to production scale and builds a network with national and international research infrastructures. It supports knowledge transfer on the regional level (demonstration farm) as well as on the European level (one of ten Living Labs of the Horizon Europe Climate Farm Demo project). Over 30 national and international joint research and transfer projects are currently based within the initiative.

Research and transfer activities are carried out at labs and pilot facilities at three campuses in Bornim, Marquardt and Groß Kreutz (see Chapters 3 and 4), e.g. the Fieldlab for Digital

Agriculture, the Center for Research and Communication in a Circular Bioeconomy and the Atmospheric Boundary Layer Wind Tunnel.

Transfer

ATB communicates activities and transfer results to target stakeholders and the public through expert reviews and statements towards policymakers, public authorities, businesses and associations, position papers, specific transfer projects, peer-reviewed publications, non-scientific publications and through various channels, including outreach activities and educational events, as well as social media. Since 2023, a new Transfer and Co-Creation Strategy is in place. In the years 2021–2023, 54% of all third-party funded projects were conducted in collaboration with industry and practitioners, and ATB researchers published on average 3.3 expert reviews per year. Exploitation of research results is achieved through property rights such as patents and license agreements (see Appendix 2). On 31 December 2023, ATB had a portfolio of 19 active intellectual property rights and three agreements with licenses. The institute is supporting two technology-based spin-offs in animal husbandry funded by EXIST start-up grants (2019 and 2020), a spin-off in consultancy in bioeconomy (2023), and a spin-off in analytical hydrological data is currently established.

As most important transfer results since the last evaluation, ATB highlights the following:

9. In the European Innovation Partnership project "pH-BB: Precision liming Brandenburg", ATB alongside Eberswalde University for Sustainable Development, the Leibniz Institute for Vegetable and Ornamental Crops (IGZ), three agricultural farms and two service providers developed a fully digitised workflow and decision support system (DSS) for practical implementation of site-specific and demand-oriented soil acidity management. It includes sensor-based soil mapping, algorithms for data processing, a novel approach for lime requirement calculation, and a user-friendly DSS to generate variable-rate lime application maps. Project results were presented, among other occasions, at 10 field days, 10 practical workshops, and 11 scientific conferences. The projects led to 5 articles published in practical farmer's magazines, 7 articles in international scientific journals and 12 fact sheets. The approach has been successfully transferred to a commercial soil mapping service for farmers. pH-BB was awarded the 2024 EIP-Agri Innovation Award in the category digitalisation.
10. ATB contributed in a leading role to developing the guidelines on livestock water use in the FAO's "Water use in livestock production systems and supply chains – Guidelines for assessment (Version 1)". The document addresses both impact assessment and water productivity and was created in close cooperation with partners worldwide in a Technical Advisory Group (TAG) organised by the FAO Livestock Environmental Assessment and Performance (LEAP) Partnership. The mandate of the TAG was to i) provide recommendations to monitor the environmental performance of feed and livestock supply chains over time so that progress towards improvement targets can be measured, ii) be applicable for feed and water demand of small ruminants, poultry, large ruminants and pig supply chains, iii) build on, and go beyond, the existing FAO LEAP guidelines and iv) pursue alignment with relevant international standards.

3. Changes and planning

Development since the previous evaluation

ATB has seen a turnover in the Executive Board since the last evaluation: In October 2020, a new Scientific Director took up her position at ATB in a joint appointment to a professorship at Humboldt-Universität zu Berlin. In January 2023, a new Administrative Director took up her post after the retirement of her predecessor.

Under the new Scientific Director, ATB initiated a strategic process to reflect on its research programme and structures from January 2022 onwards. The process included a retreat and several workshops with the scientific leadership, discussions in the Internal Advisory Board, monthly staff meetings, and a continuous close exchange with the Scientific Advisory Board. Based on a status quo analysis, a comprehensive development of medium- and long-term strategic research goals, and considering the 2018 evaluation and 2021 audit recommendations to develop a more coherent structure of research programmes and departments, the following changes and strategic initiatives were realised:

- The previously three research programmes were reorganised into **five new programme areas** to better reflect and interconnect the integral bioeconomy sub-domains in which ATB is active. Each PA has a spokesperson and a deputy from different scientific departments. Spokespersons meet monthly with the heads of departments, the board representative for research, and the Scientific Director to discuss scientific work and the PA roadmaps.
- As part of the strategic process, and in context of the introduction of the five new programme areas, the methodological and technical competencies of the **scientific departments** were evaluated and subsequently reorganised to bundle core competences e.g. in mechatronics and process engineering within one department. The department “Horticultural Engineering” was dissolved in 2023, following the retirement of the head of department. Its scientific working groups were integrated into other departments.

  From 2021 on, a **new department “Data Science in Bioeconomy”** was established, financed by additional institutional funding of 770 k€ annually (minor strategic item of expenditure, *Sondertatbestand*).

  After the retirement of the former Head of Department „Bioengineering“, it was initially planned to appoint a Head of Department in a joint appointment with Technical University of Berlin in the area of “Bioengineering”. After no appointment could be made, a strategic process in connection with the planned proposal for a minor strategic item of expenditure was initiated and a W3 professorship Plant Microbiome Management in a joint appointment with University of Potsdam was initiated. The position was filled in 2021. The department that formerly was mainly oriented towards bioprocess engineering with only one group focussing on research into microbiology under its new name as Department **Microbiome Biotechnology** now combines its old focus with research on deeper understanding of microorganisms and their role in natural and technical processes, microbiome management and (bio)technology as well as microbiome-based products.
- **Central infrastructures** were introduced to make them more visible and increase workflow efficiency. These include the InnoHof (see Chapter 2), the Fieldlab for Digital Agriculture, the

Central IT and Research Data Management (RDM). The chemical and physio-chemical laboratories of two scientific departments were merged to form the central infrastructure of the Central Analytics Lab.

- Board Representatives for Research, the InnoHof and the Joint Lab Artificial Intelligence and Data Science (Joint Lab KI & DS) were appointed to assist the Scientific Director regarding specific domains of ATB's research, transfer and co-creation activities.

Besides the new Scientific Director, ATB has seen the following changes in leadership positions and joint appointments to professorships since the last evaluation:

- In 2019, the leader of the independent junior research group "Machine Learning and Scientific Modelling" became jointly appointed W2 professor for Data Science in Agriculture at University of Potsdam. Subsequently, in 2021, he left ATB to take up a W3 professorship at the University of Hildesheim.
- The professorship was advertised as a W3 professorship Data Science in Bioeconomy with the University of Potsdam and linked with the position of the Head of the new Department Data Science in Bioeconomy. The position was filled in 2022.
- In 2021, the position of the Head of Department Microbiome Biotechnology was filled in a joint appointment for a W3 professorship "Plant Microbiome Management" with the University of Potsdam. The position had been vacant since 2016 and was filled for the first time in a joint appointment (see above).
- In 2023, a joint junior professorship for Systems Sciences in Bioeconomy was advertised with Osnabrück University. Due to an unsatisfactory candidate situation, a decision was made to establish a W2 professorship for five years instead, advertised in July 2024.

ATB points to an increased participation in national and international committees, with the new Scientific Director serving as President of the European Society of Agricultural Engineers (November 2022 – July 2024), and founding member of the Circular Bioeconomy Systems Working Group of the International Commission of Agricultural and Biosystems Engineering CIGR. Since 2021, she also serves as vice-president of the Leibniz-Association. Further examples are the involvement of ATB scientists in the 6th Intergovernmental Panel on Climate Change (IPCC) assessment report as review editor, the co-chairing of three Food and Agriculture Organisation (FAO) panels for guideline production on nutrient, water and bioeconomy in livestock supply chains and co-chairing of two UNECE groups tasked with nitrogen management and emission inventory guidelines. According to the institute, other indicators for positive developments since the last evaluation include a higher number of publications (see chapter 2), a diversification of third-party funding (chapter 4), and higher percentage of employees from abroad (chapter 5).

Strategic work planning for the coming years

ATB has defined three innovation fields, which form the central aspects of the future research priorities:

The concept of **Diversification and Individualisation** through individualised management practices supports the specific needs of plants and animals in primary production as well as product and material flows throughout value creation and recycling. Across all programme areas, ATB aims at the development of appropriate technological solutions. This includes e.g. further investigations on the implementation of diversified cropping systems in combination with precision farming technologies, animal individual sensors and treatment, the automated analysis of the effects on biodiversity and other key metrics in primary production as well as optimised and novel operations in postharvest handling and processing.

In the field of **Digitalisation and Systems Modelling**, ATB is developing machine learning models to extract valuable insights from diverse data modes, including images, spectra, gas and biochemical sensor readings, originating from various bioeconomic systems. In 2025, the establishment of a junior research group in „Explainable AI in Bioeconomy" is planned in the department Data Science in Bioeconomy. A further focus across all PAs is on leveraging sensor, control and actuator technologies for bioeconomy systems. (Sub-)systems modelling and technology assessment using hybrid approaches (physics-based and data-driven) builds the foundation for the development of comprehensive digital twins of bioeconomy systems and their sub-domains and to assess e.g. technology impact.

Focussed on **Microbiome (Bio)technology and Management**, ATB plans e.g. to further develop plant protection products and growth promoters, biomarkers and sensors, and probiotics to extend the shelf life of foodstuffs and promote human and animal health. The cross-system microbiome approach combines the five programme areas. From 2025 onwards, ATB will receive additional institutional funding *(Sondertatbestand)* amounting to 2.2 M€ annually to extend the work on Microbiome Management in the Circular Bioeconomy. In the first phase, a new junior research group in the area of „Microbiome Based Products for the Bioeconomy" will be established and the laboratory capacity expanded in the area of antimicrobial resistance in the area of livestock production.

ATB plans to further develop its strategic partnerships and infrastructures:

The InnoHof (see chapter 2), established in 2021, already acts as a facilitator for mission-driven, inter- and transdisciplinary translational research and will be further developed. The focus is on the development of technological innovations, processes, and methods such as digital twins and on the collection of data for developing integrative models across (sub) system levels. From 2025 onwards, ATB will extend the current focus on crop and livestock production by establishing a biorefinery on the Groß Kreutz campus comprising a pilot scale processing plant for lignocellulosic biomass, facilities for insect and algae cultivation, and thus a bioconversion system.

From April 2023 on, the **Joint Lab „Artificial Intelligence & Data Science"** was set up at the Coppenrath Innovation Center in Osnabrück in a partnership between ATB and Osnabrück University (UOS). Associated partners are the Osnabrück University of Applied Sciences (HSOS), the German Research Center for Artificial Intelligence (DFKI), and the Agrotech Valley Forum (AVF). The Joint Lab takes the form of a graduate school for the qualification of doctoral researchers and is supported by approximately 20 scientists from ATB and the partners in Osnabrück, respectively. Funding of 6.7 m€ in total is provided by the VolkswagenStiftung for 5 years (2023–2028), half of which is allocated to ATB and administered by UOS. ATB plans to further extend its collaborations with UOS through the joint appointment for a W2 professorship at UOS (see above) and the development of Bio-SysTeIn (as described in the next paragraph).

Planning of a Strategic Institutional Extension

ATB plans to establish a **FutureLab for Bioeconomic Transformation through Systemic and Technological Innovation** (Bio-SysTeIn). An efficient transformation to securing healthy living conditions through resilience and technological sovereignty can only be achieved by the development of appropriate technologies, processes and regulatory systems while taking a systemic approach to transformation. Within Bio-SysTeIn, ATB and the partners involved in Brandenburg and Lower Saxony aim to develop holistic concepts for systemic-technological innovations and transformations towards sustainable and circular bioeconomic systems (SCBS) according to the principle of “Circularity by Design”. This includes aspects of all sustainability dimensions and subsystems of SCBS as well as the entire development process from laboratory scale to pilot plants to real operation, the processing and use of products and their subsequent recycling. The objectives of the FutureLab Bio-SysTeIn range from the analysis of process levels with innovative data science and AI methods to the scale-up of systemic-technical innovations and transformations in model regions and supporting the design of legal frameworks through dialogue with politics, business, industry and society.

For this purpose, two new research units are to be established, one at ATB’s sites in Brandenburg and one in Osnabrück to facilitate Living Lab and Future Lab research at two sites. ATB sees the Osnabrück and the Brandenburg regions as ideal model regions to take location-specific characteristics into account in technological developments. Research at the Osnabrück unit will focus on research on system sciences in bioeconomy, applied biosystems engineering, and horticultural engineering in combination with informatics/mathematics and legal sciences. It will collaborate closely with local partners, such as Osnabrück University, the University of Applied Sciences Osnabrück, the German Research Center for Artificial Intelligence and the Agrotech Valley Forum. Research in Brandenburg will focus on sub-system modelling and data science, technology scaling from lab to value chain, concepts for field & future labs, and digital traceability as well as horticultural questions together with the Leibniz Institute for Vegetable and Ornamental Crops (IGZ).

ATB's General Assembly approved the application. The application for an increase in institutional funding (a so-called major strategic extraordinary item of expenditure, großer *Sondertatbestand*) was submitted in August 2024. The evaluation of such an institutional extension will be conducted in a separate assessment procedure by the Leibniz Association and the German Science and Humanities Council *(“Wissenschaftsrat”)* in 2024/2025. Subject to positive evaluation, funding of Bio-SysTeIn will start in 2028 and amount to 8.4 M€ per year.

4. Controlling and quality management

Facilities, equipment and funding

Over the years 2021–2023, ATB’s average annual revenue for ongoing activities was 21.5 m€, thereof 13.3 m€ (62% of annual revenue) were provided as institutional funding by the Federal and the Länder governments. Revenue from third-party sources amounting to 7.8 m€ (36%)

on average per year was provided for research projects. Additionally, the institute received on average 385 k€ (2%) annual revenue from services (see Appendix 3).

76% (6.0 m€) of third-party project funding was obtained from the Ministries at the Federal and Länder level (thereof 685 k€ per year for the InnoHof and 267 k€ for energetic renovation). Approximately 1.5 m€ (20% of revenue) per year were obtained from the EU and 260 k€ from the DFG (3%). ATB aims to further increase the European Union and DFG funding share to about 25%.

Research facilities

The ATB **main campus** comprises 18 office and laboratory buildings and workshops. The institute states that the required number of seminar rooms, lecture halls and offices has been available since 2019. Between 2021 and 2023, ATB received a total of 3.0 m€ in additional funding by the State of Brandenburg for modernisations of its facilities.

ATB's **microbiological and chemical laboratories** include the Central Analytics laboratory, a Microbiology Laboratory and the Innovation Laboratory for Proteins.

The **pilot plants and the large process equipment** consist of the Pilot Plant for Biobased Chemicals, the Pilot Fibre Plant Lab, the Biogas Laboratory, the Biochar Laboratory, the Atmospheric Boundary Layer Wind Tunnel, and the Drying Pilot Plant.

Besides the InnoHof infrastructure in Groß Kreutz (see chapter 2), ATB's **experimental stations** are the Fieldlab for Digital Agriculture in Marquardt, a 20-hectare experimental station for digitally monitored and supported crop production and fruit-growing experiments, as well as 33 hectares for short rotation coppices and agroforestry systems at the ATB campus in Bornim.

ATB highlights an expansion of its **IT infrastructure** to support the activities at the three different sites. The central IT data storage, backup, and archive system is in the process of being replaced by a new tiered, extensible system across the sites. Server systems at the sites provide computing resources for data acquisition, analysis, and modelling. More demanding tasks are supported by additional systems in Bornim and a High-Performance Computing cluster owned by ATB and hosted at the University of Potsdam. Measures to support IT security include mandatory awareness training, two-factor authentication for access to sensitive IT infrastructure services, and routine physically air-gapped backups of data.

Organisational and operational structure

The **Executive Board** consists of the Scientific Director as chair and the Administrative Director. Both are appointed for five years, reappointment is possible.

The heads of **scientific departments** are responsible for personnel, resources, and research infrastructure. The Executive Board invites the heads of departments monthly to inform, receive advice, and discuss matters that are within the responsibility of the first and second management levels. From 2020 onwards, **working groups** were established within the scientific departments. Heads of working groups manage workflows and apply for and carry out research projects, including responsibility for employee management within their working groups. Together with heads of departments, they are responsible for developing their methods competences further.

The five **programme area** spokespersons are responsible for developing the PA roadmaps. They coordinate the collaboration between researchers and manage the scientific development of their PA. Funded projects are carried out in the respective PAs, and project budget responsibility lies with the principal investigators. In monthly meetings of the PA spokespersons, heads of departments, board representative for research and the Scientific Director, overarching issues including the PAs' fit within the ATB research strategy and their further development are discussed.

The **Internal Advisory Board** (IAB) comprises representatives from all status groups at ATB. It advises the Executive Board on the strategic orientation, research planning, and nominations for the Leibniz competition. Since 2024, the monthly Internal Advisory Board meeting is public for all employees.

Three **Board Representatives** support the Executive Board: The Board Representative for Research supports the development of the research programme and the strategic orientation. The Board Representative InnoHof works to refine and further develop the InnoHof concept and attract partners. The Board Representative Joint Lab KI & DS develops and integrates Lab's strategy with the research areas.

Quality Management

ATB's Guideline on Safeguarding **Good Scientific Practice** was updated in 2023 and is based on the German Research Foundation (DFG) and the Leibniz Association guidelines. The Executive Board appoints an ombudsperson and deputy for Good Scientific Practice. The heads of department are responsible for the scientific excellence of research projects and compliance with the rules.

The **Publication Strategy** was last updated in 2024 and gives priority to publications in high-quality peer-reviewed journals and proceedings (computer science) as well as increasingly data publications. It defines average annual targets for the number of publications in peer-reviewed journals for researchers in different career stages. The institute encourages Open access publishing through financial support and memberships in consortia. It also encourages the publishing of data alongside research articles by considering it in the performance-oriented allocation of funds.

A new **Transfer and Co-Creation Strategy** was adopted in 2023. The scope of the strategy was broadened from a past focus on the creation of intellectual property. It now includes a focus on co-creation, co-design and co-development of technologies, processes and strategies with partners from industry, practitioners and other relevant stakeholders as well as dialogue with political decision makers and other interest groups and general society. As another part of the strategy, the unit for research data management develops solutions to release digital products freely under appropriate licenses.

ATB researchers use cooperation partners' animals for research projects. In accordance with the German **Animal Welfare** Act (TierSchG) and the Animal Welfare Regulation Governing Experimental Animals (TierSchVersV) in-house regulations have been defined. The Animal

Welfare Officer is responsible for ensuring compliance with regulations, conditions, and requirements in the interest of animal welfare and providing advice for ATB.

The **performance-oriented allocation of funds** (PAF) was introduced at ATB in 2017 and revised in 2023. The indicators used include, among others, refereed publications, publications of research data, achievements in transfer and co-creation, and the promotion of junior researchers. The PAF budget of each scientific department can be used flexibly.

The **programme budget** defines scientific and administrative goals and settles and forms the basis for a budget plan. If a position financed by the core budget becomes vacant, the finances automatically fall back into the institute's general staff pool. The Executive Board decides, after consultations with the heads of departments and the Internal Advisory Board, if the position is filled again or resources are reallocated.

Quality management by advisory boards and supervisory board

The **General Assembly** is the Supervisory Board of ATB. Its members are the Federal Government, represented by the Federal Ministry of Agriculture (BMEL) and the Federal Ministry of Education and Research (BMBF), the State of Brandenburg, represented by the Ministry of Research (MWFK) and the Ministry of Agriculture, Environment and Climate Protection (MLUK), the Technical University of Berlin, the Humboldt-Universität zu Berlin and the University of Potsdam. In addition, natural and legal persons who substantially promote ATB's work can become members. This is currently the case for the Association of German Engineers. The General Assembly has eight members and is responsible for all fundamental matters of the association, including the appointment of the members of the Executive Board and decisions on the strategic research programme proposed by the Executive Board.

The **Scientific Advisory Board** (SAB) can have between six and ten members, according to the statutes. Members are elected for up to four years, reappointment is possible once. The SAB reviews scientific progress and provides feedback on annual reports and resource planning, including the programme budget. The SAB meets at least once per year. In 2021, it conducted an audit of ATB.

5. Human Resources

As of 31 December 2023, ATB had 249 employees (218 full-time equivalents, see Appendix 4). Additionally, 20 student assistants (7 FTE), 8 trainees, and 15 scholarship recipients contributed to the activities.

Leading scientific and administrative positions

The Scientific Director and 5 of the 6 heads of departments are jointly appointed with universities (see chapter 6). Recruiting procedures for leading scientific and administrative positions follow Leibniz standards and start with establishing a selection committee. The committee comprises members with relevant expertise from ATB and other universities and institutions in Germany and abroad. Since the last evaluation, the positions of the Scientific and the Administrative Director as well as two positions as Head of Department have been filled (see chapter 3).

Heads of working groups are appointed by the Executive Board based on the recommendation of the Internal Advisory Board for five years. ATB is currently developing a process for continuation evaluation in year four of the respective appointment.

Staff with a doctoral degree

At ATB, staff with a doctoral degree comprises 28 postdocs without leadership responsibilities, 7 senior scientists without leadership responsibilities, and 24 scientific working group leaders. ATB will advertise two junior group leadership positions in “Microbiome Based Products for the Bioeconomy” and “Explainable AI in Bioeconomy” in 2025.

ATB’s Career Development Strategy considers the Leibniz Career Guidelines and includes career counselling, mentoring programmes, and support for longer-term programmes to obtain teaching qualifications. With regard to temporary contracts, regular career development meetings take place to plan contract terms, goals and career-paths. The performance-oriented allocation of funding incentivises successful placements of doctoral students and postdocs. Since the last evaluation, one postdoc and one junior research group leader were appointed to professorships. Two other postdocs have taken on leading positions in research institutions abroad.

The institute rarely offers tenured positions. If the Scientific Director or a head of department decides to provide a permanent position, this position is published publicly and advertised broadly outside ATB. Selection then entails a screening and interview process by an external and international selection committee.

Doctoral Candidates

As of 31 December 2023, 44 doctoral researchers were working at ATB, 34 of which were employed in projects and 10 on third-party stipends. ATB aims to offer doctoral positions with 100% payment. Scholarship holders are usually funded for at least three years via DAAD or programmes from their countries of origin. In the years 2021–2023, 19 doctorates were completed, with an average duration of 5.3 years (4.7 years in 2023). The institute aims for an average duration of 4 years. It states that in the past few years, due to measures described below, a reduction has been achieved. At date, for 80% of the doctoral researchers a professor at ATB acts as primary supervisor.

Guidelines to support doctoral researchers are defined in the Career Development Strategies. Measures include a doctoral agreement concluded six months after commencing employment, annual progress reports and interim evaluations by ATB’s Thesis Advisory Board.

ATB established a structured mandatory doctoral programme “Bioeconomy”, including scientific lectures and interdisciplinary doctoral training on topics such as research data management, Good Scientific Practice and technology transfer. In addition, the institute encourages doctoral researchers to participate in structured graduate programmes at universities (mainly FU and HU Berlin, University of Potsdam).

Science supporting staff

ATB's science supporting staff comprises 128 employees (115 FTE), 87 working in laboratories, experimental stations, or central infrastructures, and 41 in administrative departments.

The institute offers vocational training as specialist for agricultural services, industrial mechanic, IT specialist for system integration, and office management assistant. In addition, a traineeship for a laboratory assistant will be offered starting in 2025. Between 2021 and 2023, three trainees completed their vocational qualification. As of 31 December 2023, 8 trainees worked at ATB.

Equal opportunities and work-life balance

As of 31 December 2023, out of 121 employees in "Research and scientific services" 48 were women (40%). The Scientific Director and the Administrative Director as well as 4 out of 6 department heads were women, as were 10 of the 24 persons in 3rd level leadership positions (group leaders or equivalent; 42%). ATB points out that the lower proportion of women among doctoral positions (32% compared to 60% at the last evaluation), reflects the proportion of women among applicants for these positions. The institute aims to reduce the underrepresentation of women among doctoral researchers and among the 3rd level leadership and has set target quotas of 50% for all scientists below heads of department in the 2025 programme budget.

ATB stresses its commitment to promoting equal opportunities in all dimensions of diversity and considers the expanded „DFG Standards for Research-Oriented Equality and Diversity'. 26% of employees are non-German nationals. Measures to support international employees include the use of English in committee meetings and co-financing for German and English courses. As of 31 December 2023, seven disabled employees worked at ATB. Measures to improve the integration include information availability in multiple formats such as plain language or accessible electronic documents, and a special workplace equipment like a voice control tool.

To support ATB employees in balancing work and family life, the institute offers flexible working models. ATB has been participating in the audit *berufundfamilie* since 2010.

6. Cooperation and environment

National collaborations

ATB is connected to **local universities** through the joint appointment of ATB-leadership personal to professorships and through joint research projects:

- Since 2020, the position of the Scientific Director is filled in a joint appointment to a W3 professorship at Humboldt-Universität zu Berlin (HU). The head of the department Technology Assessment is also jointly appointed with HU (W2 professorship). 7 joint research projects were pursued in the years 2021–2023.
- The heads of the departments Microbiome Biotechnology and Data Science in Bioeconomy are jointly appointed with the University of Potsdam (both W3 professorships; appointed in 2021 and 2022 respectively). 7 joint research projects were pursued in the years 2021–2023.

- The head of the department Agromechatronics is jointly appointed professor with <u>Technical University Berlin</u> (W2). 3 joint research projects were pursued in the years 2021–2023.
- The head of the department Sensors and Modelling is jointly appointed professor with <u>Freie Universität Berlin</u> (W2). 6 joint research projects were pursued in the years 2021–2023.
- Another joint appointment on W2 level is currently advertised with <u>Osnabrück University.</u> The university is the major partner in the Joint Lab AI & Data Science (see chapter 3).

Collaborative research projects are also pursued with HNE Eberswalde, University of Hohenheim, and Technical University Munich. In 2022, a cooperation agreement and a joint qualification programme for young researchers to conduct their habilitation was established jointly with the University of Kassel. Between 2021 and 2023, ATB scientists offered an average of 51 semester credit hours per calendar year at higher education institutions in Germany and abroad.

Within the **Leibniz Association**, close partners include the Leibniz Centre for Agricultural Landscape Research (ZALF), Leibniz Institute of Vegetable and Ornamental Crops (IGZ) and Leibniz Institute German Collection of Microorganisms and Cell Cultures (DSMZ). ATB is a member of the Leibniz Research Alliance “INFECTIONS in an Urbanizing World – Humans, Animals, Environments” as well as the Leibniz Research Networks “Mathematical Modelling and Simulation”, “Green Nutrition – Healthy Society”, and „Biodiversity”. Other important non-university partners include the Thünen Institute (TI), the Julius Kühn Institute (JKI), and the German Biomass Research Centre (DBFZ).

International collaborations

Almost three-quarters (74%) of ATB’s peer-reviewed publications were published with partners abroad. ATB highlights its appointments to adjunct and associate professorships at the University of Zielona Góra (PL) and the University of Bologna. A further teaching authorisation exists with the University of Natural Resources and Life sciences in Vienna (BOKU, AT). Other important international partners include the Aarhus University, Agricultural University of Athens, Wageningen University and Research, the National Research Institute for Agriculture, Food and Environment (INRAE, FR), and the Agriculture and Food Development Authority (Teagasc, IRL) as particularly fruitful.

ATB is involved in several large collaborative research and infrastructure projects both nationally and internationally, partly taking on coordinating roles. Besides the InnoHof (35 partners, s. Chapter 2) and the Joint Lab AI & Data Science (see chapter 3) the institute highlights eight COST Action networks (European Cooperation in Science and Technology) ATB was involved in between 2021 and 2023, thereof seven as German representative and two as working group chair. Also, a Memorandum of Understanding is about to be signed with the newly formed Alliance for Fruit Growing, Viticulture and Vegetable Cultivation that aims to promote synergies between research institutions in Austria, Germany, Switzerland and Italy.

ATB collaborates with the national and international private sector in co-creative projects, developing technological (up to technology readiness level 6) and management solutions. 54% of ATB’s projects in the years 2021–2023 involved partners form **industry** and (agricultural) businesses. In a funding programme of the Federal Ministry for Economic Affairs and Climate

Action that aims to foster the innovative capacity of small and medium-sized enterprises, ATB partnered with six cooperation networks.

Institution's status in the specialist environment

ATB sees itself as uniquely positioned in the research landscape with a focus on agricultural engineering, innovative method and technology development and bioeconomy research, paired with a high level of interdisciplinarity. Regarding bioeconomy in the field of agriculture, ATB sees the University of Hohenheim and Thünen Institute as institutions that share core research fields and future visions with ATB. Similarly, ATB sees overlaps concerning bioeconomy and agricultural engineering with TU Munich. Internationally, the institute points to the Brazilian Agricultural Research Corporation EMBRAPA and Wageningen University and Research as leading institutions that have a broad spectrum of agricultural and bioeconomic research, and share general orientations and thematic focusses with ATB.

7. Subdivisions of ATB

Programme area Diversified Crop Production

(58 FTE, of which 26 FTE Research and scientific services, 8 FTE Doctoral candidates, and 24 FTE Service staff)

The overarching research goal of the programme area Diversified Crop Production (PA DCP) is knowledge gain and the development of methods and tools (including technological hardware) to manage complex and diverse crop cultivation as part of sustainable, circular bioeconomy systems. The programme area analyses the impact of crop production on the environment as well as the impact of climate change on crop production to derive recommendations for resilient, environmentally, and economically viable cropping systems. Scientific methods include sensor systems and multicriterial data analytics, explainable artificial intelligence (XAI), microbiome management, life cycle assessment, scenario simulation, control systems for field robots, and developing digital twins of highly diverse crop production systems. PA DCP collaborates with transdisciplinary groups within ATB and externally with partners in Germany and abroad, including stakeholders from politics, international organisations, practical farming, and the agricultural machinery industry.

Research of the **PA DCP focusses on** (i) Assessing soil health – proximal soil sensing and microbiome analysis; (ii) Assessing plant health – precise crop and product monitoring; (iii) Automation and field robotics; (iv) Assessment of crop production systems; provision of machine-readable information is the common goal of the different approaches, with identifying new sensor-indicator systems for diversified production systems being the main future target.

Between 2021 and 2023, the activities in PA DCP led to ∅ 61 articles in peer-reviewed journals p.a. In the same period, the revenue from project grants was ∅ 2.5 m€ p.a. Of these, on average 1.8 m€ were obtained from Bund und Länder, 586 k€ from the EU and 127 k€ from the DFG. Revenue from services amounted to 265 k€ p.a. In total, 4 doctoral degrees were completed.

Programme area Individualised Livestock Production

(26 FTE, of which 15 FTE Research and scientific services, 5 FTE Doctoral candidates, and 6 FTE Service staff)

The programme area Individualised Livestock Production (PA ILP) analyses site and animal-specific agricultural processes to advance knowledge-based agricultural production as part of holistic bioeconomic systems. The research focusses on adaptive process control mechanisms and management strategies for an environment-friendly, health-promoting, animal-friendly, and profitable agriculture with high resource use efficiency. Scientific objectives are defining indicators for animal health and welfare, antimicrobial resistance reduction, gaseous emissions, developing related sensor technologies, modelling the interactions and multi-criteria assessment of livestock systems.

Analytical methods encompass the causal and empirical analysis of measurement-indicator-relations applying multiple source data fusion, the latest machine learning techniques, mechanistic and data-driven modelling, and hybrid approaches, including investigating underlying microbial processes. The backbone of PA ILP is inter- and transdisciplinary cooperation within ATB and with external partners aiming at integrating sustainable crop and livestock production processes into holistic bioeconomic systems. PA ILP is in close dialogue with stakeholders, policymakers and international bodies.

Research of the **PA ILP focusses on** (i) Animal Welfare and Husbandry, (ii) Barn Climate and Emissions, and (iii) Assessment of Livestock Production. Objective indicators for animal health, welfare and heat stress are determined and incorporated into the optimisation of husbandry systems. Primary research is carried out on developing and spreading of gaseous emissions and germ-contaminated particles. The assessment of livestock systems includes animal welfare, green-house gas emissions, nitrogen use efficiency, water productivity and environmental impacts of water use. A multi-criteria assessment delivers region-specific concepts for sustainable livestock systems.

Between 2021 and 2023, the activities in the programme areas led to ∅ 37 articles in peer-reviewed journals p.a. In the same period, the revenue from project grants was ∅ 1.4 m€ p.a. Of these, on average 1.1 m€ were obtained from Bund und Länder, 166 k€ from the EU and 82 k€ from the DFG. In total, 6 doctoral degrees were completed.

Programme area Healthy Foods

(25 FTE, of which 11 FTE Research and scientific services, 4 FTE Doctoral candidates, and 10 FTE Service staff)

The programme area Healthy Foods (PA HF) focusses on fruit, vegetables, and alternative food materials and works on resource-efficient production and minimal processing of these into high-quality and microbiologically safe products. Particular emphasis is placed on the reduction of food loss and waste, material and energy losses, the valorisation of by-products, the reuse of water, the recycling of nutrients, and a robust food supply. Employing emerging and interdisciplinary approaches along the entire food value chain and integrating by-products into bioeconomic networks, the PA HF aims to design sustainable processes that positively impact food systems.

Research of the PA HF **focusses** on (i) incorporating novel monitoring techniques, considering essential food ingredients, microbial profiles, product characteristics, and production-related conditions and environmental effects along the food value chain, (ii) the development of digital twins and (iii) the development of advanced and „(digital twins-based) smart" physical, physico-chemical and/or biological process settings and technologies. The outcomes of PA HF aim to deliver tailor-made sustainable production processes and consider the One Health approach. Implementation in practice is often initiated in Germany, where PA HF supports the transfer to other European and non-European countries.

Between 2021 and 2023, the activities in PA HF led to ∅ 59 articles in peer-reviewed journals p.a. In the same period, the revenue from project grants was ∅ 645 k€ p.a. Of these, on average 572 k€ were obtained from Bund und Länder and 59 k€ from the EU. In total, 6 doctoral degrees were completed.

Programme area Multifunctional Biomaterials

(27 FTE, of which 10 FTE Research and scientific services, 6 FTE Doctoral candidates, and 11 FTE Service staff)

The programme area Multifunctional Biomaterials (PA MB) adopts a circular biorefinery model, focussing on sustainable bioeconomic systems. PA MB research has shifted towards fundamental studies of biomass processes, including biomass supply, carbon storage potential in agriculture, biomass pre-treatment, thermo-mechanical processing, bioconversion and microbiome monitoring.

Research of the PA MB **focusses** on (I) cultivating woody biomass in agroforestry, harvesting and processing gramineous biomass from rewetted peatlands (paludiculture), (ii) processing technologies that exploit the natural structural properties of natural fibre plants are developed in order to create advanced process chains for higher-value fibre uses, (iii) the bioconversion of waste from these sectors, converting organic materials into commercial-grade organic acids, such as lactic and succinic acid, through fermentation.

Strategic development within PA MB and other ATB PAs focusses on maximising the use of underutilised biomass resources and waste streams to enhance raw material and energy efficiency in biomass processing and conversion. In several projects AT and digital twins are utilised for the investigation of sustainable biomass production and process optimisation. AI-driven methods have been developed for object recognition and parameter derivation of fast-growing trees in agroforestry systems (AFS), enabling monitoring of biomass yields, carbon stocks, and biodiversity. 4D mathematical models are developed as digital twins to simulate these processes with real-time monitoring via leveraging sensor-based data acquisition and AI techniques. This ensures system optimisation resource efficiency, waste minimisation, and reduced environmental impact, contributing to a resilient and sustainable circular bioeconomy.

Between 2021 and 2023, the activities in PA MB led to ∅ 23 articles in peer-reviewed journals p.a. In the same period, the revenue from project grants was ∅ 1.2 m€ p.a. Of these, on average 720 k€ were obtained from Bund und Länder and 464 k€ from the EU. Revenue from services amounted to 79 k€ p.a. In total, 1 doctoral degree was completed.

Programme area Integrated Residue Management

(30 FTE, of which 13 FTE Research and scientific services, 5 FTE Doctoral candidates, and 12 FTE Service staff)

The programme area Integrated Residue Management Programme (PA IRM) focusses on the sustainable valorisation of residual biomasses and the recycling of substances from multifarious biomass-based production systems. The residual biomass to be processed often differs in terms of its material properties and composition, comes from different decentralised sources and is only available at certain times of the year. The challenge is to establish effective process chains for these inhomogeneous raw materials.

The **overarching approach** for sustainable residue management comprises measures of residue supply, preservation and storage, conversion including pre- and post-processing, and product utilisation, consistently following the aims to enhance resource recovery, close nutrient cycles, and reduce environmental burdens and risks of residue or waste streams. Particular emphasis is placed on system integration, whereby interactions of linked processes and synergistic effects are identified and reached by targeted adaptation of residue management to upstream processes, return of products and tailored product supply. **Research** of the PA IRM **focusses** on (i) an enhanced understanding, modelling and knowledge-based control of complex residue conversion processes, (ii) the development of new technologies and pathways for residue supply, treatment and utilisation, and (iii) their environmental and economic assessment. Based on its integrated approach, the PA IRM strongly relies on interdisciplinary collaboration with the other ATB PAs. It acts as a bridge between crop, food and feed, livestock, and biomaterial production.

Between 2021 and 2023, the activities in PA IRM led to Ø 29 articles in peer-reviewed journals p.a. In the same period, the revenue from project grants was Ø 1.2 m€ p.a. Of these, on average 1.0 m€ were obtained from Bund und Länder and 210 k€ from the EU. Revenue from services amounted to 27 k€ p.a. In total, 2 doctoral degrees were completed.

8. Handling of recommendations from the previous evaluation

ATB responded as follows to the nine recommendations of the last external evaluation (highlighted in italics, see also statement of the Senate of the Leibniz Association issued on 20 March 2018, pages B-3/B-5):

1) “The committees involved in appointing the new Scientific Director must find a scientifically proven leader for the management of ATB who will further develop the reform process initiated since the last evaluation with their own impulses and lead it to completion.”

2) “The scientific work of ATB is organised in six departments, which work together on three research programmes (RP) with a total of six research areas (RA) within the framework of a matrix structure. The two RA in RP1 are rated as "very good". The RA in RP2 is rated as "good to very good". The three RA in RP3 are rated as "good". Under the new institute leadership, the coherence of the work in the RAs should be further increased, and their respective position in the context of the newly formulated mission should be worked out more clearly. This applies in *particular to RP3. In addition, the matrix structure with the methodologically oriented departments and the topic-oriented RPs should be reviewed with regard to ATB's future areas of work."*

On 1 October 2020, a new Scientific Director was appointed. Under her leadership, a strategic process was initiated, including the development of five programme areas and the restructuring of the departments (see chapter 3). A research strategy was defined to integrate the programme areas into a holistic approach. A board representative for research was appointed to assist in securing the coherence of the PAs with the ATB research strategy and mission, a board representative for the InnoHof was appointed to support the research strategic work on a Living Lab level and coordinate the partners and a board representative for the Joint Lab KI & DS was appointed to coordinate the collaboration with the partners. The representatives and the Scientific Director meet regularly to discuss the further integration of the three areas.

3) "As recommended, the ATB has developed a strategy to focus its publications on significantly fewer journals to become more visible as a whole institute. The publication performance has been improved, especially quantitatively and qualitatively in some cases. The ATB should continue the positive trend and publish even more regularly in higher-ranking journals in the future."

ATB points to a 23%-increase in the number of peer-reviewed articles. In 2021–2023, on average 2.2 articles in peer-reviewed journals were published per FTE (excluding doctoral researchers), 41% of which are our first authorships, while 46% are ATB last authorships. The number of articles in Q1 peer-reviewed journals increased by 26%. Publication in Q1 and Q2-journals are included in the performance-oriented allocation of funds. Publication targets are defined for each career stage (see chapter 4). Due to the breadth and specialisation of disciplines present at ATB, it was agreed with the SAB that publishing in high ranked, topical journals should be given priority to publishing in a limited number of focus journals.

4) "The ATB's development of a third-party funding strategy is appreciated. The ATB's coherent goal is to stabilise third-party funding income at the current level and, at the same time, increase income from competitively acquired third-party funding from the DFG and the EU, as was also recommended in the last evaluation. The ATB must pursue its efforts with vigour. So far, the amount of third-party income still depends too much on funding from the federal government, especially the BMEL. As a scientifically independent Leibniz Institute, the ATB must diversify its third-party funding portfolio further."

ATB refers to a diversification of third-party funding (see chapter 4). Between 2021 and 2023, 12 DFG projects and 32 European projects, including 18 EU projects, and 14 transnational projects were active. Additionally, ATB coordinated eight EU and transnational projects.

5) "A separate "Data Science in Agriculture" department with institutional funds is currently being set up at the ATB. The area is to be expanded into a new department in 2021 via a "minor strategic extraordinary item of expenditure". The management position should not be advertised until 2021, as planned by the ATB, but immediately as a joint W2 professorship with the University of Potsdam and pre-financed by the ATB. It is welcomed that the University of Potsdam is also available for an earlier appointment, as was explained in the discussions on site. In addition, the term "Data Science" should be further specified. The ATB's financial plans are plausible. The total annual expenditure for the measure is € 1.175 million. The ATB envisages € 405,000 *as its own contribution. To finance the remaining € 770,000, the core budget was permanently increased by € 400,000 in 2021 and by another € 370,000 in 2022."*

In 2019, the professorship (W2) „Data Science in Agriculture" was filled in a joint appointment with the Institute of Computer Science at the University of Potsdam. The job holder left ATB in April 2021 to take up a full professorship (W3) at the University of Hildesheim. The position was re-established as a W3 professorship „Digital Bioeconomy" and filled in November 2022. The position is linked to the position of head of the department "Data Science in Bioeconomy", which was established from 2021 on with additional institutional funding (see chapter 3).

6) "In principle, the expansion of microbiological competence planned by ATB after the completion of the new Centre for Technology and Knowledge Transfer is to be welcomed. However, ATB should first establish sufficient basic competence at the institute through the strategic use of its own funds in order to build on this and carry out the expansion presented. There is not yet a sufficient basis to justify additional funds from the federal and state governments within the framework of a "minor strategic extraordinary item of expenditure" envisaged by ATB. Further planning should be developed under the new Scientific Director. This should also include the yet-to-be-appointed head of the Department of Bioprocess Engineering."

ATB points to a strategic development of microbiological competence towards microbiome (bio)technology and management. The appointment of a Head of the Department of Bioprocess Engineering (W2) in a joint appointment with TU Berlin could not be realised. Thus, the department's profile was further developed towards the understanding of the microbiological process and to include microbiome aspects. A joint appointment with the University of Potsdam in „Plant Microbiome Management" (W3) was filled in 2021. The department was reorganised and renamed to "Department of Microbiome Biotechnology". From 2025 on, ATB will receive additional institutional funding of 2.2 m€ p. a. to further develop its research in microbiome biotechnology (see chapter 3).

7) "As recommended in the last evaluation, ATB has made efforts to fill vacancies in the scientific area with external persons. Various young scientists from ATB were also able to successfully apply for external follow-up positions. ATB should continue to make sure that vacancies in the scientific area are filled on the basis of competitive, international calls for applications."

ATB refers to its Career Development Strategy (most recently updated in 2024), the increased recruitment of international staff, and measures such international advertisements for vacancies (see chapter 5). Currently, 44% of ATB's scientific staff (including doctoral researchers) comes from abroad.

8) "ATB must continue its efforts to develop a structured doctoral programme across the institute. The aim must continue to be to increase the number of doctorates, reduce the average duration of doctorates and further increase the number of first supervisions by ATB employees.

The recent and planned joint consultations should help to achieve these goals and coordinate ATB's support measures well with the surrounding universities."

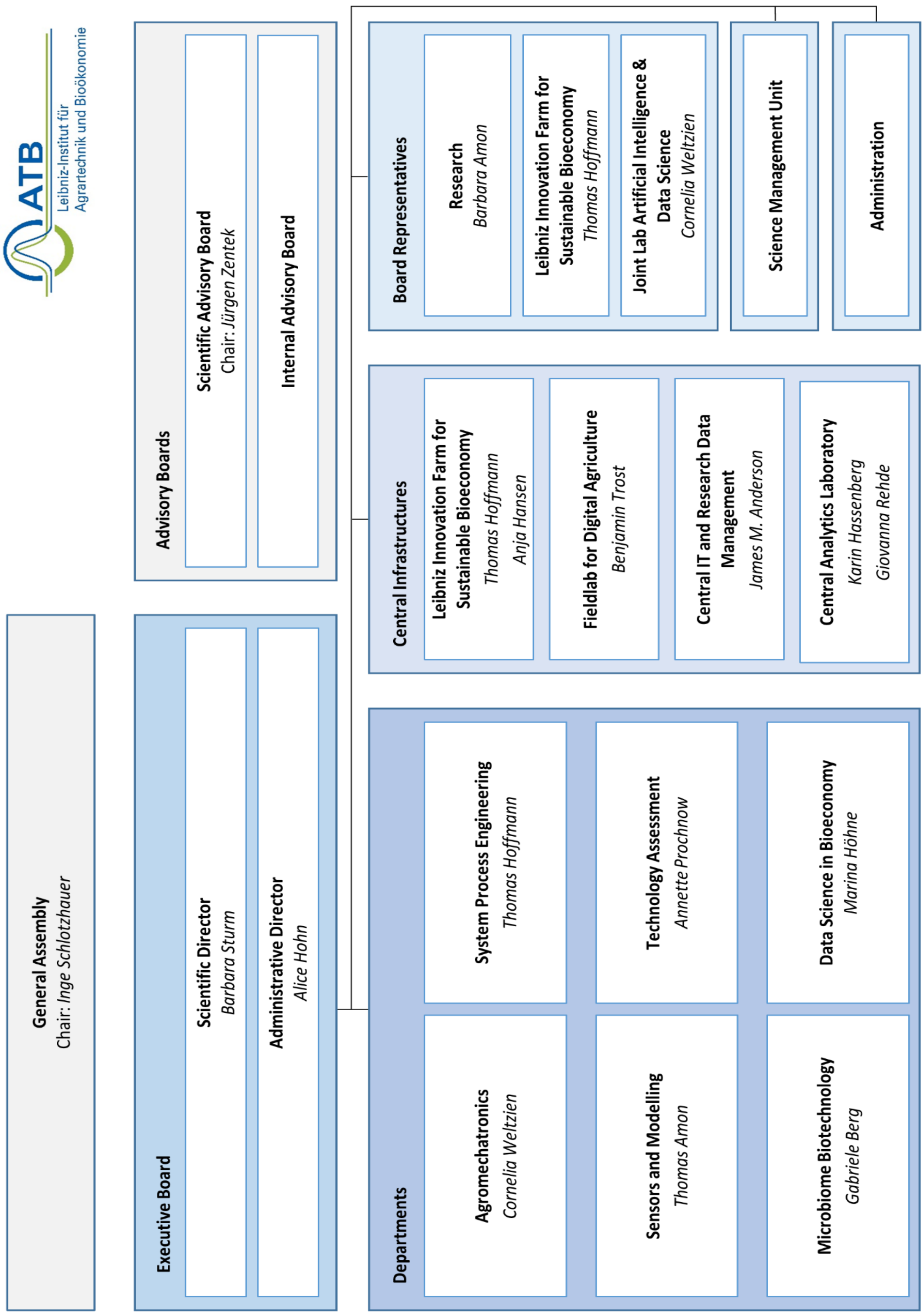
In 2021, the Career Development Strategy was expanded and defines measures for the supervision of doctoral researchers. The structured doctoral programme "Bioeconomy" was established, the number of supervised doctoral researchers increased by 50% and the ratio of primary supervisions by an ATB-professor was increased to 80%. Additionally, in 2023, the Joint Lab AI & DS was established as a graduate school, which can be joined by all doctoral researchers as associates (see chapters 3 and 5). In 2023, the average duration of a doctorate was at 4.8 years (5.5 years on average 2014-2016).

9) "The ATB has developed appropriate new internal quality management measures during its strategy process. In particular, it is to be welcomed that a performance-related allocation of funds (PAF) was introduced on 1 January 2017, as recommended in the last evaluation. The new Scientific Director should further expand the PAF."

The PAF was fundamentally revised in 2023 and considers scientific publications, transfer and co-creation, the promotion of the careers of doctoral researchers and postdocs, as well as indicators for open science (see chapter 4).

Appendix 1

Organisational Chart



Appendix 2

Publications, patents, and expert reviews

	Period		
	2021	**2022**	**2023**
Total number of publications	191	218	246
Monographs	10	6	7
Individual contributions to edited volumes	34	57	70
Articles in peer-reviewed journals	142	148	151
Articles in other journals	10	8	19
Editorship of edited volumes	3	4	2
Open Source data publications	2	1	4

Patents	**2021**	**2022**	**2023**
Applications giving rise to a right of priority (in the calendar year)	0	0	1
Patents (number held as of 31.12. of the year)	20	20	16
Patent families (number held as of 31.12. of the year)	11	11	8

Trade mark rights[1)]	**2021**	**2022**	**2023**
Applications giving rise to a right of priority (in the calendar year)	0	0	1
Trade mark rights (number held as of 31.12. of the year)	2	2	3
Trade mark families (number held as of 31.12. of the year)	1	1	2

	2021	**2022**	**2023**
Number of expert reviews	3	4	3

[1] Concerning financial expenditures for revenues from patents, other industrial property rights and licences see Appendix 3.

Appendix 3 Revenue and Expenditure

	Revenue	2021 k€	2021 %	2021 %	2022 k€	2022 %	2022 %	2023 [1] k€	2023 [1] %	2023 [1] %
Total revenue (sum of I., II. and III.; excluding DFG fees)		**19.952**			**22.251**			**25.850**		
I.	**Revenue (sum of I.1.; I.2., and I.3.)**	**18.893**	100%		**20.760**	100%		**24.804**	100%	
1.	Institutional Funding (excluding construction projects and acquisition of property)	12.812	68%		13.378	64%		13.648	55%	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and *Länder* governments according to AV-WGL	12.812			13.378			13.648		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL									
2.	Revenue from project grants	5.675	30%	100%	6.951	33%	100%	10.838	44%	100%
2.1	DFG	312		6%	203		3%	260		2%
2.2	Leibniz Association (competitive procedure)	31		1%	26		0%	128		1%
2.3	Federal, *Länder* governments [2]	4.062		72%	4.607		66%	9.261		85%
	thereof BMBF	*886*			*791*			*1.408*		
	thereof BMEL	*1.902*			*1.909*			*3.270*		
	thereof Land Brandenburg	*770*			*1.381*			*3.004*		
	thereof InnoHof	*300*			*586*			*1.168*		
	thereof special funding for energetic renovation							*802*		
2.4	EU (revenue based) [3]	1.206		21%	2.086		30%	1.160		11%
	EU (expenditure based)	1.598			1.371			1.719		
2.5	Foundations	63		1%	28		0%	30		0%
3.	Revenue from services	406	2%		431	2%		318	1%	
3.1	Revenue from commissioned work (industry, ministries, other stakeholders)	402			431			311		
3.2	Revenue from publications	0			0			0		
3.3	Revenue from exploitation of intellectual property for which the institution holds industrial property rights (patents, utility models, etc.)	4			0			7		
II.	**Miscellaneous revenue** (e. g. membership fees, donations, rental income, funds drawn from reserves)	**159**			**244**			**145**		
III.	**Revenue for construction projects** (institutional funding by Federal and *Länder* governments, EU structural funds, etc.)	**900**			**1.247**			**900**		

	Expenditures	2021 k€	2022 k€	2023 k€
Expenditures (excluding DFG fees)		**19.989**	**22.251**	**25.850**
1.	Personnel	13.337	14.425	15.957
2.	Material expenses	3.178	2.977	4.330
2.1	*Proportion of these expenditures used for registering industrial property rights (patents, utility models, etc.)*			*1*
3.	Equipment investments	2.098	2.107	1.958
4.	Construction projects, acquisition of property	268	1.030	820
5.	Other operating expenses "Selbstbewirtschaftungsmittel"	1.108	1.712	2.785
	thereof Selbstbewirtschaftungsmittel Betrieb - SAW	*288*	*312*	*285*
	thereof Selbstbewirtschaftungsmittel Invest and Construction	*820*	*1.400*	*2.500*

	2021	2022	2023
DFG fees (if paid for the institution - 2.5% of revenue from institutional funding)	316	330	336

[1] Preliminary data.
[2] 2023: Includes a. o. revenue for Leibniz-Innovationshof, one-time revenue to compensate additional energy expenditure due to rise in inflation as well as high annual tranches for federal projects.
[3] Due to EU funding regulations (payout every 18 months), there is an increase for EU revenue in 2022.

Appendix 4

Staff

(Basic financing and third-party funding / proportion of women (as of: 31/12/2023)

	Full-time equivalents		Persons		Women		Foreigners
	Total	on third-party funding	Total	on temporary contracts	Total	on temporary contracts	Total
	Number	Percentage	Number	Percentage	Number	Percentage	Number
Research and scientific services	**103**	**65%**	**121**	**79%**	**48**	**77%**	**53**
1st level (scientific director)	1	-	1	100%	1	100%	-
2nd level (department leaders or equi.)	5	-	6	-	4	-	-
3rd level (group leaders or equi.)	22	12%	24	33%	10	40%	3
Junior research group leaders (if applicable)	-	-	-	-	-	-	-
Scientists in non-executive positions (E13, E14)	47	85%	56	93%	22	95%	25
Doctoral researchers (E13)	28	85%	34	100%	11	100%	25
Science supporting staff (Laboratories, technical support, central infrastructures)	**79**	**27%**	**87**				
Laboratory and technical support (E9 to E12, upper-mid-level service)	36	39%	41				
Laboratory and technical support (E5 to E8, mid-level service)	13	18%	13				
Team assistants	5	-	6				
Workshop (E5 to E8, mid-level service)	3	-	3				
Central infrastructures (from E13, senior service)	5	31%	5				
Central infrastructures (E9 to E12, upper-mid-level service)	11	25%	12				
Central infrastructures (E5 to E8, mid-level service)	6	-	7				
Science supporting staff (Science management unit, administration incl. facility management)	**36**	**12%**	**41**				
Administrative director	1	-	1				
Staff positions (from E13, senior service)	9	18%	12				
Administration (E9 to E12, upper-mid-level service)	14	14%	15				
Administration (E5 to E8, mid-level service)	9	6%	9				
Administration (E1 to E4)	3	-	4				
Student assistants	**7**	**68%**	**20**				
Trainees	**8**	**-**	**8**				
					Women		Foreigners
Scholarship recipients at the institution (thereof 2 Erasmus scholarship recipients)	**15**		**15**		**1**		**15**
Doctoral researchers	10		10		-		9
Post-doctoral researchers	3		3		1		3

14 February 2025

Annex B: Evaluation Report

Leibniz Institute for Agricultural Engineering and Bioeconomy, Potsdam (ATB)

Contents

1. Summary and main recommendations

ATB conducts application-oriented fundamental research in the field of agricultural engineering to support the transformation towards a circular, sustainable and diverse bioeconomy. The aim is to develop new technologies and management strategies for a knowledge-based production of biomass and for its use for nutrition, and as bio-based products and energy sources. ATB's work is highly interdisciplinary. The competences represented at the institute range from natural and engineering sciences to agricultural economics.

The institute's six departments interact in five programme areas, which effectively reflect the five bioeconomy subdomains to which ATB aims to contribute: Diversified Crop Production, Individualised Livestock Production, Healthy Foods, Multifunctional Biomaterial, and Integrated Residue Management. Within the programme areas, researchers from the different disciplines interact productively. The activities benefit from exceptional research infrastructure and lead to important research results along the spectrum from basic to applied research e.g. in the field of alternative food bioresources, emissions and airflow in barns and the use of peatlands for the production of woody biomass. The institute regularly follows a co-creation approach, involving collaboration with industry partners and practitioners in the projects. It focusses on developing technological solutions up to the demonstration of prototypes in relevant environments and currently supports three spin-off companies. All five programme areas are rated "very good".

Following a critical evaluation in 2013/2014, ATB initiated a reform process, which gained momentum after a new Scientific Director took up office in 2020. She manages ATB very capably alongside the Administrative Director, who took up her post in January 2023. The comprehensive strategic process initiated under the new leadership is starting to show results and must be continued. Positive developments include strengthening the bioeconomy as the institute's guiding principle, and establishing two new research departments for data science and microbiome biotechnology. Since 2021, the institute's already impressive infrastructure has been extended, with the establishment of the Leibniz Innovation Farm for Sustainable Bioeconomy (InnoHof). This infrastructure opens up a large number of new research opportunities on different aspects of the bioeconomy. With regard to a desirable close integration into the Berlin-Brandenburg research landscape, it is very good to see that the institute has doubled the number of joint appointments since 2017; six ATB researchers are now jointly appointed in collaboration with four different universities in the region.

ATB aims to further develop along three overarching priorities, which are coherently linked to the institute's bioeconomy concept *(Diversification and Individualisation, Microbiome (Bio)-technology and Management, and Digitalisation and Systems Modelling).* For the implementation, ATB has presented promising plans, which include maintaining its long-standing expertise in cropping systems and management practices, further strengthening the two new departments for data science and microbiome technology, as well as extending its research on system science in the bioeconomy context.

In the further development of ATB, special consideration should be given to the following main recommendations in the evaluation report (highlighted in **bold face** in the text):

Overall concept, activities and results (chapter 2)

1. ATB has improved its publication record considerably since the last evaluation. However, many of the research results generated at the institute have the potential to receive wider recognition and contribute to further increases in ATB's visibility. For that purpose, ATB researchers should aim to publish their results more frequently in journals with high international visibility.

Changes and planning (chapter 3)

2. In order for the conceptual planning for developing its bioeconomy concept to be effective, the institute has to continue its process of refining the focus of departments and programme areas. These are important prerequisites for achieving ATB's desired profile in international research.

Controlling and quality management (chapter 4)

3. As recommended at the last evaluation and recognised by ATB's own third-party funding strategy, ATB must increase funding obtained from highly competitive procedures, such as those of the DFG, and should diversify its portfolio.

Human resources (chapter 5)

4. It is good to see that ATB has developed a comprehensive Career Development Strategy, which was updated in 2024 and includes career counselling, mentoring programmes, and support in obtaining teaching qualifications. This strategy must now be put into effect.
5. The average time to complete a doctoral degree between 2021 and 2023 is still too long at 5.3 years. It is good to see that the institute aims to ensure that PhD projects are completed within four years, and is already showing a positive trend with an average of 4.7 years for doctoral degrees completed in 2023.

Cooperation and environment (chapter 6)

6. There is a wide range of projects and staff links at international level, as evidenced by joint publications. On this basis, it is recommended that a few particularly promising partnerships be strategically developed and put on a permanent footing through institutional cooperation agreements.

2. Overall concept, activities and results

ATB conducts application-oriented fundamental research in the field of agricultural engineering to support the transformation towards a circular, sustainable and diverse bioeconomy. The aim is to develop new technologies and management strategies for a knowledge-based production of biomass and for its use for nutrition, and as bio-based products and energy sources. ATB's work is highly interdisciplinary. ATB achieves a good balance of fundamental and application-oriented research, operation of research infrastructures, and transfer activities.

The competences represented at the institute range from natural and engineering sciences to agricultural economics. The institute's six departments interact in five programme areas, which effectively reflect the five bioeconomy subdomains to which ATB aims to contribute: Diversified

Crop Production, Individualised Livestock Production, Healthy Foods, Multifunctional Biomaterial, and Integrated Residue Management (see chapter 7 for details on the programme areas). Within the programme areas, researchers from the different disciplines interact productively.

Activities and results

Research

ATB's activities lead to important research results along the spectrum from basic to applied research, e.g. in the field of alternative food bio-resources, emissions and airflow in barns and the use of peatlands and other less-productive agricultural areas for the production of woody biomass.

ATB has improved its publication record considerably since the last evaluation. However, many of the research results generated at the institute have the potential to receive wider recognition and contribute to further increases in ATB's visibility. For that purpose, ATB researchers should aim to publish their results more frequently in journals with high international visibility.

Research infrastructure

Since 2021, ATB has been pursuing a very promising infrastructure project: the establishment of the **Leibniz Innovation Farm for Sustainable Bioeconomy (InnoHof)** on the premises of the Teaching and Research Station for Animal Breeding and Husbandry (LVAT) in Groß Kreutz. InnoHof provides a very good enabling structure for conducting experiments and tests for concepts and technologies on a lab scale, in pilot plants, and in practice. ATB and its partner institutions (including 22 Leibniz institutes such as the Leibniz Centre for Agricultural Landscape Research ZALF) have already started a considerable number of projects focussing on crop and livestock production within InnoHof. In particular, the infrastructure offers good potential to further advance ATB's research on the different aspects of the bioeconomy value chain and to contribute to all five of ATB's current programme areas. In a next step, the infrastructure will be expanded by establishing a biorefinery, facilities for insect and algae cultivation, as well as a bioconversion system. ATB is responsible for the operation of InnoHof as well as the coordination of activities. The developmental phase is being supported by the State of Brandenburg until 2026 with funding of €25m, which is administered at ATB. It is good to see that the institute is exploring different business cases and external funding sources to finance InnoHof after the initial funding phase.

Among ATB's **application laboratories**, the atmospheric boundary layer wind tunnel provides a unique infrastructure for research on emissions in animal housing systems. The wind tunnel forms a basis for many innovative projects for fundamental and application-based research, e.g. on emission-measurement strategies at barn scale and on model validation.

Transfer

Since ATB conducts application-oriented research, projects are regularly pursued in a **co-creation approach**, which involves collaboration with industry partners and practitioners. ATB focusses on developing technological solutions up to technology readiness level 6 (technology demonstration in a relevant environment). The institute benefits from long-standing connections to farming practice in the Brandenburg region, which can be further expanded through InnoHof.

The institute is supporting two technology-based **spin-offs** in animal husbandry funded by EXIST start-up grants (2019 and 2020) and a spin-off for consultancy in bioeconomy (2023). A spin-off in the area of analytical hydrological data is currently being established.

ATB is also actively involved in transfer activities to **policymakers** through its membership of international bodies and committees. Particularly noteworthy are its contributions to the FAO guidelines for the assessment of water use in livestock production systems and supply chains.

3. Changes and planning

Development since the previous evaluation

ATB was evaluated critically in 2013/2014. At the subsequent evaluation, which was conducted earlier than usual, in 2017/2018, the Senate acknowledged that a comprehensive reform process had been initiated and saw great potential in ATB's plans to further develop bioeconomy, digital farming, and microbiology as key topics.

Since then, the institute has managed to successfully establish these topics, which is remarkable in view of the fact that ATB was under interim leadership from 2017, when the Scientific Director resigned, until 2020, when the new Scientific Director took up office. It is good to see that the leadership position was filled in a joint appointment to a W3 professorship at HU Berlin for the first time. The new Scientific Director has initiated a **strategic process**, which has given significant momentum to the restructuring of ATB. Since 2023, she has had first-rate support from a newly appointed Administrative Director. A major result of this strategic process is that the concept of bioeconomy has now become the institute's guiding principle.

In this context, the institute has started to reorganise the methodological and technical competencies in the **scientific departments**:

- The <u>department "Horticultural Engineering"</u> was dissolved, the chemical and physico-chemical <u>laboratories</u> were merged to form the central infrastructure of the Central Analytics Laboratory, and ATB's expertise in mechatronics and process engineering is now pooled in one <u>department.</u> This process of concentrating expertise in departments should be continued, e.g. by combining the expertise in sensor technology and development in one unit.
- Additionally, the institute has expanded its expertise in data science. From 2021 onwards, ATB received additional institutional funding of €770k annually *(kleiner strategischer Sondertatbestand)* to establish a new <u>department "Data Science in Bioeconomy".</u> The position of head of department is linked through a joint appointment to a W3 professorship at the University of Potsdam. It was filled in 2022 with a very promising scientist whose expertise has the potential to contribute to a wide range of research questions addressed by ATB.
- The <u>department "Microbiome Biotechnology"</u> was established to succeed the department "Bioengineering" from 2021 onwards, after the retirement of the previous head of department.

The new leadership position was filled with a renowned scientist in a joint appointment to a W3 professorship with the University of Potsdam. It is very good to see that ATB will receive additional institutional funding amounting to €2.2m annually (*kleiner strategischer Sondertatbestand*) from 2025 onwards to further develop its microbiome management capacities by setting up a junior research group and expanding laboratory capacity for antimicrobial resistance in livestock production.

It is an extremely positive development that these new leadership appointments have significantly increased the number of staff who are jointly appointed to professorships: from three W2 professorships at the last evaluation to three W2 and three W3 professorships at present (see chapter 6 for details).

By linking expertise from different departments in **programme areas**, ATB has found a suitable way to implement its interdisciplinary approach. They cluster the corresponding activities and allow the researchers from the different departments to interact productively. As part of the strategic process, the number of cross-departmental programme areas was increased from three to five. This came into effect from 2023 onwards. The current programme areas suitably reflect the five bioeconomy subdomains to which ATB aims to contribute (see chapter 7 for details on the programme areas). Now ATB should aim for refining the focus of the programme areas. This should help to avoid overlaps in the future and to make clear decisions about which projects should be included in ATB's research portfolio.

Strategic work planning for the coming years

ATB aims to further develop the topic of bioeconomy and has identified three promising priorities for its research:

The projects related to ***Diversification and Individualisation*** will build on ATB’s long-standing expertise in crop and biomaterial production to develop appropriate technology solutions e.g. to support individualised management practices and the implementation of diversified cropping systems in combination with precision farming technologies.

To further extend its work on ***Microbiome (Bio)technology and Management*** ATB will make use of expertise in the department “Microbiome Biotechnology”, which was established in 2021 and will be expanded from 2025 onwards (see above), e.g. for the development of plant protection products and probiotics to promote human health and prolong the shelf life of foodstuffs.

To further develop its research on ***Digitalisation and Systems Modelling***, ATB has established institutional collaborations with the University of Osnabrück and other partners in Lower Saxony that are focussed on data science and artificial intelligence (see also chapter 6 on cooperation):

- Since April 2023, the partners have been training doctoral students at the intersection between agricultural science and AI in a Joint Lab for Artificial Intelligence & Data Science. The Volkswagen Foundation is funding the collaboration as part of the "zukunft.niedersachsen" programme, providing approximately €6.7m for 5 years (2023-2028). The institute is well aware of the computational infrastructure requirements the expansion of its research entails and has found reasonable solutions with the Universities of Potsdam and Osnabrück.

- Additionally, there are plans to establish a junior research group on "Explainable AI in Bioeconomy" in the department of Data Science in Bioeconomy in 2025.
- The collaboration with the University of Osnabrück in this field is currently being extended with a joint appointment to a W2 professorship in "Systems Science in Bioeconomy" at the University of Osnabrück. The position is limited to five years and was advertised in July 2024.

ATB plans to further expand its expertise in system science with the establishment of two additional research units, one at ATB's site in Brandenburg and one in Osnabrück. They are to be financed as a "FutureLab for Bioeconomic Transformation through Systemic and Technological Innovation" (Bio-SysTeIn) as part of the institute's expansion (large strategic extraordinary item of expenditure, *großer Sondertatbestand*) from 2028 onwards. The project is currently being assessed in a separate evaluation procedure.

The three research priorities that ATB would like to pursue in the coming years *(Diversification and Individualisation, Microbiome (Bio)technology and Management, and Digitalisation and Systems Modelling)* are consistently linked to the institute's bioeconomy concept. **In order for the conceptual planning for developing its bioeconomy concept to be effective, the institute has to continue its process of refining the focus of departments and programme areas. These are important prerequisites for achieving ATB's desired profile in international research.**

4. Controlling and quality management

Facilities

ATB's **institutional funding** increased from €11m in 2016 to €13.7m in 2023. This includes additional institutional funding from the federal and *Länder* governments *(Sondertatbestand),* which the institute has been receiving since 2021 to set up a new department "Data Science in Bioeconomy" (€770k, see chapter 3). From 2025 onwards, ATB will receive a further permanent increase in institutional funding of €2.2m per year for the development of microbiome research.

It is laudable that the **revenues from project grants** have also increased, from €4.2m on average between 2014 and 2016 (corresponding to approx. 27% of the overall budget) to €6.9m p.a. on average between 2021 and 2023 (32%; not including funding for the development of the InnoHof and for energy-related renovations, see below). Additionally, ATB generated €400 per year on average in **revenue from services**. In its *third-party funding strategy*, valid from 2024 onwards, the institute set itself a permanent goal of obtaining 30% of its overall budget through highly competitive programmes. Currently, grants from the federal (BMEL and BMBF) and *Länder* governments make up 73%. **As recommended at the last evaluation and recognised by ATB's own third-party funding strategy, ATB must increase funding obtained from highly competitive procedures, such as those of the DFG, and should diversify its portfolio.** As a minimum target, ATB should aim to secure funding amounting to the DFG fee that it pays as a Leibniz institute (approx. €330k per year). It is encouraging that the institute has become very successful in acquiring funds from EU framework programmes. Now, it should also seek ERC funding.

Facilities and equipment

The main **ATB campus** is located in Potsdam-Bornim with two more sites in Brandenburg (InnoHof in Groß Kreutz and Fieldlab in Marquardt). It is good to see that the State of Brandenburg has provided extensive funding in recent years for renovation and modernisation measures in the existing buildings, some of which date back to the GDR era. A photovoltaic system including a storage system is currently being built with special funding from the state. For the development phase of InnoHof, which runs until 2026 (see chapter 2), the State of Brandenburg is providing €14.5m for construction and €10.5m for investments.

ATB has state-of-the-art **equipment** at its disposal. The Fieldlab for Digital Agriculture is a fully equipped experimental station, where experimental plots are mapped at high resolution. The Fieldlab includes permanent infrastructure for the testing of soil sensors as well as for optical sensors for horticulture. The Center for Research and Communication in a Circular Bioeconomy (CIRCLE) offers a high-end laboratory complex that supports ATB's research on e.g. antimicrobial resistance, nitrogen emissions, and the improvement of soil health. CIRCLE has been in operation since 2019.

The **IT infrastructure** has been expanded in recent years. Server systems are provided at the various ATB sites. The institute's high-performance computing cluster is hosted at the University of Potsdam. The institute is currently developing a data catalogue and publication repository system. ATB has taken measures to ensure IT security by implementing solutions for data backup and protection against unauthorised access, and it conducts appropriate staff training.

It is very good to see that ATB works together with other Leibniz institutes in Brandenburg to **pool resources in the science support sector**. For example, it shares a construction coordinator with the German Institute of Human Nutrition (DIfE) and receives support from the Leibniz Institute for Research on Society and Space (IRS) in the area of third-party funding management.

Organisational and operational structure

ATB's **Executive Board** consists of the Scientific Director and the Administrative Director. They both perform very well, work together successfully and have implemented a communicative leadership style and transparent decision-making processes at ATB. These include monthly meetings between the Scientific Director, the PA spokespersons, heads of departments, and board representatives, as well as the monthly **internal advisory board** meetings that involve representatives from all status groups and are open to all employees.

The **matrix organisation** (see chapter 3) was developed further. The heads of scientific departments are responsible for personnel, resources and research infrastructure, while the five programme area spokespersons coordinate collaboration between researchers and manage the scientific development of their programme area.

Quality management

ATB's **quality management** system is well aligned with the expected standards. The institute follows the recommendations for good scientific practice as developed by the DFG and adopted by the Leibniz Association. ATB has two ombudspersons in place.

The **publication strategy** (including handling of open access) was last updated in 2024 and must now take effect (see recommendation 1). It is good to see that the institute prioritises publications with high visibility as well as, increasingly, data publication according to FAIR principles.

As recommended at the last evaluation, ATB has revised its system for the **performance-oriented allocation of funds.** It is good to see that it now recognises other indicators of scientific performance as well as achievements in transfer and co-creation, and the successful promotion of doctoral students and postdocs.

Quality management by advisory boards and supervisory board

The Scientific Advisory Board (SAB) is very committed to and constructive in its support of ATB's work. The advisory board includes members from industry. It is also very positive that the SAB now has international members and consequently holds its meetings in English.

5. Human resources

Since the last evaluation, the number of employees in research and scientific services has grown from 87 (2016) to 121 (2023). This was possible, on the one hand, due to additional institutional funding and, on the other hand, because it successfully acquired third-party funds. The working atmosphere at the institute is extremely good. ATB is an attractive employer internationally, as evidenced by the high proportion of scientific staff who come to ATB from abroad. It is therefore worth mentioning that the administrative team is perceived as very supportive and also provides its services in English.

With around 100 people joining and leaving each year, ATB experiences high staff turnover. It is therefore a good thing that the institute has developed a welcoming culture and is continuously expanding its measures in this regard.

Leading scientific and administrative positions

The Scientific Director took up her position in October 2020 in a joint appointment to a professorship at the Humboldt University of Berlin. A new Administrative Director took up her post in January 2023, following the retirement of her predecessor. Following this change in leadership, an **Executive Board** consisting of both the Scientific and Administrative Directors *(Doppelspitze)* was established.

In addition to the Scientific Director, two **department heads** have been appointed in joint appointments with university partners since the last evaluation. This means that five of the six department heads are now jointly appointed professors (see chapter 6). Recruitment procedures for leading scientific and administrative positions follow the standards of the Leibniz Association.

Working group heads are appointed on the recommendation of an internal advisory board, ensuring transparency of the appointment procedures. At the same time, however, these positions should in future be filled more often with people from outside the institute’s close network.

Staff with a doctoral degree

Besides the 24 scientific working group leaders, ATB employees with a doctoral degree include 56 scientific group members, of whom 28 are postdocs who completed their doctorate no more than six years ago. The majority (93%) are employed on fixed-term contracts, which leads to high staff turnover at this level. In principle, researchers who are working on third-party projects should be offered contracts for the entire funding period.

Since the last evaluation, four ATB researchers have taken up leadership positions in research institutions in Germany and abroad, two of them as professors. ATB previously had an independent junior research group, which was effective in developing the data science competences at the institute. It is good that the institute plans to establish two new junior research groups from 2025 onwards.

It is good to see that ATB has developed a comprehensive Career Development Strategy, which was updated in 2024 and includes career counselling, mentoring programmes, and support in obtaining teaching qualifications. This strategy must now be put into effect. To this end, individual funding tools should be further refined; for example, training in grant writing should be provided from day one. It would be helpful if postdocs elected trusted representatives from among their number, as is already the case for doctoral researchers, to represent their concerns on the institute's internal committees and to the institute's leadership.

Doctoral candidates

At 31 December 2023, 44 doctoral researchers were working at ATB, representing a significant increase, as had been recommended at the last evaluation. For most doctoral candidates, ATB researchers now act as their primary supervisor. ATB offers 100% positions to all doctoral candidates in positions financed from the institutional budget (and for third-party-funded positions where possible).

Between 2021 and 2023, 19 doctorates were completed. The institute provides an attractive environment for PhD students, many of whom come from abroad (77%). **The average time to complete a doctoral degree between 2021 and 2023 is still too long at 5.3 years. It is good to see that the institute aims to ensure that PhD projects are completed within four years, and is already showing a positive trend with an average of 4.7 years for doctoral degrees completed in 2023.**

As recommended at the last evaluation, ATB has further structured the supervision and promotion of its doctoral researchers by setting up guidelines, a Thesis Advisory Board and a mandatory doctoral programme in bioeconomy. Doctoral researchers are also encouraged to take part in structured graduate programmes at neighbouring universities.

Science-supporting staff

ATB's science supporting staff provide invaluable services for ATB's researchers, including supporting the acquisition of third-party funding, science communication, and a central data position. The institute should continue its efforts to make all employees aware of these support structures.

It is good to see that ATB is very much involved in **vocational training.** The institute offers traineeships for agricultural services, industrial mechanics, IT specialists in system integration, and office management. Between 2021 and 2023, three trainees completed their vocational qualification. Additionally, ATB offers six positions for voluntary service years *(Freiwilliges Soziales Jahr /Freiwilliges Ökologisches Jahr).*

In line with the increase in the number of employees in research, the number of **administrative staff** has also increased significantly. In contrast, the number of science-supporting staff in laboratories, technical support, and central infrastructure has remained constant. Care should be taken to ensure that an appropriate balance is maintained to support ATB's activities.

Equal opportunities and work-life balance

At the end of 2023, 40% of ATB employees in research and scientific services were female – a lower proportion of **female researchers** than at the last evaluation (48% in 2016). On the other hand, it is a very positive development that men and women are equally represented in scientific leadership positions. The institute rightfully aims to reduce the underrepresentation of women, especially among doctoral researchers, and has set target quotas of 50% in the 2025 programme budget.

Family-friendly careers are supported by a variety of measures at ATB and it has been certified by *audit berufundfamilie* since 2010. The regulation stating that employees can work from home for 60% of the time is helpful since many employees have long commutes to ATB's location outside of Potsdam.

ATB supports **international employees** e.g. by encouraging language classes. The institute has 17 apartments on site, which are made available for new international employees and guest researchers.

At 31 December 2023, seven employees with disabilities were working at ATB.

6. Cooperation and environment

Since the last evaluation, ATB has intensified its links to universities in the **Berlin and Brandenburg** region through joint appointments to professorships. A joint appointment (W2) with the Humboldt University of Berlin has been in place since 2011, and in 2020 the Scientific Director's appointment (W3, initially fixed-term, now permanent) was added. The head of the Department of Agromechatronics is jointly appointed with the Technical University of Berlin, and the head of the Department of Sensors and Modelling is appointed jointly with Freie Universität (FU) Berlin (both W2). The links with the University of Potsdam through joint appointments in biology and computer science (both W3) were established in 2021 and 2022. Within this collaboration, ATB's computing cluster is also hosted at the university.

A partnership exists with the University of Kassel, which is designed to provide access to university teaching for researchers seeking to achieve their habilitation. It is good to see that a pragmatic interim solution has been found to provide opportunities for ATB staff to gain teaching experience. However, ATB should continue to seek more obvious opportunities at local universities.

The most recent connection is with the **University of Osnabrück,** which has been in place since 2023 as part of a Joint Lab on “Artificial Intelligence & Data Science” and will be expanded with the establishment of a joint professorship (W2). The ATB plans to strengthen this collaboration significantly (for plans for a major strategic expansion/Bio-SysTeIn, see chapter 3). A collaboration with actors in the Osnabrück region is highly attractive for ATB, since the farming and agrifood industry is much larger there than in ATB’s home region and is structurally different (including soil characteristics). It also opens up links to additional experts on legal aspects concerning transfer activities (including intellectual property as well as the commercialisation of software and data). Nonetheless, the geographic dispersion of the partner institutions will be a challenge, particularly when it comes to integrating researchers at the different sites.

ATB is a very active member of the Leibniz Association, in which the Scientific Director has held the office of Vice President since 2021. For example, ATB participates in the Leibniz Lab “Pandemic Preparedness” and the Leibniz Research Alliance “INFECTIONS in an Urbanizing World – Humans, Animals, Environments”. The institute is involved in several large **collaborative research** and infrastructure projects, including numerous EU-funded COST Action networks, and now often takes a leading or coordinating role in these. Also worthy of mention are the numerous collaborations with the private sector (industry, agricultural businesses) in co-creative/transfer projects, developing technological solutions up to technology readiness level 6 (see chapter 2).

There is a wide range of projects and staff links at international level, as evidenced by joint publications. On this basis, it is recommended that a few particularly promising partnerships be strategically developed and put on a permanent footing through institutional cooperation agreements.

7. Subdivisions of ATB

Programme area Diversified Crop Production

(58 FTE, of whom 26 FTE research and scientific services staff, 8 FTE doctoral candidates, and 24 FTE service staff)

The programme area has high expertise in the development of sensor technologies to monitor the health of soils, plants, and their environment. The projects range from the identification of optimal sensors and sensor systems for predicting soil properties to a process for generating soil-property maps, which then allow for site-specific fertilisation. Another strength of the programme area lies in the development of model systems, particularly the use of artificial intelligence to analyse sensor data. Topics also include biodiversity monitoring and analysis of the economic potential of site-specific fertiliser application.

Researchers from different perspectives and disciplines contribute to the work on this broad range of topics. At present, the underlying 3M concept (measure, model, manage) is illustrated very well by some of these projects. This common denominator could serve as the basis for developing a more coherent profile for the programme area in the future.

The programme area is very successful in transferring its technologies into applied contexts, e.g. the development of sensors for site-specific liming. Here, it benefits from close connections to the agricultural industry. The development of InnoHof will provide opportunities to further extend its fruitful application-oriented research collaborations.

Overall, the programme area is rated “very good”.

Programme area Individualised Livestock Production

(26 FTE, of whom 15 FTE research and scientific services staff, 5 FTE doctoral candidates, and 6 FTE service staff)

The programme area works mainly on animal health, barn climate & emissions, and assessment of livestock production systems. One longstanding focus is on the development of sensors to monitor animal health, e.g. to measure the respiration rate. In the context of its cooperation with other Leibniz institutes through the Leibniz Research Alliance INFECTIONS, the programme area has also developed strong expertise in the aerial transmission routes of infections as well as antimicrobial resistance and pathogenic bacteria among livestock. A further focus has been on research combining system modelling and multi-criteria assessment methods to analyse the environmental impact and efficiency of livestock production systems. This has led to the DEXi-Dairy tool for assessing the sustainability of dairy production, which has been applied to case study farms across Europe.

The programme area benefits greatly from the exceptional infrastructure maintained in the atmospheric boundary layer wind tunnel. By combining physical modelling in the wind tunnel with on-farm measurements and high-performance mathematical modelling, it pursues a unique approach to researching barn climate and emissions. This leads to important findings on the prediction of gaseous emissions and their sources in the animal husbandry system that are frequently published in international outlets. However, researchers in this area are encouraged to aim for even higher international visibility. This would be helped by sharpening the profile on emissions and, in turn, altering the name of the programme area.

As part of the work on emissions, the programme area is actively involved in international committees, e.g. at the FAO. It also successfully transfers knowledge to policymakers, e.g. through contributions to the FAO guidelines for the assessment of water use in livestock production systems and supply chains.

Overall, the programme area is rated “very good”.

Programme area Healthy Foods

(25 FTE, of whom 11 FTE research and scientific services staff, 4 FTE doctoral candidates, and 10 FTE service staff)

The programme area works on the resource-efficient production of food, including the reduction of waste and the development of new food materials. One particular focus lies on the microbiome, particularly the apple microbiome and its preservation. Additional expertise has been built up in non-thermal processing technologies. Based on ATB’s strong history in sensor technology for detecting the current status of foods, the field offers high potential for development, particularly by further incorporating agromechatronics as well as artificial intelligence approaches. For this purpose, the programme area would benefit from further extending its expertise in data compression and other prerequisites for the application of AI-based techniques. It is recommended to include researchers from ATB's department of Sensors and Modelling in the programme area's team.

Within the field of alternative food materials, the programme area has pursued a number of projects with a particular focus on algae and insects as alternative protein sources, e.g. projects on pulsed electric field treatment for extracting protein, fat and chitin from crickets to generate a flour alternative. These projects are very promising and show that ATB is on the way to becoming one of the leading institutions for alternative food materials in Germany. A high number of interesting publications have already been generated.

The programme area coherently combines research on different steps of post-harvest food processing, from the farm to packaging and storage. It makes sense that activities focus on some aspects of food safety and the reduction of food waste, along with the environmental impact of food production. However, the title of the programme area implies a wide range of topics that are thus far not considered in its research portfolio, such as nutrition and food security. ATB should therefore consider how the name of this programme area affects expectations others might hold about the institute's expertise.

Overall, the programme area is rated “very good”.

Programme area Multifunctional Biomaterials

(27 FTE, of whom 10 FTE research and scientific services staff, 6 FTE doctoral candidates, and 11 FTE service staff)

This programme area develops site-specific technology and processes for sustainable production of biomass in agriculture and its resource-efficient use through further processing into biomaterials. Since the last evaluation, the research on biomaterials has developed very well and now addresses the full value chain in a coherent manner.

The focus of one series of projects is on technology for the production of woody biomass, particularly in agroforestry systems in peatlands. By developing alternative agricultural production systems with positive environmental effects for these agricultural areas, ATB is addressing a highly relevant issue for the German agricultural sector. Important results achieved thus far include pilot projects to establish value chains for the production, transport, and processing of biomaterials from peatlands, as well as the development of a manufacturing process for the production of packaging materials from *paludi* biomass in cooperation with an industry partner.

In another line of research, the programme area focusses on the production of organic acids, such as lactic and succinic acid, using biomass generated from woody and fibre crops, food residues, and production side streams. Particularly noteworthy are research results on the processing of pasta waste, which were published in 2024 in collaboration with the programme area Integrated Residue Management.

While some of the materials and production processes investigated are particularly suitable for implementation within Germany, the programme area should also explore ways to transfer the research results into application in other countries. For this purpose, the aim should be to publish research results in journals that reach wider international audiences.

Overall, the programme area is rated “very good”.

Programme area Integrated Residue Management

(30 FTE, of whom 13 FTE research and scientific services staff, 5 FTE doctoral candidates, and 12 FTE service staff)

The programme area brings together research activities on biogas as well as carbonized biomass, such as biochar and humic substances. These are produced using residual biomass from crop or livestock production, food residues or municipal waste. The activities focus on highly relevant topics, such as understanding residue conversion processes, technology development for treatment and utilisation, and environmental and economic assessments.

Among the wide range of conversion processes investigated, the microbial and thermochemical approaches are already well established. Recently, the use of macroalgae for conversion has been picked up as a promising topic. Other innovative approaches include the coupling of anaerobic digestion with cold plasma treatment. Particularly noteworthy is the development of a Biological Resource Utilization Impacts model (BIORIM), which allows for comparisons between the ecological and economic effects of different residue treatment options.

In the programme area, Fundamental research and system approaches are linked very well with various aspects of application development, including legal matters related to implementation. The projects benefit from collaborations with other partners in Germany, e.g. in the work on improving the cost-effectiveness of small-scale biogas plants for use in tractors. The research results from the projects are published in very good outlets.

Overall, the programme area is rated “very good”.

8. Handling of recommendations of the last external evaluation

ATB successfully addressed the recommendations made by the Leibniz Association Senate in 2018 (see Status Report, p. A-20ff). The recommendations to publish in highly visible outlets (recommendation 3) and to diversify third-party funding (recommendation 4) still apply.

Appendix

1. Review board

Chair (Member of the Leibniz Senate Evaluation Committee)

Nicola **Fohrer**	Department of Hydrology and Water Resources Management, Kiel University

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

[cancellation on short notice]

Reviewers

Hélène **Carrère**	Laboratory of Environmental Biotechnology, Centre Occitanie-Montpellier, INRAE
Eldert van **Henten**	Professor of Biosystems Engineering, Wageningen University & Research
Tiina **Roose**	Professor of Biological and Environmental Modelling, University of Southampton
Thomas **Scholten**	Professor of Soil Science and Geomorphology, University of Tübingen
Lars **Schrader**	Institute of Animal Welfare and Animal Husbandry, Federal Research Institute for Animal Health, Celle
Iryna **Smetanska**	Department of Agriculture, Food, and Nutrition, University of Applied Sciences Weihenstephan-Triesdorf
Achim **Walter**	Professor of Crop Science, ETH Zürich
[cancellation on short notice]	[Food technology]

Representative of the federal government (member of the Leibniz Senate Evaluation Committee)

Volker **Wiesenthal**	Federal Ministry of Education and Research, Berlin

Representative of the Länder *governments (member of the Leibniz Senate Evaluation Committee)*

Christine **Burtscheidt**	Hessian Ministry of Higher Education, Research, Science and the Arts, Wiesbaden

10 March 2025

Annex C: Statement of the Institution on the Evaluation Report

Leibniz Institute for Agricultural Engineering and Bioeconomy, Potsdam (ATB)

ATB sincerely thanks the chair, co-chair, and review board members, along with the Leibniz Association's evaluation office staff and guests, for their thorough evaluation and insightful evaluation report. We greatly appreciate their valuable comments and recommendations and will integrate them into our strategic development efforts.

Since our last evaluation in 2017, ATB has undergone a significant transformation. We are very pleased that the review board recognised the success of this process, deeming its progress successful throughout in terms of organization, structure, and personnel. We are delighted that the review board acknowledged the concept of bioeconomy as the institute's guiding principle, marking a key outcome of the strategic process. Furthermore, it is very gratifying that our substantial improvements in scientific publications, third-party funding, the strategic development of our experimental infrastructure, our co-creative approach, and other transfer activities are being recognised. Additionally, our high-performance computing cluster and the two minor strategic extraordinary items of expenditure in Data Science in Bioeconomy (implementation since 2021) and Microbiome Technologies for Circular Bioeconomy (µTec) (implementation from 2025) were particularly positively highlighted.

ATB's overall research performance and inter- and transdisciplinary integration of expertise has significantly increased through the implementation of the five Programme Areas which replaced the previous three Research Programmes. This positive trajectory was clearly illustrated by the reviewers' identification of numerous activities within our strategic innovation fields Diversification & Individualisation, Digitalisation & Systems Modelling, and Microbiome (Bio)technology and Management. We are particularly delighted to see our research infrastructure development (Leibniz Innovation Farm for Sustainable Bioeconomy (InnoHof), Field Lab for Digital Agriculture, pilot plants, and state-of-the-art laboratories), research data infrastructures, our graduate college in collaboration with Osnabrück University, the Joint Lab for Artificial Intelligence and Data Science (Joint Lab KI & DS), and our participation and leadership in the Leibniz Labs Pandemic Preparedness and Systemic Sustainability were recognised as successful. Driven by our ambition to further enhance our scientific excellence while expanding our co-creation and transfer activities, we will further strengthen our strategic collaboration with our partners in Osnabrück significantly. This partnership in conjunction with our plans for a strategic expansion of our expertise including the establishment of a branch in Osnabrück in the context of the application for a major strategic extraordinary item of expenditure “FutureLab Bio-SysTeIn Bioeconomic Transformation through Systemic-Technological Innovation” will play a key role in the further strategic development of ATB and will be an important step towards achieving ATB’s future goals.

We are very gratified that the review board attested ATB promising plans, which include maintaining our long-standing expertise in agricultural engineering, technology development, and management practices, further strengthened by the two new Departments for Data Science and Microbiome Biotechnology, as well as extending our research in system science in the bioeconomy context.

We appreciate the positive feedback on our updated Career Development Strategy (2024) and will now focus on its effective implementation, including mentorship, grant-writing training, and structured career support.

Since the last evaluation, we have focused on enhancing our international visibility and standing within our field, including implementing strategic collaborations globally, particularly in the context of the InnoHof and our Living Lab research. We are gratified that the review board acknowledged the significant progress we have made in international research visibility. Our revised publication strategy, updated in 2024, has already taken effect to ensure broader dissemination of our research findings. The review board highlighted the increase of our visibility and position as a recognised collaboration partner, as well as lead of international activities, such as the FAO guidelines for the assessment of water use in livestock production systems and supply chains.

ATB welcomes the review board's recognition of its achievements and constructive recommendations. We are pleased that the successful implementation of the recommendations from the previous evaluation were recognised. We will continue the diversification of our funding portfolio beyond the already achieved success in the increase of EU and DFG funding and further increase the impact of our publications by the implementation of the new Third Party Funding and Publication Strategies in 2024. The findings reinforce our commitment to pioneering research in sustainable bioeconomy and strengthening our role within the Leibniz Association and the global research community. We will continue our strategic development with a focus on excellence, collaboration, and impact-driven innovation, including the careful consideration and further implementation of the recommendations.