Leibniz Gemeinschaft

Der Senat

15. Juli 2025

Stellungnahme zum Leibniz-Institut für Gemüse- und Zierpflanzenbau, Großbeeren (IGZ)

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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 19. und 20. September 2024 das IGZ in Großbeeren. Ihr stand eine vom IGZ 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 IGZ 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 Gemüse- und Zierpflanzenbau“ (IGZ) hat satzungsgemäß den Auftrag, interdisziplinär zu Pflanzen und ihrer Wechselwirkung mit der Umwelt zu forschen. Auf dieser Grundlage sollen nachhaltige Produktionssysteme im Gartenbau entwickelt werden, die die Lebensmittelsicherheit und -versorgung erhöhen und die Ernährung verbessern.

Im IGZ wurden 1992 das Zentralinstitut für Gemüsebau der DDR in Großbeeren und die Forschungsabteilung für Zierpflanzen eines Saatgut-Betriebs in Erfurt zusammengeführt. Der Senat identifizierte 2016 gravierende Leistungsschwächen der drei Arbeitseinheiten in Erfurt und empfahl eine Konzentration auf den Standort Großbeeren. Diese einschneidende Maßnahme ging mit einer erheblichen Reduktion der institutionellen Förderung einher, erwies sich jedoch bei einer vorgezogenen Evaluierung vier Jahre später als richtiger Schritt. Die wissenschaftliche Neuausrichtung war aber noch nicht abgeschlossen, so dass das IGZ nun erneut vorgezogen evaluiert wird.

Die 2020 vorgestellte neue Strukturierung in vier Programmbereiche (PB) mit jeweils zwei bis drei Forschungsgruppen (FG) hat sich bewährt. Wie vom Senat angemahnt, verbesserten sich

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

auf dieser Grundlage die **Forschungsleistungen**, teilweise erheblich. Drei der vier Programmbereiche werden besser als zuvor eingeschätzt („exzellent“, „sehr gut“, „gut bis sehr gut“), einer wird erneut als „gut“ bewertet.

Das IGZ profitierte **seit der vergangenen Evaluierung** in hohem Maße von strukturellen Verbesserungen und der personellen Entwicklung. Im Oktober 2022 wechselte die heutige Direktorin unter Beibehaltung ihrer universitären Anbindung in Jena an das Institut. Sie hat wichtige strategische Weichen gestellt und bietet den Beschäftigten sehr gute Möglichkeiten, sich in die Institutsentwicklung einzubringen. Der Senat begrüßt die geplante Umbenennung in „Leibniz-Institut für Gartenbauwissenschaften“. Damit wird ein Leitbegriff verwendet der eine starke integrative Funktion nach innen entfaltet und das IGZ treffend von fachlich benachbarten Einrichtungen abgrenzt. Die Arbeiten werden mittlerweile auch in erheblich höherem Maße in Projekten bearbeitet, die im Wettbewerb eingeworben wurden und in denen das Institut eng mit nationalen und internationalen Partnern kooperiert.

Die Basis der IGZ-Forschungen bilden die beiden grundlagenwissenschaftlich ausgerichteten Programmbereiche *Plant Adaptation* (ADAPT) und *Biotic Interactions* (BIOTIC), die sich mit ihrer Ausrichtung auf abiotische und biotische Umweltfaktoren sehr gut ergänzen. Wissenschaftlich kam es dem IGZ in außerordentlich hohem Maße zugute, dass kurz vor der vergangenen Evaluierung ein international ausgewiesener Molekularbiologe die Leitung des **PB ADAPT** (und gleichzeitig eine der beiden FG) übernahm. Seine weltweit stark rezipierte Forschung zur Temperaturwahrnehmung von Pflanzen und deren Bedeutung für die Anpassung an Umweltveränderungen förderte der ERC mit einem *Advanced Grant*. Für die Leitung der zweiten FG im Bereich wurde eine ausgezeichnete jüngere Wissenschaftlerin gewonnen. Im **PB BIOTIC** setzte die Direktorin mit ihrer hohen Expertise in der chemischen Ökologie wichtige Impulse und richtete eine neue Forschungsgruppe ein. Ruhestandsbedingt wird in diesem Jahr die Leitung des PB BIOTIC (und damit gleichzeitig der zweiten FG im PB) vakant, die Neubesetzung ist gemeinsam mit der HU Berlin vorgesehen. Mit Blick auf die **weitere strategische Entwicklung** bietet dies die Chance, die hochrelevanten wissenschaftlichen Bezüge zwischen ADAPT und BIOTIC auszugestalten. Es wird empfohlen, die Position auf dem Gebiet der Nutzpflanzengenomik zu besetzen, um ein vertieftes Verständnis der genetischen Grundlagen gartenbaulich relevanter Merkmale, wie z.B. Hitzetoleranz und Resistenz gegen Schädlinge, zu erlangen.

Der Bereich *Plant Quality and Food Security* (**PB QUALITY**) umfasst drei FG, die fachlich aber nur teilweise aufeinander bezogen sind. Eine Forschungsgruppe führt sehr überzeugende chemische Studien zu sekundären Pflanzenstoffen durch, die in das IGZ gut eingepasst sind. Deren Leiterin ist inzwischen neben ihrer Tätigkeit am IGZ auch als Professorin an die TU Berlin berufen (Förderung über das Leibniz-Professorinnenprogramm). Eine weitere Gruppe befasst sich mit der Qualität von pflanzlichen Nahrungsmitteln für eine nachhaltige Ernährung, die seit langer Zeit am IGZ tätige FG-Leiterin führt derzeit auch den PB QUALITY. Die inhaltlichen Bezüge der dritten, sozial- und wirtschaftswissenschaftlichen FG zum Institut bleiben nach wie vor gering. Es ist zu würdigen, dass der Leiter dieser FG eine Heisenberg-Professur an der HU Berlin einwarb. Der anwendungsorientierte Bereich *Next-Generation Horticultural Systems* (**PB HORTSYS**) ist thematisch klar fokussiert. Er wird seit 2018 kommissarisch geleitet. Es ist dringlich, die angestrebte gemeinsame Berufung einer Leitung nun zügig umzusetzen.

Die institutionelle **Förderung** des IGZ wurde mit der Konzentration auf Großbeeren von 10,6 M€ (2016) auf 7,5 M€ (2017) reduziert. Sie liegt inzwischen dank der von Bund und Ländern vereinbarten Regelaufwüchse bei 8,5 M€ (2023). Das IGZ plant, einen „kleinen strategischen Sondertatbestand“ zu beantragen. Wie empfohlen wurden Überlegungen aufgegeben, die sozialwissenschaftlichen Arbeiten auszubauen. Stattdessen möchte das IGZ die Antragsoption für eine Mittelerhöhung ab 2029 nutzen, um seine Kernkompetenzen in den Gartenbauwissenschaften zu stärken (s. Institutsstellungnahme). Dafür sehen die Sachverständigen grundsätzlich einen Bedarf. Ein Antrag sollte im vorgesehenen Verfahren mit einem Votum des Beirats vorgelegt werden. Der Drittmittel-Anteil am Budget für laufende Maßnahmen erhöhte sich von 12 % (2016–2018) auf 30 % (2021–2023). Für die kommenden Jahre wurden bereits in deutlich höherem Maße als zuvor Projektförderungen im Wettbewerb eingeworben, insbesondere bei der DFG.

Das IGZ verfügt über eine sehr gute **Forschungsinfrastruktur** (Gewächshäuser, Feldversuchsgelände, Labore). Anfang 2024 wurden die zentralen wissenschaftlichen Services in einer *Science Support Platform (SSP)* zusammengeführt. Der empfohlene Ausbau der Nutzpflanzengenomik könnte zu komplexeren Anforderungen an die Bioinformatik führen, die dann nicht mehr im Rahmen einer unterstützenden Arbeitseinheit zu bewältigen sind; gegebenenfalls müssten dann, wie im Bewertungsbericht erläutert, neue Strukturen etabliert werden.

Die Direktorin und der Verwaltungsleiter, der die Position im März 2023 übernahm, arbeiten ausgesprochen gut zusammen. Im **Vorstand** sind der Satzung nach außerdem zwei weitere wissenschaftliche Mitglieder vorgesehen. Früher repräsentierten sie die beiden IGZ-Standorte, nun sind aufgrund dieser Regelung zwei der vier Programmbereichsleitungen in den Vorstand eingebunden. Es wird begrüßt, dass – wie die Fachressorts im SAE mitteilten – die Satzung im Herbst 2025 an die Konzentration des Instituts auf Großbeeren und seine veränderte Organisationsstruktur angepasst wird, um eine angemessene Beteiligung der leitenden Wissenschaftlerinnen und Wissenschaftler an strategischen Entscheidungen sicherzustellen.

Unter der amtierenden Leitung wurde mit einem ***Early Career Programme*** ein sehr guter Rahmen für die Förderung von Promovierenden und Postdocs entwickelt. Das IGZ wirkt in zwei *International Max Planck Research Schools* mit und hat außerdem wie empfohlen sein Graduiertenprogramm klarer strukturiert. Dies sollte nun zu einer Verkürzung der durchschnittlichen Promotionszeit von derzeit 4,7 Jahren führen.

Die **Gleichstellung der Geschlechter** und die Vereinbarkeit von Familie und Fürsorgetätigkeit werden erfolgreich vorangebracht. Fünf der neun leitenden wissenschaftlichen Positionen sind mit Frauen besetzt.

Der **wissenschaftliche Beirat** wurde entsprechend den Empfehlungen erweitert und internationaler besetzt. Drei von derzeit neun Mitgliedern arbeiten im Ausland. Die anstehende Besetzung einer zehnten Position und personelle Wechsel sollten genutzt werden, um die strukturellen Änderungen am Institut wissenschaftlich zu spiegeln und Unternehmen einzubinden.

2. Zur Stellungnahme des IGZ

Der Senat begrüßt, dass das IGZ beabsichtigt, die Empfehlungen und Hinweise aus dem Bewertungsbericht bei seiner weiteren Arbeit zu berücksichtigen und ein Neubau geplant ist.

3. Förderempfehlung

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

26 August 2024

Annex A: Status report

Leibniz Institute of Vegetable and Ornamental Crops, Großbeeren (IGZ)

Contents

1. Key data, structure and tasks

Key data

Year established:	1992
Admission to joint funding by Federal and *Länder* Governments:	1992
Admission to the Leibniz Association:	2007
Last statement by the Leibniz Senate:	2020
Legal form:	Registered Association (eingetragener Verein, e. V.)
Responsible department at *Länder* level:	Ministry of Sciences, Research and Cultural Affairs (MWFK) of Brandenburg
Responsible department at Federal level:	Federal Ministry of Food and Agriculture (BMEL)

Total budget (2023)

€ 8.5m institutional funding

€ 2.8m revenue from project grants

€ 0 revenue from services

Number of staff (2023)

54 individuals in “research and scientific services”

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

10 individuals in “science supporting staff (administration)”

Mission and structure

Statutory mission

“The purpose of the association is to promote science and research. To realise this mission, the IGZ conducts interdisciplinary and fundamental research to improve our understanding of plants and their interaction with the environment. The institute is dedicated to developing sustainable production systems in horticulture, increasing food safety and security, and improving human nutrition.” (Statutes §2 (1))

Structure/organisation

The Executive Board (EB) consists of the Scientific Director, the Head of Administration and two elected Programme Area Heads as Deputy Directors. The science is organised in four Programme Areas (PA) with two or three Research Groups (RG) each and one Junior Research Group (RG). Additionally, there is a Science Support Platform (SSP) as a new structural unit. The research is supported by technical, administrative and managerial staff. These operational units are led by the Head of Administration.

2. Overall concept and core results

The mission of IGZ is to conduct research on sustainable and resilient plant-based agrifood systems and integrate research in plant sciences, horticultural sciences, nutritional sciences, and social sciences. Thus, IGZ research is positioned at the interface between plants, humans and the environment. Advances in basic research have led to exciting research questions and new analytical methods that contribute to an improved understanding of plants and their interactions with the environment. The IGZ contributes to these advances and uses them to develop sustainable production systems in horticulture thereby covering the entire spectrum from basic to applied research following the Leibniz mission statement.

According to the institute, it provides a diverse and interdisciplinary scientific environment where current challenges in agrifood systems can be addressed across different organisational levels; from the basic molecular, cell and organismic levels to the individual, sectoral and global levels. The scientific expertise covers the entire spectrum from molecular plant physiology and biochemistry, human nutrition and food security to horticultural production systems, and addresses overarching topics from fundamental to applied research.

In its Research Programme 2024–2029 the institute defined that the research agenda focuses on **four systemic challenges** that are detailed by the following specific mission statements:

Climate Change

The IGZ seeks to understand how climate change affects horticultural production systems. This spans from studying molecular mechanisms in plants to the impact of heat stress and food insecurity on societies. Its knowledge provides fundamental insights into how plants perceive and remember stressors, which is essential for the precise engineering of climate resilient crops. The institute states, that it is able to understand and mitigate global threats to human wellbeing by studying societal responses to climate.

Biodiversity & Pesticide Reduction

The institute aims to identify the chemical and molecular mechanisms underlying beneficial and antagonistic plant biotic interactions. Thereby, IGZ researchers provide the scientific basis for sustainable horticultural production systems in which pesticide and fertiliser inputs are reduced. This knowledge will support the implementation of biodiversity-supportive agrifood systems.

Healthy Nutrition & Food Security

The IGZ aims to unravel the mechanisms and processes of biosynthesis and degradation as well as biofunctionality of metabolites in plant-based food and study their effect on human health. The institute’s research investigates natural diversity as a resource of alternative food sources with the aim to enhance the nutritional quality of the human diet and planetary health. The generated knowledge contributes to sustainable and healthy agrifood systems that reduce hunger and malnutrition.

Resource-Efficient Agrifood Systems

The scientists study, design and model concepts for novel, low-input horticultural production systems that minimise the use of resources in both indoor and outdoor, controlled production

environments. The institute claims to contribute to the development of resource-efficient agri-food systems, which enhance resource efficiency, soil health, and food security.

The research is structured into **four Programme Areas (PA)**. Within each PA, two to three RGs contribute to the overarching topic of the respective PA and the research objectives of the institute.

PA Plant Adaptation (ADAPT): This PA contributes to the mechanistic understanding of regulatory networks that enable plants to adapt to their environment at the physiological and molecular genetic level. The work supports the institute's profile in basic plant science research and at the same time contributes to the development of climate-adapted and climate-friendly food systems.

PA Biotic Interactions (BIOTIC): This PA investigates the biotic interactions of microorganisms and insects with plants and the influence of the environment on these interactions. The knowledge gained contributes to the development of sustainable, environmentally friendly horticultural production systems with reduced resource inputs.

PA Plant Quality and Food Security (QUALITY): This PA characterises the biofunctionality of selected plant metabolites in plant-environment interactions and in human nutrition. In addition, ecological and socio-economic effects of vegetable production and consumption on food security are studied. In this way, this research contributes to linking aspects of sustainable plant cultivation with the utilisation of these plants as high-quality food.

PA Next-Generation Horticultural Systems (HORTSYS): This PA deals with the development of innovative management strategies for the sustainable use of resources in horticultural crops, climate-friendly cultivation systems, circular economy systems and the use of biological diversity in horticulture. The work strengthens the institute's profile in assessing the environmental relevance of horticulture and contributes to knowledge-based innovation in horticulture.

Results

Research

Between 2021–2023, IGZ researchers contributed to ø 127 publications per year, of which ø 69 (55 %) were published in peer-reviewed journals (see Appendix 2 for details).

IGZ refers to the following ten most important results since the last evaluation:

- Protein phase change in plant adaptation: Phase separation of the protein EARLY FLOWERING 3 (ELF3) occurs as a function of temperature and is driven by its prion-like domain (PrLD). The study determines the dynamics and molecular basis for phase separation using complementary structural, biophysical, and microscopy techniques. Changes in temperature trigger the formation of a condensed phase that shows increased molecular ordering. These results resolve the structure of different physical states for a key plant thermosensor. (*PA ADAPT*: PNAS; 2023)
- Thermomemory in *Arabidopsis*: The study indicated that the shoot apical meristem (SAM) has the ability to “memorise” previous stresses (thermopriming). Specifically, HSFA7b was identified as a crucial factor of the thermomemory network at the SAM. Furthermore, HSFA7b

regulates ethylene homeostasis at the SAM by controlling ethylene biosynthesis and signalling genes such as EIN3 to establish thermotolerance. (*PA ADAPT*: Plant Comm.; 2022)

- Local and systemic induction of root herbivore induced defences: Several studies showed that feeding by cabbage root fly larvae on *Brassica* roots induces the biosynthesis of glucosinolates, but also of structurally related phytoalexins, which target microbes. This led to the hypothesis that the plant's response to root damage is optimized to target both herbivores and soil pathogens. (*PA BIOTIC*; Phytochem. Rev.; 2023)
- Effect of farming practice on rhizosphere microbiomes and plant health (DiControl): The authors found that farming practices, e.g., tillage and N-fertilisation, influence composition of bulk soil and rhizosphere microbiota (*PA BIOTIC*; Phytobiomes J.; 2022)
- Effect of food processing and effects on human health: Reseachers found antioxidant plant compounds to affect thermal glucosinolate degradation mechanisms and studied different chemical degradation pathways of Isothiocyanates. Newly identified products were bioavailable and non-toxic. (*PA QUALITY*; Food Chem.; 2023)
- Effect of an integrated school garden and home garden intervention on anaemia among school-aged children in Nepal: In a cluster-randomized control trial, researchers discovered that even integrated school and home garden interventions are not sufficient to reduce anemia among school children. Incorporating behavioral change components around food and hygiene practices into integrated garden interventions is important to unlocking their health impacts. (*PA QUALITY*; Food Nutr. Bull.; 2023)
- UVB-induced metabolites in alternative food sources: Optimising UVB application, positively influences the valuable metabolite profile of halophytes, macroalgae and medusae (holobiont). In crickets, UVB-assisted cultivation induces an increase in protein and chitin content. From an ecophysiological perspective this demonstrates for the first time that targeted UVB manipulation increases macro and micro nutrient content, in crickets, macroalgae, and halophytes in a saline indoor cultivation system. This provides an approach to develop sustainable as well as natural functional foods. (*PA QUALITY*; J. Plant Physiol.; 2023)
- Effect of food processing and effects on human health: The research revealed antioxidant plant compounds to affect thermal glucosinolate degradation mechanisms and studied different chemical degradation pathways of Isothiocyanates. Newly identified products were bioavailable and non-toxic. (*PA QUALITY*; Mol. Nutr. Food Res.; 2023)
- Mapping and modelling of soil heterogenity: In order to manage nutrients in field conditions, the institute's expertise in mapping and modelling soil heterogeneity is used in soil process modelling on soil pH and economic yields. (*PA HORTSYS*; Precis. Agric.; 2021)
- Environmental impact assessment of local decoupled multi-loop aquaponics in an urban context: By modelling greenhouse production and combined systems, mathematical optimisation of the dynamic interactive processes in greenhouse dynamics and in indoor-farming was investigated. An aquaponics system model and experimental units were used to analyse the effects of water from a recirculating aquaculture system (RAS) on crop quality and growth in hydroponics. The methods were applied to decrease the environmental impact of various impact categories. (*PA HORTSYS*; J. Clean. Prod.; 2021)

Research Infrastructure

The IGZ has a research infrastructure with a broad spectrum of facilities from molecular labs to greenhouses and field premises. This infrastructure enables research from bench to practice. The infrastructure is available not only to IGZ staff, but can also be used by partners in joint research projects, and by staff of collaborating universities and research institutes, including partners in JointLabs; access by third parties not collaborating with IGZ staff is currently being explored. The Science Support Platform (SSP) that was established in the beginning of 2024, allows the institute's analytical infrastructure to gain higher efficiency and visibility, and to attract more research projects and collaborations.

Transfer

In 2023, IGZ researchers were involved in an invention resulting from the project *PermAFoG* that was transferred to a company partner who will file a patent and develop a product for market launch.

The major focus of IGZ knowledge transfer activities lies in the dialogue with public stakeholders and citizen science. These actors participate in the generation of research strategies, but also directly in innovation generation and co-creation processes. IGZ realises this by including stakeholder interaction modules in its research projects, and by establishment of, or their participation in, *Living Labs* as instruments to realise hands-on participation. The institute is the driving force in the Living Lab *zirkulierBAR* on sanitary revolution, and the Living Lab *Future Food* is under development for urban production of new food sources.

Besides companies and citizens, the institute addresses politicians and decision makers. With this particular focus, IGZ actively engages in the science-policy discourse to contribute to the public dialogue and provide the basis for evidence-based decision-making. IGZ research findings form the basis for policy briefs and recommendation papers, they contribute to standards development, legal frameworks or are leveraged in advisory boards.

3. Changes and planning

Development since the previous evaluation

Since the last evaluation the IGZ implemented the following **structural changes**:

- 10/2022: The new Scientific Director took over after the retirement her predecessor in 09/2022. She holds a W3 professorship in joint appointment with Friedrich Schiller University Jena.
- 01/2024: Establishment of the *Science Support Platform* (SSP, see chapter 2).

The organisational development and changes of the Programme Areas (PA) are listed below:

Programme Area ADAPT: established in 01/2017; renamed in January 2024, before: PA FUNCT. The head was jointly appointed in 06/2018 with the University of Potsdam and in cooperation with the *Max Planck Institute of Molecular Plant Physiology* (MPIMP).

- RG ADAPT.1 "Temperature Sensing in Plants": established in 01/2019. The RG was founded and is led by the head of the Programme Area.

- RG FUNCT.2 “Plant metabolism”: closed in 11/2022. The head was jointly appointed W2 Professor with the University of Potsdam and left the institute for a position outside academia but stayed on a limited contract (15 % regular working time) until the RG was dissolved by June 2024.
- RG ADAPT.JR “Stress and Development” (Junior Research Group): established in 05/2023. The head and a postdoc position are funded via institute’s budget.
- RG FUNCT.3 “Grafting and plant communication”: closed in 02/2022. The RG head retired.

Programme Area BIOTIC: established in 01/2017; renamed in January 2024, before: PA MICRO. The head leads the PA since its founding. She will retire by the end of 2024 (for future planning see below and chapter 5).

- RG BIOTIC.1 “Principles of integrated pest management”: established in 01/2017. The RG was founded and is led by the head of the Programme Area.
- RG MICRO.2 “Beneficial plant-microbe interactions” closed in 10/2023: The RG head retired.
- RG BIOTIC.2 “Plant biotic interactions”: established in 01/2023. The group was founded and was led by the new Scientific Director until 07/2024. In 08/2024 a new head joined the IGZ to take over the position as RG head. This change was implemented to allow the Scientific Director to dedicate more time to the strategic leadership of the IGZ. She will continue to be a member of the RG and co-supervise doctoral students.

Programme Area QUALITY: established in 01/2017. The head leads the PA since its founding and is Honorary Professor at the University of Hanover.

- RG QUALITY.1 “Plant Quality for Human Consumption”: established in 01/2017. The RG was founded and is led by the head of the Programme Area.
- RG QUALITY.2 “Food Chemistry and Human Nutrition”: closed in 12/2020. The head was jointly appointed Professor with University of Potsdam and left the institute to take over a W3 Professorship at the University of Bayreuth, but stayed on a limited contract (25 % regular working time) and the RG was dissolved end of June 2024.
- RG QUALITY.2 “Optimisation of Glucosinolate Degradation Pathways”: established in 01/2021. The group is led by the head of the former *Leibniz Junior Research Group* RG QUALITY1.JR (OPTIGLUP; 2018–2023), who was tenured as RG leader (see also chapter 5).
- RG QUALITY.3 “Economic Development and Food Security”: established in 06/2015. The RG was founded and is led by a scientist, who joined the IGZ. In 07/2022, he was jointly appointed to a tenured W2-Heisenberg Professorship at the Humboldt University of Berlin.

Programme Area HORTSYS: established in 01/2017. The PA is led by an acting head since 03/2018, who joined the IGZ in 11/2017 (for future planning see below and chapter 5).

- RG HORTSYS.1 “Open-Field Horticultural Systems”: established in 01/2017. The RG is led by a scientist since 10/2022. Before, a scientist led the RG from 2017 until her retirement in 2020 followed by the former Scientific Director, who retired in September 2022.

- RG HORTSYS.2 “Controlled Environment Horticultural Systems: established in 03/2018. The RG was founded and is led by the head of the Programme Area.

Based on its mission statements, the IGZ defined **strategic and operational goals** for its new research programme 2024–2029:

Strategic Goal 1 Leadership in horticultural research

The IGZ states that it is one of the few research institutes in Germany conducting horticultural research across the entire spectrum from basic plant sciences to production systems. According to the institute, this opens up the prospect of becoming a leading national research institute in this area and a highly attractive cooperation partner worldwide.

Strategic Goal 2 Excellence in research

In order to live up to its leadership role in horticultural sciences, the IGZ aspires to conduct excellent research in order to advance the knowledge of sustainable and resilient plant-based agricultural systems. Therefore, the institute has implemented support measures including the establishment of a Science Support Platform (SSP), which unlocks state-of-the-art omics technologies to all RGs as well as to national and international collaborators.

Strategic Goal 3 Knowledge and Technology Transfer

The IGZ implements knowledge and technology transfer and will continue and expand its efforts over the next five years. As laid out in the IGZ Knowledge and Technology Transfer Strategy, the IGZ implements formats for technology transfer, including participatory dialogues and co-creation processes. The target for the next period will be to strengthen transfer in research-based collaborations with industry, knowledge exchange between various stakeholders, science dialogues with public participation, and citizen science projects.

Strategic Goal 4 Next-Generation Researchers

According to IGZ, the institute aims to support early-stage researchers (ESRs) in their development as laid down in the IGZ Postdoctoral Strategy and embed them in a productive and dynamic environment with a suitable balance between junior and senior researchers (see chapter 4 and 5).

Operational Goal 1 Third-party funding acquisition

The IGZ has defined a Third-Party Funding Strategy in 2024 which specifies that the third-party funding volume should cover at least 30 % of the total IGZ budget. Third-party projects will also include industrial or societal stakeholders as cooperation partners.

Operational Goal 2 Publication record

The IGZ defined a Publication Strategy in 2023 to support continued successful publication. The operational goal of the IGZ is to publish 2.5 peer-reviewed papers per FTE research scientist per year, excluding doctoral candidates. The IGZ encourages and funds open access publications.

Operational Goal 3 Culture of open and participatory science

To promote the transfer of knowledge and technology, the IGZ is increasingly relying on target group-specific dialogue and participation processes that include all relevant stakeholders. In

addition, the IGZ strongly supports participation in Living Labs as instruments for testing practical and societal outcomes of IGZ research.

Strategic work planning for the coming years

As a consequence of the institute's recent scientific and strategic development, the IGZ decided to change its name into "Leibniz Institute for Horticultural Sciences (IGZ)/Leibniz Institut für Gartenbauwissenschaften (IGZ)". The institute intends to implement this new name in 2025.

To implement the strategic and operational goals of the IGZ, the institute has outlined a strategic roadmap that comprises four strategic fields of action: scientific excellence, transfer & transformation, building alliances and next-generation scientists.

For the coming years, the institute outlines the following structural changes at leadership level:

- 2025: The head of RG BIOTIC.1 "Principles of Integrated Pest Management" will retire. The IGZ plans to advertise the position in 01/2025 as joint professorship with the HU Berlin (W2) on the topic of plant-soil-microbiome interactions for sustainable horticultural production systems.
- 2025/2026: Advertisement of a W2 professorship to establish a new RG in the PA HORTSYS. The joint appointment is planned with HU Berlin, Eberswalde University for Sustainable Development (HNEE) or the FU Berlin.

Additionally, the IGZ plans to establish two Junior Research Groups:

- 2024: A JRG on the topic of science-based sustainable farming practices in open field cultures together with HNEE. The advertisement for this position was issued in June 2024 and the interviews took place in August 2024.
- 2029: A JRG "Social impact of urban indoor farming" is to be set up as part of the plans for an application for additional funds deriving from institutional funding (see below).

Planning for additional funds deriving from institutional funding

In order to strengthen competence and expertise of the IGZ especially towards its strategic goal of "Knowledge and technology transfer" and towards the operational goal "Culture of open and participatory science" the institute plans to expand its structure by a **fifth Programme Area on *"Sustainable Transformation of Agrifood Systems (STARS)"***. This PA will focus on identifying trans- and interdisciplinary transformation pathways towards sustainable plant-based agrifood systems. A particular research focus will be on the knowledge, attitudes and practices of producers, consumers, and policy makers towards innovations for sustainable agrifood systems. The institute aims to apply for additional institutional funding to establish PA STARS that will comprise two RGs and one JRG:

- The new RG SoConsum ("Socio-economic effects of changing consumption patterns and diet choices") (1 head – E-14 TVL, 2 postdocs – E-13 TVL, 2 doctoral students – E-13 TVL [65 %]) will focus on the analysis of socio-economic effects of changing consumption patterns and diet choices, e.g., towards plant-based diets and planetary diets, in particular changes caused by the increased consumption of alternative foods (from orphan, indigenous plants to underutilised marine organisms).

- Incorporation of the current RG QUALITY.3 (1 head – W2 professorship, 2 postdocs – E-13 TVL, 2 doctoral students – E-13 TVL [65 %]) into the PA STARS to become RG FoodSecur ("Economic development and food security"), which will be an excellent complementary match with the research in the new PA.
- The new JRG SoFarm ("Social impact of urban indoor farming") (1 head – E-14 TVL, 2 postdocs – E-13 TVL, 2 doctoral students – E-13 [65 %]) will analyse the challenges and opportunities of novel production methods aimed at creating local and sustainable plant-based diet systems.

According to IGZ, this strategic change will strengthen the social science research and will better integrate this research with the natural sciences-based research on plant nutritional quality. For that purpose, the IGZ plans also to establish a **new RG in PA QUALITY** (1 head – E-14 TVL, 2 postdocs – E-13 TVL, 2 doctoral students – E-13 [65 %], 2 science support staff – E-9 TVL), which will focus on the nutritional value of novel food sources such as underutilised organisms that can be cultivated for consumption, e.g. algae.

Together, the research of the new RG in QUALITY and those in STARS will cover the full range from the production, consumption and quality assessment to the societal and economic aspects of taking up novel, sustainable and healthy foods in the agrifood system.

Overall, 22 additional staff members are to be financed, amounting to personnel costs of 1.925 k€ for each year. In addition, the institute plans approximately 600 k€ p.a. for infrastructure/consumables. In total, IGZ calculates an additional institutional funding of 2.24 M€ from 2029 on. The General Assembly has agreed to propose the planning for an "extraordinary item of expenditure" in the evaluation.

„Extraordinary item of expenditure": summary of funds planning

	2029	2030	2031	2032	Permanently
Own funds + additional funds = „extraordinary item of expenditure"	*2,525 k€*	*2,525 k€*	*2,525 k€*	*2,525 k€*	*2,525 k€*
Own funds from existing funding by institution (at least 3 % of core budget)	*285 k€*	*285 k€*	*285 k€*	*285 k€*	*285 k€*
Additional funds of institutional funding	*2,240 k€*	*2,240 k€*	*2,240 k€*	*2,240 k€*	*2,240 k€*

4. Controlling and quality management

Facilities, equipment and funding

Between 2021 and 2023 the institute's budget amounted to ∅ 12.1 M€ p.a, of which 8.4 M€ came from institutional funding.

In the same period, revenues from project grants were ∅ 3.8 M€ p.a. (31 %). Of these, an average of annually 2.6 M€ was obtained from Federal and Länder governments, 465 k€ from the EU, 455 k€ from the Leibniz Association, 105 k€ from the DFG, and 80 k€ from Industry.

For an overview of IGZ's revenue and expenditure, see appendix 3. The revenues in the years 2021–2023 are mainly derived from acquisitions in previous years. In this context, the IGZ states, that the acquisition of third-party funded projects for the coming years has increased. Between 2021–2023 on average 5.8 M€ p.a. of third-party funding was acquired, thereof ∅ 1 M€ p.a. each in competitive procedures of the DFG and EU.

There is an increase of miscellaneous revenues from 2.6 M€ in 2021 to 5.1 M€ in 2023 (see appendix 3). For the years 2021 and 2022, the state of Brandenburg has agreed to spend institutional funding in the following year (financial resources which are designated as *Selbstbewirtschaftungsmittel* or that are deposited as cash balance at the institute, in German *Kassenbestand*). These financial resources were put aside for the establishment of PA Bioinformatics and the imminent change in directorship. With the implementation of the new strategies and structures, e.g., Science Support Platform (SSP), the institute expects that these reserves will be structurally reduced by 2025.

The available space in the IGZ building amounts to 880 m² including rooms for laboratories and offices, analytical equipment and sample preparation, clean benches, plant growth chambers and IT infrastructure. According to the IGZ, these spatial capacities are increasingly limited. The institute requires infrastructural expansion in the form of a new multi-functional building since the number of scientific and science supporting staff have been increasing due to higher third-party funding acquisitions and the ambition to become a leader in sustainable and resilient agri-food systems. The institute states, that novel research projects and formats, such as Joint and Living Labs, focussing on interactive, collaborative work in a multi-actor setting, make meeting and testing rooms, debriefing spaces, as well as co-working rooms with real and digital prototypes necessary. Additionally, the demand for the processing and analysis of large datasets requires space for the installation of a High-Performance Computing Cluster (HPCC).

According to the institute, the IGZ hosts experimental facilities that enable state-of-the-art plant, phytonutrient and horticultural research supported by expert staff. The facilities range from labs equipped for molecular and chemical analyses via growth chambers as well as greenhouses and experimental fields. Some of the laboratories, plant growth chambers and greenhouses are certified for working under security level conditions, partly up to S2-level. For the coming years, the institute aims for the infrastructure to be extended and upgraded in the form of a new building with facilities tailored to host this infrastructure.

Organisational and operational structure

The IGZ is a registered non-profit organisation. Its bodies are the General Assembly (GA) and the Executive Board (EB). The IGZ is headed by the Scientific Director and the Head of Administration. Together with two Deputy Directors they form the EB that manages the institute in accordance with the Statutes and the Rules and regulations of the IGZ. The EB reports to the General Assembly and receives scientific-strategic advice from the Scientific Advisory Board.

The scientific work is performed in Research Groups (RG) and one Junior Research Group (JRG) that are structured in four thematical Programme Areas with up to three RG each. The RG heads and the EB meet monthly to discuss the institute's strategic and managerial processes.

The Scientific Director and/or Head of Administration have monthly meetings with the Work's Council and Equal Opportunities Officer to discuss structural changes, work safety, work time registration, home office regulations, or employee well-being. Every six months, the EB and the Work's Council jointly invite all IGZ employees to an institute's meeting informing the entire staff about strategies, activities and decisions to ensure transparent information flow.

The Scientific Director has regular meetings with the doctoral candidate and postdoc representatives as well as biweekly meetings with the science management team for information exchange and activity planning. Moreover, the Head of Administration organizes jour fixes with the staff every second week.

The Science management team supports board and committee meetings, strategy development, facilitates funding acquisition and knowledge transfer, internal communication, press and outreach activities, and coordinates career development programmes as well as sustainability measures. A third-party funding expert completes the current science management team.

Quality Management

In 2021, the IGZ updated its regulations to ensure good scientific practice following the guidelines of the DFG and the Leibniz Association.

The IGZ also adopted *"Guidelines for Corruption Prevention"* in 2015 that is safeguarding ethical and legal principles along the entire spectrum from research to administration.

In 2023, the IGZ implemented a new *Publication Strategy*. The institute prioritises Open Access publications (preferably under Gold Open Access), and centrally funds Open Access publications. Between 2021–2023, the IGZ has published around 97 % of its scientific, peer-reviewed journal articles open access. The institute also signed contracts with publishers via the DEAL agreement.

In addition, IGZ researchers are encouraged to use pre-print options in public repositories such as *bioRxiv* or *Zenodo*, as well as the open sharing of datasets in public repositories not included in publications. IGZ is also committed to sharing research results with and transfer knowledge to society and thereby aims to publish in high quality public media.

The IGZ has defined a *Third-Party Funding Strategy* in 2024 which specifies that the third-party funding volume should cover at least 30 % of the total IGZ budget. Third-party projects should also include industrial or societal stakeholders as cooperation partners, thereby supporting knowledge and technology transfer. The institute strives for a balanced portfolio of funders to cover the entire spectrum from basic to applied research.

In 2024, a new *Transfer Strategy* was implemented that specifies how technology transfer and knowledge sharing is achieved. One new element are LivingLabs that the institute established.

The lab-based research infrastructures for proteomic and metabolomic analyses are now combined in the *Science Support Platform* (SSP). These facilities are maintained and operated by a team of expert researchers and technicians. The SSP will develop a strategy, including rules and guidelines regarding use, training and co-authorships. A similar strategy will also be pursued for the greenhouse and field facilities.

The institute developed Guidelines for Research Data Management that define the actors, responsibilities, processes, duties and rights for handling data as a result of the research process. In 2024, the IGZ applied to become a full partner in NFDI *FAIRagro*, which is coordinated by the Leibniz Institute ZALF.

The IT department implemented an IT security concept. This includes measures such as monitoring data traffic, continuous assessment of system integrity and security, in particular regarding all kinds of threats, and system compartmentalisation. In addition, the IT team organises trainings to raise awareness among the IGZ staff. The IGZ participates in an agreement between the Leibniz Association and an incident response support provider.

The institute plans to introduce the system of performance-based funding allocation (LOM) in 2025 at the earliest. Currently, funds are allocated internally according to the FTEs of researchers working in the research groups or according to the appointment commitments.

Quality management by advisory boards and supervisory board

The Science Advisory Board (SAB) advises the Executive Board and the General Assembly on scientific matters, in particular with regard to the program budget. The members are appointed by the General Assembly (see below) for four years and one consecutive reappointment is possible. It consists of up to ten external experts covering IGZ's major fields of activity. Out of the current nine members, five are women and three are from abroad. The SAB meets at least once a year and conducts an audit between evaluations. The last audit took place in 2023.

The General Assembly (GA) consists of the members of the Association. Full members are two representatives of the federal government (BMEL and BMBF) and the State of Brandenburg (MWFK and MLUK) each, as well as one delegate of the Humboldt University of Berlin, the University of Potsdam, the German Horticultural Association, and the German Society for Horticultural Science. The SAB chairperson is non-voting member. The GA is responsible for all fundamental matters of the Association. It determines the guidelines of the activities of the association and supervises the Executive Board. The GA meets twice a year.

5. Human Resources

As of December 31st, 2023, IGZ had 114 employees, thereof 54 in research and scientific services (plus 3 scholarships recipients), 39 in services and 10 in administration (including facility management). These persons are supported by 7 student assistants and 1 trainee (see appendix 4).

Leading scientific and administrative positions

The Scientific Director is jointly appointed with the Friedrich Schiller University Jena (W3). Additionally, two heads of Research Groups are jointly appointed with the University of Potsdam (W3) and Humboldt University of Berlin (W2 Heisenberg Professorship). Furthermore, one honorary professor is appointed with the University of Hanover.

Appointment procedures for leading scientific and administrative staff follow the standards of the Leibniz Association. Cooperation agreements with the Friedrich Schiller University Jena,

University of Potsdam, Humboldt University of Berlin and TU Berlin regulate joint appointment procedures.

These leading scientists hold professorships at universities:

- 06/2018: Recruitment of the head of RG ADAPT.1, who holds a W3 professorship in joint appointment with the University of Potsdam.
- 10/2022: Appointment of the new Scientific Director. She has been holding a W3 Professorship at the University of Jena since 2014. The former Scientific Director retired by 09/2022. He had been a W2 professor at HU Berlin.
- 07/2022: The head of RG QUALITY.3 "Economic Development and Food Security" was jointly appointed to a tenured W2-Heisenberg Professorship at the Humboldt University of Berlin.

The following joint appointments are planned in the upcoming years:

- 10/2024: The head of RG QUALITY.2 "Optimisation of Glucosinolate Degradation Pathways" obtained a five-year grant from the *Leibniz Programme for Women Professors*. The funds can be utilised if a joint appointment procedure with TU Berlin is successfully completed (expected in October 2024). From 2029 onwards, the position will have to be financed from the IGZ budget in case of a permanent appointment. The previous head of RG QUALITY.2 "Food Chemistry and Human Nutrition" held the W2 Professorship for Food Analytics of Secondary Plant Metabolites at the University of Potsdam, to take over a W3 Professorship at the University of Bayreuth.
- 01/2025: Advertisement of the position as head of RG BIOTIC.1 "Plant-microbiome interactions", which will be filled for the first time in joint appointment with the HU Berlin (W2). The background is the retirement of the head by the end of 2025.
- 2025/2026: Advertisement of a W2 professorship to establish a new RG focussing on sustainable horticultural field production systems in the PA HORTSYS. The joint appointment is planned with HU Berlin, Eberswalde University for Sustainable Development (HNEE) or the FU Berlin.

Staff with a doctoral degree

As of December 31st, 2023, the IGZ employed 32 researchers in non-executive positions. Thereof, 15 scientists were in the postdoc phase, of whom 53 % are international.

In 2023, a *Strategy for postdoctoral career development* was implemented. Important elements of the strategy are mentoring and regular structured feedback meetings.

The IGZ considers three main career paths in its strategy:

1. The **project-based career path** covers postdocs on temporarily funded projects. At the IGZ, these postdocs are supported in the development of methods and competences, as well as in submitting their own applications for their own funding. They supervise bachelor and master students, and receive mentoring and feedback on their performance in relation to their preferred career path.

2. The **Junior Research Group leader** position allows ESRs to develop an independent research agenda. Commonly these positions are funded up to six years, and include a mid-term evaluation. At the IGZ, candidates will be supported to acquire competences essential for a career in academia. These include supervision and science management skills as well as support in writing proposals for funding acquisition for their own research. Active participation in outreach and committees as well as functions within the IGZ is expected.
3. **Infrastructure researchers** are scientists with a PhD degree aiming at a career as an infrastructure expert (infrastructure postdocs; see also Leibniz Association Career models in research infrastructures). At the IGZ, this track applies to a limited number of permanent positions, in particular in the SSP (see chapter 2). These researchers develop and maintain expertise on state-of-the-art technology and research infrastructure at the IGZ to support institute-wide research projects, besides developing own research lines in one of the RGs. These postdocs are supported to develop skills on infrastructure technology, project management, data management and teaching. They also actively participate in the acquisition of funds for the infrastructure and collaborative grants as well as co-author publications.

An Early Career Coordinator monitors the implementation of the strategy for all postdoctoral researchers. There are also two elected postdoc representatives. Since the last evaluation, four scientists left IGZ for positions at higher education institutions in Germany and Australia.

Doctoral Candidates

As of December 31st, 2023, there were 13 doctoral researchers employed at IGZ and two scholarship recipients (see appendix 4). Between 2021 and 2023, eight doctorates have been completed with an average duration of 5.1 years (median 4.7 years).

The IGZ usually complements the contracts of doctoral candidates on three-year third-party funded contracts with a fourth year funded by the IGZ budget. In addition, doctoral students that incurred delays due to the COVID-19 pandemic, received a three-months contract extension. The institute also provides contract extensions to doctoral candidates that take maternity and parental leave.

As part of the IGZ Graduate Student Programme, which was established following the recommendations of the previous evaluation, each doctoral candidate is advised by a main supervisor and two other researchers. This is fixed in a PhD Agreement that is signed by the doctoral candidate and his/her supervisors. It specifies the responsibilities of both the doctoral candidate and the supervisors.

The Early Career Coordinator together with the two elected doctoral student representatives are responsible for further developing and monitoring the doctoral Programme. The first focus will be the development of a regular training programme using the in-house expertise on topics demanded by doctoral candidates, e.g., training in chemical or molecular analyses, experimental design and statistics. This programme is complemented by soft skill seminars. Another topic that will be a prime focus for the Early Career Coordinator will be mental health, e.g. by providing self-management and communication trainings, access to psychological counselling and Mental Health First Aid trainings. Since 2023, the IGZ allocates budget (10k € per year) to training of early-stage researchers, e.g., for courses or retreats. In 2023, an “Active bystander

training" providing skills to challenge unacceptable behaviours was organised for doctoral students. The institute plans to establish an alumni network for doctoral and postdoctoral researchers.

Science supporting staff

IGZ offers vocational training for chemical and biological laboratory technicians. The last 2 trainees completed their training in 2020. Due to the COVID-19 pandemic, the IGZ has not opened the application process for new trainees because adequate supervision could no longer be guaranteed. The institute plans to offer positions again in 2025. The institute also offers traineeships for IT specialists for system administration (one completed in 2024).

The institute provides funds for training measures for both scientific and non-scientific staff. Over the last years, the IGZ funded training for scientists and technical staff in ion chromatography and device maintenance for mass spectrometry and other instruments for lab analytics. Science support staff is demanded to regularly attend training on relevant issues of their daily work to be up-to-date with new regulations and practices, such as intellectual property protection, patenting processes as well as social media use. Furthermore, the IGZ financially supports course fees for German and English language courses.

Equal opportunities and work-life balance

As of December 31st, 2023, out of 54 employees in "Research and scientific services" (see appendix 4) 30 were women (56 %). The Scientific Director and two Deputy Scientific Directors are women and the Head of Administration is a man. Out of 4 heads of Programme Areas 2 were female (50 %). Out of 9 Research Group and Junior Research Group leaders 4 were women (44 %). Among the 32 scientists in non-executive positions were 20 women (63 %). Of the 13 employed doctoral researchers and 2 doctoral scholarship holders 5 were female (33 %).

The institute has established target quotas for scientific personnel (Kaskadenmodell). An equal opportunities officer (EOO) and a deputy are elected from among the female staff members. Their tasks and rights are defined in the IGZ "Equal Opportunities Implementing Agreement" (2006). The EOO regularly reports to IGZ's committees and informs IGZ staff in a monthly newsletter and intranet.

The relevant internal documents and all internal communication are available in German and English. In addition, for institute meetings ("*Institutversammlungen*"), which are usually held in German, the IGZ provides professional simultaneous translation into English.

To support IGZ employees in balancing work and family life the institute offers flexible working models, a (grand)parent-child room and regular employee appraisals. Furthermore, guidelines for scientific staff career development and career strategies for doctoral students and postdocs were developed. In 2022, the institute newly established a gender equality plan and was re-certified by the audit *berufundfamilie*.

6. Cooperation and environment

Cooperation with universities

Collaboration with universities is pursued through joint appointments (see chapter 5).

In 2018, the IGZ initiated collaborations with several faculty members and Heads of Brandenburg Technical University (BTU) in Cottbus. This resulted in IGZ´s participation in the programme “Landinnovation in der Lausitz” (LiL) for the BMBF programme “WIR!” followed by the acquisition of two collaborative research projects: “InnoWild” in 2021, and “InnoWert” in 2023.

IGZ scientists contribute to university teaching and offer lectures on scale of 115 semester weekly hours, e.g. at HU Berlin, TU Berlin, University of Potsdam, University of Bayreuth, FSU Jena and University of Hanover.

To support doctoral students, the IGZ participates in IMPRS, the *International Max Planck Research School* "Primary Metabolism and Plant Growth" in Potsdam Golm. The Scientific Director is a faculty member of the *International Max Planck Research School* "Chemical Communication in Ecological Systems" in Jena. In addition, there are two doctoral candidates affiliated with yDiv, the graduate school of iDiv, the German Centre of Biodiversity Research, Halle-Jena-Leipzig. Additionally, the Scientific Director submitted a proposal for a *Research Training Group* (Graduiertenkolleg) entitled “Reciprocal effects of phyllosphere microbial communities and plants” (UniPhyD) together with FU Berlin.

The IGZ cooperates within collaborative research projects. These include:

- DFG-funded *Research Unit FOR 3000* - “Ecology and Evolution of Intraspecific Chemodiversity of Plants” This consortium joins researchers from the universities of Bielefeld (Speaker), Jena, Kiel, Marburg, Stuttgart, Munich, the Helmholtz Centrum Munich and the IGZ (since 2020).
- *Collaborative Research Centre 1644* “Phenotypic plasticity in plants: Mechanisms, constraints and evolution” together with partners at University of Potsdam, HU Berlin, Max Planck Institute of Molecular Plant Physiology and Hasso Plattner Institute in Potsdam as well as University of Cologne, Cologne (since 2024).
- Within the BMBF programme "Agricultural systems of the future” the IGZ leads and coordinates the project “food4future (f4f)". This comprises a consortium of Leibniz Institutes (ATB, ZMT, and DIfE), universities (HU Berlin, FU Berlin, and Technical University of Applied Sciences Wildau), as well as the Fraunhofer Institute of Applied Polymer Sciences.
- In addition, the IGZ, together with ZALF, received funding to manage the central coordination office of the eight consortia funded by “Agricultural systems of the future”. This involves coordination of 50 German institutions from academia, industry and other organisations (funding until 2028).
- On the European level, the IGZ participates in the Horizon Europe-funded projects, *ECO-NUTRI* and *P2GreeN*. Both projects started in 2022 and involve 30 international partners from 13 countries each.

Cooperation within the Leibniz Association

The IGZ is an active member of eight Leibniz research networks, e.g. "Biodiversity", "Green Nutrition - Healthy Society", "Immune-Mediated Diseases" and "Mathematical Modelling & Simulation (MMS)". Furthermore, it is associated partner in the research network "INFECTIONS in an urbanising World - Humans, Animals, Environments". In 2020, the IGZ acquired the 3-year project "KETCHUP" in the Leibniz Cooperative Excellence programme. This project was a collaboration with the Leibniz institutes IPK in Gatersleben and IPB in Halle.

In 2023, the Leibniz Association launched the "Leibniz Labs (LL)" initiative. These consortia aim to address current societal topics and transfer the results to stakeholder groups. The IGZ is partner and work-package co-lead in the LeibnizLab “Systemic Sustainability”, which is comprised of 41 Leibniz Institutes.

Joint Labs and Living Labs

JointLabs are an instrument to intensify cooperation with universities and other institutions and to promote knowledge transfer, science-public dialogues and citizen science. In JointLabs, researchers from different institutions form an interdisciplinary Research Group on a common research topic. The institute participates in the JointLab “PhaSe - Phytochemistry and biofunctionality of secondary plant metabolites” (since 2018 with UP and Leibniz Institute DIfE) and "Zero Hunger Lab" (since 2023 with HU Berlin)

The Living Lab “zirkulierBAR” on sanitary revolution was established together with HNEE. This Living Lab facilitates transfer and citizen participation; a second Living Lab on Future Food is currently under development for urban production of new food sources.

Joint publications with international partners

On an international level, the institute highlights publications in co-authorship (2021-2023: 57 countries) with institutions from the UK, Netherlands, Denmark, Austria, Italy, France, Spain, Switzerland and others within Europe. Furthermore, there is a high number of joint publications with institutions in the USA and Latin America.

Institution’s status in the specialist environment

According to IGZ, the institute’s focus on horticultural sciences, spanning from molecular and chemical plant biology, via food quality to sustainable horticultural production systems is unique in the German research landscape.

On a national level, the institute names *Hohenheim University Stuttgart* and *University of Applied Sciences Osnabrück* that conduct fundamental research, combined with teaching and transfer to practitioners, thereby focussing on selected aspects. On a European level, the IGZ identifies the *National Research Institute for Agriculture, Food, and Environment* (INRAE, France), *Wageningen University and Research* (WUR, Netherlands), and the *Swedish Agricultural University* (SLU) as leading institutions in its scientific environment.

7. Subdivisions of IGZ

Programme Area "Plant Adaptation" (ADAPT)

(11.4 FTE, of which 7.2 FTE Research and scientific services, 3 FTE Doctoral candidates, and 1.2 FTE Service staff)

The PA "Plant Adaptation" (ADAPT) aims to understand how plants perceive changes in their environment and integrate this information to adjust their growth and development. This inquiry is pivotal for answering fundamental scientific questions regarding the perception of temperature difference by cells, the integration of diverse signalling pathways in space and time and the adaptation of signalling networks to diverse climates. Moreover, it holds significant potential for practical applications, e.g. understanding these processes is crucial for developing crops that are resilient to climate change. It is estimated that each additional 1°C of global warming will reduce yields of many staple crops by approximately 10 % due to thermal stress. By addressing this research in the model plant *Arabidopsis thaliana* as well as horticulturally relevant plants such as tomato and potato, the PA aims to foster advances in the breeding of climate-resilient crops. Consequently, the obtained research results mainly contribute to the IGZ mission "Climate Change".

Hotter temperatures impact plant productivity via two major pathways: heat stress and thermomorphogenesis. While these pathways are often considered separately, the PA find that full understanding of thermal resilience requires an understanding of the tissue and developmental context in which it occurs, while there is also cross-talk between the traditional heat stress pathway and thermomorphogenesis. The researchers focus on understanding how plants perceive and remember these stress signals, particularly in the context of development. The research has led to the discovery of several temperature sensors. The PA highlights the significance of metabolic signalling and carbon status in the heat shock response at the shoot apical meristem (SAM). The identification of thermosensory pathways, and how these integrate into key plant processes such as light signalling and the circadian clock provides a key area for further understanding important concepts in plant biology.

The PA ADAPT consists of one Research Group (RG) and one Junior Research Group (JR):

- RG ADAPT.1 "Temperature Sensing"
- RG ADAPT.JR "Stress and Development"

Between 2021 and 2023, this PA published 11.7 papers on average per year (40 % in peer-reviewed journals). Out of these, an average of 4.7 were co-authored with other subdivisions. Additionally, in the same period 7 monographs were published. Its third-party revenues totalled 816 k€ on average per year. Third-party funding mostly comes from the Leibniz-Association (⌀ 309 k€), the EU (⌀ 291 k€), federal and Länder governments (⌀ 172 k€) and the DFG (⌀ 41 k€). Three doctoral degrees were completed.

Programme Area "Biotic Interactions" (BIOTIC)

(16.8 FTE, of which 10.8 FTE Research and scientific services, 3 FTE Doctoral candidates, and 3 FTE Service staff)

The research in the PA “Biotic Interactions” (BIOTIC) aims to identify the chemical and molecular mechanisms of interactions between plants and aboveground and belowground organisms. The research focuses on the role of plant-associated microbiomes in plant health and metabolites as mediators of plant interactions with herbivores, natural enemies and pollinators. It thereby considers how changes in abiotic conditions, such as drought, may impact these interactions. For that purpose, the PA studies bioactive compounds and enzymes that act directly or indirectly against phytopathogens and pests. Moreover, the researchers identify genetic and metabolic markers with their corresponding candidate genes, proteins and metabolites and study the function of plant-health promoting microbes. This research supports the breeding of crops with enhanced resistance and the development of novel, environmentally friendly biopesticides. The research results in this PA contribute to the development of sustainable horticultural production systems with low pesticide and fertiliser inputs.

The research in the RG BIOTIC.1 mainly focuses on interactions between plants and microbes, including the application of beneficial microbes in plant production systems. The research in the RG BIOTIC.2 focuses on the role of (volatile) plant metabolites and the genes coding for their production in aboveground and belowground biotic interactions, in particular with insect herbivores and nematodes. The research of this PA mainly contributes to the IGZ mission “Biodiversity & Pesticide Reduction” as well as to the mission “Climate Change”, because abiotic stressors may impact plant responses to biotic interactions. The mission “Resource Efficient Agrifood Systems” benefits from the knowledge on novel plant protection strategies. The aim of developing environmentally friendly plant protection strategies contributes to the IGZ mission “Healthy Nutrition & Food Security” by providing healthy, pesticide free and diverse plant-based food.

The PA BIOTIC consists of two Research Groups (RG):

- RG BIOTIC.1 “Plant-Microbe System”
- RG BIOTIC.2 “Stress and Development”

Between 2021 and 2023, this PA published 36.3 papers on average per year (31 % in peer-reviewed journals). Out of these, an average of 11.3 were co-authored with other subdivisions. Additionally, in the same period 10 monographs were published. Its third-party revenues totalled 963 k€ on average per year. Third-party funding mostly comes from federal and Länder governments (⌀ 894 k€) the Leibniz-Association (⌀ 45 k€), the DFG (⌀ 15 k€) and the EU (⌀ 10 k€). Three doctoral degrees were completed.

Programme Area “Plant Quality and Food Security” (QUALITY)

(24.4 FTE, of which 12.9 FTE Research and scientific services, 3.3 FTE Doctoral candidates, and 8.2 FTE Service staff)

The overall aim of the PA “Plant Quality and Food Security” (QUALITY) is to generate interdisciplinary knowledge on plant-human interactions grounded in life sciences and social sciences. It works on the interface of (alternative) food sources, human nutrition, recycling of human biowaste and food security, thereby deriving research-based recommendations for sustainable plant-based agrifood systems and the IGZ vision of “One Healthy Planet for All”. This will be realised by working at multiple links between plants and humans. The researchers study how

(alternative) food sources both depend on but also result in healthy human nutrition, nutrient recycling of human sanitary waste and nutritional food security for all. The focus lies on the genotypic and metabolic diversity, and targeted influencing of metabolites in plants through the alteration of physiological processes *in planta*.

The PA aims to decipher underlying regulatory and behavioural mechanisms, including along the food supply chain. This enables the researchers to outline the bio-functionality of selected metabolites in both plant-environment interaction and in human nutrition by establishment of state-of-the-art analytical methods (RGs QUALITY.1 & QUALITY.2). For closing the loop and thus for circular horticultural production the PA recovers nutrients from human sanitary waste and converts them into novel recycling fertilizers (RG QUALITY.1). In addition, the mechanisms and roles of vegetable production and consumption on food and nutritional security and livelihoods are analysed, including in developing and vulnerable settings (RG QUALITY.3).

The PA thus primarily contributes to the IGZ specific mission “Healthy Nutrition & Food Security”. Regarding the integration of recycling fertilizers from sanitary wastes and the establishment of new indoor farming systems the research is interlinked to the specific mission “Resource-Efficient Agrifood Systems”. In evaluating the potential of plant secondary metabolites for sustainable plant production it also contributes to the specific mission “Biodiversity & Pesticide Reduction”. The analysis of how food security responds to climate change and which role plant metabolites have in plant adaptation relates to the specific mission “Climate Change”.

The PA QUALITY consists of three Research Groups (RG):

- RG QUALITY.1 “Plant Quality for Human Consumption”
- RG QUALITY.2 “Optimisation of Glucosinolate Degradation Pathways”
- RG QUALITY.3 “Economic Development and Food Security”

Between 2021 and 2023, this PA published 39 papers on average per year (65 % in peer-reviewed journals). Out of these, an average of 7.3 were co-authored with other subdivisions. Additionally, in the same period 8 monographs were published. Its third-party revenues totalled 1.2 M€ on average per year. Third-party funding mostly comes from federal and Länder governments (⌀ 1.06 M€), the Leibniz-Association (⌀ 93 k€), and the DFG (⌀ 48 k€). One doctoral degree was completed.

Programme Area “Next-Generation Horticultural Systems” (HORTSYS)

(13.1 FTE, of which 9.3 FTE Research and scientific services, 1.3 FTE Doctoral candidates, and 2.5 FTE Service staff)

The aim of PA “Next-Generation Horticultural Systems” (HORTSYS) is the development of innovative management strategies for the sustainable use of resources and adaptation to climate change by using model-based decision support systems (DSS) for horticulture. Thereby, the researchers use modelling approaches, algorithms, modelling tools, and sensor techniques to optimise plant growth and to describe the interactions between plant and environment. One main goal is the development of DSS and tools for applications in horticultural production. For this, the PA cooperates with the respective horticultural industry, supporting associations, NGOs, as well as local and national governments.

The focus of RG HORTSYS.1 is on the development of innovative crop and soil management strategies for the sustainable use of resources and for adaptation to climate change. The research approaches range from basic investigations on pot, plot and field scale to applied research to be transferred into horticultural and agricultural practice. In RG HORTSYS.2 the focus is on resource optimisation of plant production in climate-controlled environments such as greenhouses and indoor farms. The group works on solutions to increase the efficiency of energy, water and nutrient use through systems thinking, IT and technology.

The research of the PA contributes to the IGZ specific missions “Resource-Efficient Agrifood Systems” and “Climate Change”, as well as “Healthy Nutrition & Food Security”. It has the potential to contribute to multiple United Nations Sustainable Development Goals (SDGs) especially “improved nutrition and promote sustainable agriculture” (SDG2), ”sustainable cities and communities” (SDG11), and ”climate action” (SDG13).

The Programme Area consists of two Research Groups (RG):

- RG HORTSYS.1 “Open-Field Horticultural Systems”
- RG HORTSYS.2 “Controlled Environment Horticultural Systems”

Between 2021 and 2023, this PA published 33.7 papers on average per year (54 % in peer-reviewed journals). Out of these, an average of 7.3 were co-authored with other subdivisions. Additionally, in the same period 20 monographs were published. Its third-party revenues totalled 763 k€ on average per year. Third-party funding mostly comes from federal and Länder governments (⌀ 485 k€), the EU (⌀ 160 k€), Industry (⌀ 78 k€) and other sponsors (⌀ 31 k€). Two doctoral degrees were completed.

8. Handling of recommendations from the previous evaluation

IGZ 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 31 March 2020, pages B-3/B-4):

1) “In comparison with the situation that was assessed as extremely critical four years ago, IGZ has strengthened fundamental research, as expected. IGZ conducts research into the properties of horticultural products, such as nutrient content, resilience to various environmental changes (e.g. temperature), nutrient utilisation efficiency (fertiliser, water), pathogen resistance, aroma and taste. The institute must now, as planned, continue along this path to the ***analysis of regulatory mechanisms****, especially on the genetic level. The requisite methodological knowledge is now available at the institute and should be widely utilised.”*

Since the previous evaluation, the institute has expanded its research profile with regards to the molecular mechanisms underlying plant adaptation to (a)biotic stresses. First, the new Scientific Director, has set up a new Research Group (RG) BIOTIC.2 “Plant Biotic Interactions”, which applies (meta)genomic, transcriptomic and metabolomic analyses to study chemical and molecular mechanisms underlying plant interactions. The genomic and biochemical expertise in RG BIOTIC.2 will be significantly strengthened by the new head, who started in August 2024. Her

research focuses on the evolutionary drivers of host plant specialisation, in particular the molecular adaptations of herbivores to plant chemical defences. In addition, a new Junior Research Group (JRG) Leader with expertise in genetic regulation of heat stress responses in plants was appointed to the Programme Area (PA) ADAPT, and the head of RG QUALITY.2 has further expanded her molecular research in the glucosinolate breakdown pathways with DFG projects and in the Leibniz Programme for Women Professors. These current developments, together with the strong focus on microbial metagenomics in the research profile for the successor of the head of RG BIOTIC.1, will increase the demand for, and utilisation of, the state-of-the-art molecular and chemical-analytical platforms at the IGZ. In order to ensure that these technologies will be used most effectively, the new Scientific Director created a new infrastructure cross-unit: the Science Support Platform (SSP). This unit comprises postdoctoral experts in proteomics, metabolomics, volatolomics, and bioinformatics as well as a data steward, and is supported by technical assistants. The aim of the SSP is to support the implementation of molecular methods for all IGZ Research Groups. This will be achieved by providing advice on experimental design, support for analytical and bioinformatic method development, and hands-on training for (early career) researchers on how to proficiently use the various platforms as well as on how to process the datasets generated. In addition, these experts will also support grant applications, support data management and (statistical) analysis as well as ensure data sharing following the FAIR standards (see chapters 2 and 3).

2) "It fits very well with IGZ's scientific objective that in a few months, a fifth Programme Area will be established in the promising field of "Genomics and Bioinformatics in Horticulture", headed by a W3 professor. A share of institutional funding has already been earmarked for the purpose. Further plans to use ***additional institutional funding*** *to strengthen rhizosphere research should not be pursued at present."*

After the previous evaluation, it was suggested that the IGZ should open a new Programme Area on bioinformatics. Two full selection rounds were initiated. In the first round (2018–2020), the negotiations were not successful. In the second round (2021–2022), the financial and personnel demands of the selected candidate could not be met by the IGZ. After consultation with the General Assembly (GA), and in close communication with the University of Potsdam, it was decided to stop the process. Instead, the new Scientific Director proposed to add a bioinformation expert to the SSP to cover the needs for support and training at IGZ. This proposal was agreed upon by the Science Advisory Board (SAB) and GA, and will be implemented in 2024. The rhizosphere research was not expanded as the head of the previous RG MICRO.3 left the institute before the last evaluation.

3) "The five ***joint appointments*** *envisaged by 2023, including the appointment of a new Director, must be very carefully coordinated with the partner universities as well as with the strategic development of IGZ. The Scientific Advisory Board and the Supervisory Board should provide substantial support for these procedures, as they have done so far, and also draw on international expertise."*

The following joint appointments with universities and with involvement of the Scientific Advisory Board (SAB) and the General Assembly (GA), have been implemented in the last five years: the

Scientific Director (W3 Friedrich Schiller University Jena), the head of RG QUALITY.3 (W2 Heisenberg Professorship, Humboldt University of Berlin), and soon the head of RG QUALITY.2 (W2 Leibniz professorship, TU Berlin). For the next few years, the institute plans to advertise for a W2 joint professorship with the HU Berlin on the topic of plant-soil-microbiome interactions for sustainable horticultural production systems, as a successor for the head of RG BIOTIC.1 (2024/2025), and for a W2 joint professorship with a university in the region Berlin-Brandenburg for the PA HORTSYS (2025/2026). The research profile for the head of RG BIOTIC.1 is currently being written with feedback from the SAB, and in close exchange with the Dean of the Faculty of Life Sciences of the HU Berlin (see chapter 5).

*4) "In recent years, more **publications in peer-reviewed journals** have been produced by the Großbeeren site than previously by both sites together. Its publication record must, however, continue to improve significantly. In order to realise the institute's potential, and in view of the current generational change in many leadership positions, a binding publication strategy should be determined stating which internationally reviewed journals should be the priority publication destination for new scientific results and what expectations should be fulfilled with regard to publishing in practice-related journals."*

Since the previous evaluation, the IGZ increased the number of articles in peer-reviewed journals significantly from an average of 55 per year (between 2016–2018) to 69 (between 2021–2023) with 87 as the highest number of peer-reviewed publications in the year 2023. In the same period, the average impact factor across all publications increased from 3.4 (between 2016–2018) to 5.4 (between 2021–2023) with an IF of 6 in 2023. In the same year, the IGZ published 2.5 publications per FTE scientist and more than three quarters of the peer-reviewed articles were published in Q1 journals. Both indicators of the institute`s scientific performance are the targets defined in the institute's Publication Strategy which was adopted in 2023 (see chapter 4).

*5) "IGZ has excellent **scientific infrastructures** (greenhouses, field experimental area and especially a phytotron with a gas-exchange greenhouse). The inherent methodological potential for the institute's own projects and, in particular, for joint undertakings with partner institutions must be exploited better. IGZ should consider whether it would be meaningful to pool the research infrastructures in an independent, and thus internally and externally more visible, core facility."*

Following the recommendations of the previous evaluation, and as elucidated above (see recommendation 1), the new Scientific Director initiated the SSP to manage the high-quality analytical infrastructure to the benefit of the IGZ as a whole. In addition, the experts at the SSP will provide support and training to IGZ researchers. Together with the new head of infrastructures and experimental operations, and in close exchange with the RG heads of HORTSYS, a strategy for further increasing the utilisation of the unique gas exchange greenhouse will be developed. In addition, the IGZ aims to develop a long-term concept for the equally unique "Kastenparzelle", an experimental field facility with box plots containing three different typical soil types for vegetable production.

*6) "Since the last evaluation, **third-party income** has risen by just over two percentage points but, at 12.6 percent of overall income, is still too low. In the future, the third-party portfolio should be more diversified. The proportion of DFG funding, in particular, must be increased."*

Since the previous evaluation the IGZ doubled its third-party funding acquisition from 6.6 M€ during the previous 2016–2018 reporting period to 17.2 M€ in the current reporting period 2021–2023 with the highest amount of 7.8 M€ in total in 2023. This means that third-party funding now constitutes 25–30 % of the total budget. As a result, the revenues increased over time, especially from the German Science Foundation (DFG). In 2023, the IGZ acquired 2.84 M€ of DFG funding, which is up to ten times the average amount of DFG funding in the years before (see chapter 4).

*7) "The work in the field of **development economics** must now be much more closely integrated into the institute's overall activities. This is still a challenge. Recently, however, promising projects have been acquired that facilitate an alignment with horticultural value chains and eating habits. Overall, the group should intensify collaborations with partner institutions in the field."*

RG QUALITY.3 "Economic Development and Food Security" contributed with its social sciences expertise as partner in the food4future joint project and successfully acquired funding for projects with research groups worldwide. The head of RG QUALITY.3, is a joint professor at Albrecht Thaer Institute of HU Berlin. This integration is fostered by the establishment of the JointLab "Zero Hunger" between HU Berlin and the IGZ. Moreover, the institute considers expanding the IGZ by a fifth Programme Area (PA) on "Sustainable Transformation of Agrifood systems (STARS)" via an application for an extraordinary item of expenditure. This PA will focus on identifying economically viable and socially inclusive transformation pathways towards sustainable plant-based agrifood systems. The institute envisions that this PA will include a new research group focusing on the analysis of socio-economic effects of changing consumption patterns and diet choices, in particular towards plant-based and planetary diets including the consumption of alternative foods. In addition, it will comprise a new JRG, on the complementary topic "Social impact of urban indoor farming". The social sciences research in this new PA will find a counterpart in the PA QUALITY; there the IGZ plans to establish a new RG to assess the nutritional value of underutilised organisms that can be cultivated for consumption, such as algae, and their potential as novel sources of eco-friendly and healthy food. The IGZ plans to apply for additional institutional funding for the new PA to embed socio-economic aspects of horticultural research in a broader, and hence more integrated context (see chapter 3).

*8) "The intended increase in the number of members as well as the impending changes should allow the **Scientific Advisory Board** to become even more international and reflect the broad spectrum of modern horticultural research."*

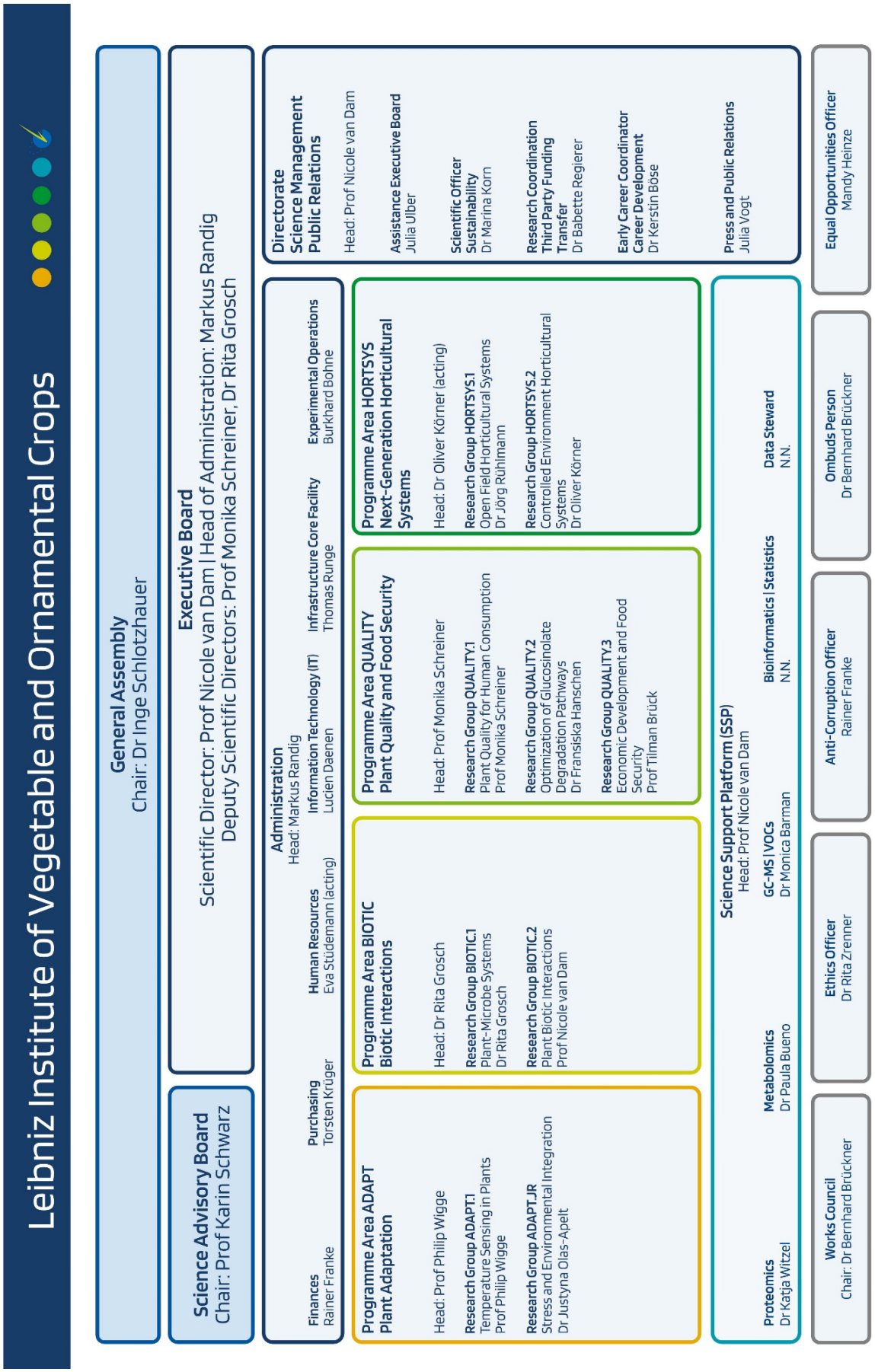
The IGZ has enlarged the SAB to nine members. It has recruited members from abroad (UK, Belgium, Netherlands) and scientists working in Germany, but originally coming from abroad (USA).

9) "It is very good that fundamental research has now been more firmly anchored in IGZ's statutes as the purpose of the institute. The specialist expertise on the ***Supervisory Board*** *should be aligned accordingly."*

For the recruitment of new members of the General Assembly (Supervisory Board), the IGZ has considered the coverage of its broad spectrum of research fields. It will take into account the dynamic changes in the institute's research profile for upcoming appointments, e.g. by adding expertise in plant-biotic interactions and metabolomics in horticultural sciences.

Appendix 1

Organisational chart



Appendix 2

Publications, patents, and expert reviews

	Period		
	2021	**2022**	**2023**
Total number of publications	**110**	**125**	**145**
Monographs	11	20	15
Individual contributions to edited volumes	12	16	16
Articles in peer-reviewed journals	63	58	87
Articles in other journals	19	21	24
Working and discussion papers	5	9	3
Editorship of edited volumes	0	1	0

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)	0	0	0
Patent families (number held as of 31.12. of the year)	0	0	0

	2021	**2022**	**2023**
Number of expert reviews	1	2	4

Appendix 3 Revenue and Expenditure

Revenue		2021			2022			2023		
		k€	%	%	k€	%	%	k€	%	%
Total revenue (sum of I., II. and III.; excluding DFG fees)		**14,903**			**15,864**			**16,310**		
I.	**Revenue (sum of I.1., I.2. and I.3)**	**12,323**	**100%**		**12,811**	**100%**		**11,258**	**100%**	
1.	INSTITUTIONAL FUNDING (EXCLUDING CONSTRUCTION PROJECTS AND ACQUISITION OF PROPERTY)	8,319	68%		8,330	65%		8,494	76%	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and *Länder* governments according to AV-WGL	8,197			8,330			8,494		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL	122			0			0		
2.	REVENUE FROM PROJECT GRANTS	4,004	32%	100%	4,481	35%	100%	2,764	25%	100%
2.1	DFG	161.7		4%	75.6		2%	76.5		3%
2.2	Leibniz Association (competitive procedure)	483.9		12%	447.5		10%	431.9		16%
2.3	Federal, *Länder* governments	2,495		62%	3,298.8		74%	2,029		74%
2.4	EU	752.3		19%	500.8		11%	140.6		5%
2.5	Industry	79.3		2%	88.1		2%	72.5		2%
2.6	Other funders (e.g. NGOs)	31.2		1%	70.6		2%	13.8		1%
II.	**Miscellaneous revenue** (e.g. funds drawn from reserves, see explanations in the text)	**2,580**			**3,053**			**5,051**		
III.	**Revenue for construction projects** (institutional funding by Federal and *Länder* governments, EU structural funds, etc.)	0			0			0		

Expenditures		k€	k€	k€
Expenditures (excluding DFG fees)		**11,739**	**10,649**	**10,323**
1.	Personnel	7,279	6,939	6,584
2.	Material expenses	3,943	2,870	2,709
3.	Equipment investments	517	841	1,030
4.	Construction projects, acquisition of property	0	0	0
5.	Other operating expenses	0	0	0

DFG fees (if paid for the institution – 2.5% of revenue from institutional funding)	199	203	207

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	Percent	Number	Percent	Number	Percent	Number
Research and scientific services	**43**	**41.6**	**54**	76	30	76.7	**22**
1st level (scientific directors)	1	-	1	100	1	100	1
2nd level (Programme Area leaders)	4	-	4	-	2	-	-
3rd level (Research Group leaders)	3	33.9	3	-	1	-	-
Junior research group leaders	1	-	1	100	1	100	1
Scientists in non-executive positions (A13, A14, E13, E14 or equivalent)	25.6	48.2	32	81.3	20	80	12
Doctoral candidates (A13, E13, E13/2 or equi.)	8.5	54	13	100	5	100	7
Science supporting staff (laboratories, technical support etc.)	**33**	**15.1**	**39**				
Laboratory (E9 to E12, upper-mid-level service)	7.5	-	9				
Laboratory (E5 to E8, mid-level service)	5.5	-	6				
Gardener (E9 to E12, upper-mid-level service)	0.8	-	1				
Gardener (E5 to E8, mid-level service)	4.6	-	5				
Workshops (E5 to E8, mid-level service)	2	-	2				
Equal opportunities officer	0.2	-	1				
Public relation (E13, E14 senior service)	1	-	1				
Information technology - IT (E9 to E12, upper-mid-level service)	1	-	1				
Science coordination (E13, E14, senior service)	5.1	73.5	7				
Science coordination (E9 to E12, upper-mid-level service	1.3	96.2	2				
Technical (large equipment, service) (E9 to E12, upper-mid-level service)	3	-	3				
Secretariat (E5 to E8, mid-level service)	1	-	1				
Science supporting staff (administration)	**9.3**	**-**	**10**				
Head of the administration	1	-	1				
Internal administration (financial administration, personnel etc.) (E9 to E12, upper-mid-level)	5.8	-	6				
Internal administration (financial administration, personnel etc.) (E5 to E8, mid-level service)	1	-	1				
Building service (E1 to E4)	1.5	-	2				
Student assistants	2	100	7				
Trainees	**1**	-	1				
Scholarship recipients at the institution	**3**	100	3		-		3
Doctoral candidates	2	100	2		-		2
Post-doctoral researchers	1	100	1		1		1

12 February 2025

Annex B: Evaluation Report

Leibniz Institute of Vegetable and Ornamental Crops, Großbeeren (IGZ)

Contents

1. Summary and main recommendations

According to its statutes, the IGZ's mission is "to conduct interdisciplinary and fundamental research to improve our understanding of plants and their interaction with the environment. The institute is dedicated to developing sustainable production systems in horticulture, increasing food safety and security, and improving human nutrition."

The institute was established in 1992 through a merger between the Central Institute for Vegetable Growing (Zentralinstitut für Gemüsebau) of the Academy of Agriculture Sciences (Akademie der Landbauwissenschaften) of the German Democratic Republic in Großbeeren and the ornamental plant research department of a seed production company in Erfurt. Attempts to integrate these two very different parts of the institute did not succeed, even over a longer period of time. Consequently, in 2017, the IGZ started concentrating on vegetable crop research in Großbeeren, as recommended by the Senate of the Leibniz Association. Four years later, this major step proved to be the right decision. The separation from the Erfurt site was a complex task, but one that the director at the time managed very well. The restructuring of the institute in Großbeeren into four Programme Areas was welcomed. At the same time, it was decided that the institute needed to make significant improvements to its research activities and another early evaluation date was set for five years later.

This key goal of improving the institute's research performance has now been largely achieved. The research activities of the Programme Areas are now rated "excellent" (Plant Adaptation/ADAPT), "good to very good" (Biotic Interactions/BIOTIC), "good" (Plant Quality and Food Security/QUALITY) and "very good" (Next-Generation Horticultural Systems/HORTSYS). The situation regarding third-party funding has also seen significant improvements: 30% of the budget for ongoing activities is now secured through project grants (2021–2023), compared with 12% in 2016–2018. This achievement is the result of leadership vacancies having been filled successfully. The new Scientific Director, who was appointed in October 2022, has brought outstanding expertise in chemical ecology to the IGZ. Since January 2019, an internationally renowned plant scientist has been head of the Programme Area ADAPT and has made significant advances in the IGZ's molecular genetic research. His research is funded by an ERC Advanced Grant. At the group leadership level too, the IGZ has managed to recruit very good researchers. It is also pleasing to see that two research group leaders have received funding for professorships: one through the Leibniz Programme for Women Professors (starting in 2025) and the other through the DFG's Heisenberg Programme (from 2022). The Heisenberg Professor has been leading a social and economic research group since 2015. However, this group continues to be integrated only partially into the IGZ, with its predominant focus on natural sciences.

The new Scientific Director leads the IGZ with strategic vision and has quickly set key directions. For instance, she has strengthened PA BIOTIC and grouped the 'omics' techniques into a core facility (Science Support Platform/SSP) at the start of 2024, as recommended. The bioinformatics and data management services are also integrated in the SSP. However, if IGZ is to benefit from the enormous amount of emerging genomic data that can greatly facilitate application of horticultural research to breeding more sustainable, resilient varieties, provision of computational expertise solely at a service/platform level may be not sufficient. Against this

backdrop, the new appointment in PA BIOTIC in line with recommendation 1 (see below) in this report is of high importance.

It is appreciated that the different IGZ Programme Areas will be strengthened in the coming years through joint appointments of professorships and the establishment of more research groups. Moreover, the Scientific Director is responsible for restructuring the way the institute supports careers in research. It was a very good decision to introduce monthly leadership meetings, to which all heads of Programme Areas and research groups are invited, to discuss the institute's strategic and managerial processes.

The IGZ's research focus is reflected in the new name that the Scientific Director is planning to give the institute: the "Leibniz Institute for Horticultural Sciences", which captures the institute's research profile much more clearly than the old name. The new name describes very well the important role of the institute in the research landscape. Although the field of horticultural science is of high importance scientifically and economically, Germany has few institutions specialising in this area and working at internationally competitive levels. In this respect, the IGZ has a clear unique selling point, which it should emphasise in the coming years. That means, in particular, the strengthening of genetic and genomic approaches and capabilities.

The review board encourages the leaders and governing bodies of the IGZ to continue along the path they have embarked on. In view of the improvement in its research activities over the past few years in key areas, the institute is well placed to do this. Special consideration should be given to the following main recommendations in the evaluation report (highlighted in **bold face** in the chapters 2–7):

Changes and planning (chapter 3)

1. The head of **PA BIOTIC** (a role combined with leadership of a research group in the PA) will need to be replaced in 2025 following her retirement. Plans for a joint appointment with HU Berlin (*Humboldt-Universität zu Berlin*) are supported by the review board. This position should be used to strengthen IGZ's central mission in horticultural research. Building on the work of PA ADAPT and PA BIOTIC this professorship offers an excellent opportunity to conduct in-depth research into the genetic foundations of horticultural traits, e.g. heat tolerance and disease resistance, and to study them in greenhouse and field environments. The review board recommends establishing the position with emphasis on horticultural genomics, to strengthen the scientific links between these two Programme Areas, which are of central importance to the future success of IGZ.
2. **PA HORTSYS** has been led by an acting head since 2018. The plans for a joint appointment for this position are in line with the IGZ's structural goal to link all Programme Area leadership positions with professorships, and should now be implemented without delay. Furthermore, the IGZ is currently setting up a joint junior research group with the Eberswalde University for Sustainable Development (HNEE). The establishment of these two new positions and the permanent staffing of the PA head is very welcome.
3. The review board sees a need to strengthen the IGZ in its core natural science areas. Plans to increase institutional funding for the period starting in January 2029, which the IGZ could submit in two years' time, should therefore focus on **horticultural research**. It must be the

priority to reach significant synergies between the institute's key research areas in this field. The ideas for intensifying social science research at the institute are not convincing and should not be pursued. Cooperation with external social scientists could be organized on a project-by-project basis as appropriate.

Controlling and quality management (chapter 4)

4. For a long time, and in line with the institute's statutes, the **Executive Board** has consisted of the scientific and administrative directors and two additional scientific members. The review board shares the IGZ's assessment that this setup is outdated in view of the new organisational structure. It is appreciated that the management of the IGZ currently is drafting a proposal for the Supervisory Board to revise the statutes. It is important to modernise the leadership structure and to ensure an appropriate representation of all the leading scientists in strategic decision making. The review board appreciates that the Scientific Director introduced monthly leadership meetings, to which all heads of Programme Areas and research groups are invited after she took up her post at the end of 2022. This is helpful for discussing and agreeing on the institute's strategic and managerial processes.
5. It is good to see that, in line with the recommendations, the **Scientific Advisory Board** has been expanded and made more international since the last evaluation. Three of the nine current members work abroad. There is a tenth board position that should be used alongside changes to the current board to ensure the necessary expertise in the field of horticultural sciences and horticultural practice, especially from companies, local, national and international.

Human resources (chapter 5)

6. It is welcomed that the IGZ's **Graduate Student Programme** has been revised under the new leadership. Five years ago, the review board recommended increasing the mandatory aspects of the programme and making the content more challenging. This clearer structuring of the doctoral phase should now lead to a reduction in the time taken to complete doctorates without compromising on the research quality (current median 4.7 years).

2. Overall concept, activities and results

In **1992**, following German reunification, the Leibniz Institute of Vegetable and Ornamental Crops (Leibniz-Institut für Gemüse- und Zierpflanzenbau/IGZ) was established as a research institute with joint funding from the federal and *Länder* governments. The IGZ was formed through a merger of two institutes/departments: (1) the Central Institute for Vegetable Growing (Zentralinstitut für Gemüsebau) of the Academy of Agricultural Sciences of the GDR (Akademie der Landwirtschaftswissenschaften der DDR) in Großbeeren; (2) the ornamental plant research department of a seed production company in Erfurt.

Following an **evaluation in 2015/2016**, the Senate of the Leibniz Association established that the integration of the two parts of the institute, which differed dramatically in terms of both their content and structure, at two locations had not succeeded, even after many years. The main

criticism regarding the institute's activities concerned the work on ornamental plants in Erfurt. The units working on vegetable research in Großbeeren received a more positive evaluation and the future prospects for this research topic were deemed much more promising. Consequently, the federal and *Länder* governments started concentrating their institutional funding on Großbeeren. After four years, they asked the Leibniz Association Senate to evaluate the results of this major change at the IGZ, which had entailed a considerable reduction in institutional funding.

The subsequent **evaluation in 2019/2020** found that the IGZ's focus on the vegetable research work in Großbeeren had been the right decision. In November 2018, the IGZ's mission was adapted accordingly and the statutes now record it as follows: "to conduct interdisciplinary and fundamental research to improve our understanding of plants and their interaction with the environment. The institute is dedicated to developing sustainable production systems in horticulture, increasing food safety and security, and improving human nutrition."

The IGZ has seen positive developments in the past five years **since the last evaluation**. In October 2022, two years before the current evaluation visit, a new Scientific Director with distinguished scientific expertise in chemical ecology joined the IGZ. She leads the IGZ with great strategic vision and has quickly set key directions. The structural development of the IGZ is assessed in detail in chapter 3. The research activities over the past few years are assessed below and in detail in chapter 7.

Activities and results

Research

The last evaluation welcomed the restructuring of the institute into four Programme Areas. However, the **research performance** was found to be still in need of significant improvement in 2018 and, at the time, one of the new Programme Areas was rated "good to very good", and three were rated "good". The improvements that were called for five years ago are now clearly visible: three of the PAs have improved their rating ("excellent", "very good" and "good to very good") and only one is still rated just "good".

The Programme Area *Plant Adaptation* (PA ADAPT) has made substantial improvements. Shortly before the last evaluation, it had recruited an outstanding researcher in a joint appointment with the University of Potsdam. He has been heading the PA since January 2019 and has achieved significant advances in molecular genetic research at the IGZ. This PA, which has since taken on an outstanding junior research group as well, achieves exceptional research outputs that are highly regarded internationally, particularly in relation to the adaptation of plants to environmental stress and climate change.

The Programme Area *Biotic Interactions* (PA BIOTIC) has been strongly influenced in the past by a long-standing IGZ researcher, but she will be retiring at the end of 2024. This PA has also seen positive developments. The Scientific Director has been a powerful catalyst for scientific development over the coming years by setting up a research group in her own specialist field of chemical ecology, which is an excellent fit for PA BIOTIC. As planned, she was able to hand over leadership of this research group in August 2024 to a researcher who joined the IGZ. The research group has already produced very good results on chemical mechanisms of plant

interactions with other organisms, and in particular the genetic basis for these mechanisms. This research should be focused on the major challenges in biotic interactions in horticultural production systems.

Expanding the scientific interactions between PA ADAPT and PA BIOTIC will offer exciting scientific opportunities particularly those based on modern genomic techniques, some of which were recently grouped within a core facility, as recommended (the Science Support Platform, see below). The IGZ is encouraged to pursue further structural measures to optimise the opportunities offered by its strengths in molecular genetics (PA ADAPT) and chemical ecology (PA BIOTIC) (see chapter 3) for the benefit of horticultural research.

A research group in the Programme Area *Plant Quality and Food Security* (PA QUALITY) is achieving very good results in its research into plant secondary metabolites as phytonutrients that are important for plant and human health. Two other research groups in this PA, focusing on plant-based food for sustainable food production and consumption and the role of horticulture for economic development and food security, produce good results. However, the links between IGZ's natural science research and its social and economic research are weak.

In the Programme Area *Next-Generation Horticultural Systems* (PA HORTSYS), the applied research into innovative crop production systems and management strategies for the sustainable use of resources and adaptation to climate change deserves a favourable mention.

Research infrastructure

The IGZ has extensive **research infrastructure facilities** (greenhouses, field experimental area, labs, see chapter 4). The last evaluation recommended forming a core facility, particularly with regard to 'omics' techniques (proteomics, metabolomics, volatilomics). The new Scientific Director started implementing this recommendation at the beginning of 2024.

The bioinformatics and data management services were also integrated into the new **Science Support Platform (SSP)**, which is headed by the Scientific Director. The previous director had planned to assign these tasks to a fifth Programme Area for genomics and bioinformatics in horticulture but two appointment procedures during his term in office were unsuccessful (see chapter 3). In view of this, the new Scientific Director's decision to assign these tasks to the SSP is understandable. Establishing the SSP is seen as a welcome step towards strengthening genetic research as a basis for the alignment of the institute towards horticultural genomics. As planned by the IGZ, the platform should be made available to external collaboration partners in future. However, if IGZ is to benefit from the enormous amount of emerging genomic data that can greatly facilitate application of horticultural research to breeding more sustainable, resilient varieties, provision of computational expertise solely at a service/platform level may be not sufficient. Against this backdrop, the new appointment in PA BIOTIC in line with recommendation 1 (see below) in this report is of high importance.

Transfer

Closely connected to its research work, the IGZ carries out a wide range of **transfer activities**. In 2023, IGZ researchers were involved in a promising innovation resulting from the project *PermAFoG* that was transferred to a company partner, which will file a patent and develop a product for market launch.

An important focus of the knowledge transfer activities lies in citizen science. For instance, the IGZ uses “Living Labs” to implement forms of direct participation. The institute is the driving force behind the *zirkulierBAR* Living Lab on sanitary revolution. The *Future Food* Living Lab is under development for urban production of new food sources.

Besides companies and citizens, the institute successfully addresses policymakers. The research findings form the basis for policy briefs and recommendation papers, contribute to standards development and legal frameworks or are leveraged in advisory boards.

3. Changes and planning

Development since the previous evaluation

The **2019/2020 evaluation** found that the IGZ director at the time had managed the extremely difficult task of separating the Erfurt site from the institute very well. The IGZ’s concentration on the Großbeeren site resulted in institutional funding being reduced by €3.1m to €7.5m in 2017, compared with the previous year, with a loss of 20% of the staff positions. At the same time, the director had presented plans to expand research at the IGZ. The restructuring of the institute into four Programme Areas was evaluated positively at the time, and has proved effective in recent years. Moreover, it was also a good plan to fill all the head of PA positions through a joint appointment procedure with universities in the longer term. This goal is expected to be reached in the coming years, as existing heads retire and are replaced (see under “Strategic work planning”).

The strategy of appointing the heads of PAs jointly with universities creates attractive **scientific leadership positions,** which strengthens basic research at the IGZ considerably. Two positions were filled with outstanding candidates in recent years: in January 2019, shortly before the last evaluation, a new scientist was appointed to lead PA ADAPT in a role associated with a W3 professorship at the University of Potsdam. In October 2022, a new Scientific Director joined the IGZ when the previous director retired. This made it possible to upgrade the position significantly from a W2 to a W3 professorship. The institute succeeded in appointing an excellent scientist to this leadership role, who also works as a professor at the University of Jena and has clearly strengthened the research focus of PA BIOTIC.

The close **scientific cooperation between PA ADAPT and PA BIOTIC** offers exciting opportunities to strengthen the institute’s profile in the coming years (see under “Strategic work planning”). This cooperation is particularly important because it was not possible to realise the previous director’s plan to create a fifth Programme Area for genomics and bioinformatics in horticulture. Two calls for applications for a W3 head of the PA in a joint procedure with the University of Potsdam were unsuccessful. Internationally there is an extremely high demand for bioinformatics expertise. Against the backdrop of this experience the review board gives a recommendation for filling a professorship in PA BIOTIC (see below).

Within the four Programme Areas, two **group leaders** left in order to take up professorships elsewhere or moved to a more senior position at another institution. Three other groups ended their research when the group leaders retired, which meant funds could be used to set up new groups like the junior research group in PA ADAPT and the research group in PA BIOTIC

initiated by the Scientific Director. In PA QUALITY, the head of the social and economic research group was appointed to a W2 professorship, which will be funded for five years through the Heisenberg Programme.

Another strategically important appointment for the IGZ was the new **Head of Administration**, who took up office in March 2023.

Strategic work planning for the coming years

The **Scientific Director** leads the IGZ with strategic vision and has quickly set key directions. As well as strengthening PA BIOTIC and developing the Science Support Platform (SSP), she has plans for streamlining IGZ's governance, which received support from the review board. The same goes for the plans to appoint the heads of the PAs through joint procedures with universities, to set up new research and/or junior research groups, and to create a clear structure for supporting scientific careers. These points are covered in more detail in this and the following chapters.

The IGZ's research focus is reflected in the **new name** that the Scientific Director is planning to give the institute: "Leibniz Institute for Horticultural Sciences". This captures the institute's research profile much more clearly than the old name. The new name describes the IGZ's important role in the research landscape very well. Although the field of horticultural science is of high importance scientifically and economically, Germany has few/no institutions specialising in this important area and working at internationally competitive levels. In this respect, the IGZ has a clear unique selling point, which it should emphasise in the coming years. That means in particular to strengthen genetic approaches.

Generally, the review board encourages the leaders and governing bodies of the IGZ to follow the new strategic priorities set for IGZ. In view of the improvement in its research activities over the past few years in key areas, the institute is well placed to do this. For the institute's **scientific and strategic development** in the coming years, the following points are particularly relevant:

- **The head of PA BIOTIC (a role combined with leadership of a research group in the PA) will need to be replaced in 2025 following her retirement. Plans for a joint appointment with HU Berlin are supported by the review board. This position should be used to strengthen IGZ's central mission in horticultural research. Building on the work of PA ADAPT and PA BIOTIC this professorship offers an excellent opportunity to conduct in-depth research into the genetic foundations of horticultural traits, e.g. heat tolerance and disease resistance, and to study them in greenhouse and field environments. The review board recommends establishing the position with emphasis on horticultural genomics, to strengthen the scientific links between these two Programme Areas, which are of central importance to the future success of IGZ.**
- It is a very positive development that the chemical research on secondary plant substances conducted in PA QUALITY was recently strengthened when the research group leader was appointed to a professorship at TU Berlin. The establishment of this professorship will be funded through the Leibniz Programme for Women Professors from 2025 onwards.

– **PA HORTSYS has been led by an acting head since 2018. The plans for a joint appointment for this position are in line with the IGZ's structural goal to link all Programme Area leadership positions with professorships, and should now be implemented without delay. Furthermore, the IGZ is currently setting up a joint junior research group with the Eberswalde University for Sustainable Development (HNEE). The establishment of these two new positions and the permanent staffing of the PA head is very welcome.**

Planning for additional institutional funding

The review board sees a need to strengthen the IGZ in its core natural science areas. Plans to increase institutional funding for the period starting in January 2029, which the IGZ could submit in two years' time, should therefore focus on horticultural research. It must be the priority to reach significant synergies between the institute's key research areas in this field. The ideas for intensifying social science research at the institute are not convincing and should not be pursued. Cooperation with external social scientists could be organized on a project-by-project basis as appropriate.

4. Controlling and quality management

Facilities, equipment and funding

The IGZ's **institutional funding** rose from €7.7m in 2018 to €8.5m in 2023. The plans to reduce the €5.1m (2023) of self-managed institutional funding carried over from previous years *(Selbstbewirtschaftungsmittel)* over the coming years are convincing. The institute will structurally reduce these reserves by 2025 through the implementation of new strategies and structures, including a professorship appointment for the head of the QUALITY.2 research group, recruiting staff for the junior research group in PA HORTSYS, the further development of the Science Support Platform and investments in infrastructure.

It is laudable that the institute has significantly increased **revenues from project grants** from €1.2m on average between 2016 and 2018 (corresponding to 12% of the overall budget) to €3.8m p.a. on average between 2021 and 2023 (corresponding to 31% of the overall budget). This is in line with the appropriate goal of a budget share of 30% for third-party funding, which the institute defined in its Third-Party Funding Strategy in 2024. In the past few years, 68% of third-party funding was obtained from the federal and *Länder* governments, and 12% each from the EU and the Leibniz Association. It is worth emphasising that the head of PA ADAPT secured a highly competitive, prestigious ERC Advanced Grant.

The IGZ has raised much higher competitive project funding for the coming years than it did previously. Over the next few years, funding from the DFG will be significantly higher than the fees that the IGZ pays the DFG as a Leibniz institute. The EU has also already approved financing for further projects. The institute is encouraged to continue this positive trend with regard to third-party funding.

The IGZ has very good **experimental facilities**, such as labs equipped for molecular and chemical analyses, growth chambers as well as greenhouses and experimental fields. Some of these facilities are certified for working under security-level conditions up to S2 level.

Organisational and operational structure

The Scientific Director and the Head of Administration are inspiring IGZ employees giving them a renewed sense of the importance of horticultural research and the mission of IGZ. They offer employees at all levels and in all subject areas opportunities to contribute their ideas. This communicative leadership style is having a very positive effect on the IGZ. In particular, it is motivating long-serving employees, for whom the changes over recent years have had serious impacts.

For a long time, and in line with the institute's statutes, the Executive Board has consisted of the scientific and administrative directors and two additional scientific members. The review board shares the IGZ's assessment that this setup is outdated in view of the new organisational structure. It is appreciated that the management of the IGZ is currently drafting a proposal for the Supervisory Board to revise the statutes. It is important to modernise the leadership structure and to ensure an appropriate representation of all the leading scientists in strategic decision making. The review board appreciates that the Scientific Director introduced monthly leadership meetings, to which all heads of Programme Areas and research groups are invited after she took up her post at the end of 2022. This is helpful for discussing and agreeing on the institute's strategic and managerial processes.

Quality management

The IGZ has appropriate internal quality management structures, based in part on the DFG's **Guidelines for Safeguarding Good Research Practice**.

As recommended, in 2023 the institute adopted a binding, convincing **publication strategy**. It is good to see that the institute prioritises peer-reviewed publications and is enforcing open access publication, provided that internationally-recognized peer review standards are upheld. Consequently, the share of the peer-reviewed journal articles that were published open access is very high (2021–2023: 97%).

The institute has developed **Guidelines for Research Data Management** that define the actors, responsibilities, processes, duties and rights for handling data generated by the research process. It is worth highlighting that, since 2024, the IGZ has been a full partner in NFDI FAIRagro, a consortium coordinated by the Leibniz Institute ZALF.

The IT department implemented an IT security concept. This includes measures such as monitoring data traffic, continuous assessment of system integrity and security, in particular regarding external threats, and system compartmentalisation. The IGZ participates in an agreement between the Leibniz Association and an incident response support provider.

Quality management by advisory boards

The Scientific Advisory Board supports the work of the IGZ in an active and constructive manner. **It is good to see that, in line with the recommendations, the Scientific Advisory Board has been expanded and made more international since the last evaluation. Three of the nine current members work abroad. There is a tenth board position that should be used alongside changes to the current board to ensure the necessary expertise**

specifically in the field of horticultural sciences and horticultural practice, especially from companies, local, national and international.

5. Human Resources

Leading scientific and administrative positions

Besides the Scientific Director, **scientific leadership positions** at the IGZ include the heads of the Programme Areas and research groups. It is welcomed that the general principle is for the Programme Areas to be led by researchers who are jointly appointed with universities or universities for applied sciences. This strategy has already been implemented in PA ADAPT (since 2019), and PA BIOTIC will follow next year. PA QUALITY is currently being led by a researcher who is an honorary professor at the Leibniz University Hannover and will retire in 2028. The heads of the other two research groups in this PA are professors. PA HORTSYS has been led by an acting head since 2018. The plans for a joint appointment to this position should be implemented without further delay (see chapter 3).

In March 2023, an experienced business manager took over as **Head of Administration**. He has been managing the administrative side of things at the IGZ very professionally and efficiently since 2018.

Staff with a doctoral degree

The IGZ offers a good training environment for early career researchers.

Since the last evaluation, one **junior research group** has been established. Furthermore, the head of a Leibniz Junior Research Group was tenured as a research group leader. She was jointly appointed with TU Berlin to a W2 professorship in 2024 that is supported by the Leibniz Programme for Women Professors (see above).

The review board appreciates that the IGZ has developed and implemented a **strategy for postdoctoral career development** and provides mentoring for postdocs to help them in their career development. An Early Career Coordinator has been implementing the strategy since 2024. Four researchers have left the institute to take up positions at higher education institutions in Germany and Australia.

Doctoral candidates

As of 31 December 2023, there were 15 **doctoral researchers** working at the institute (same number as at the time of the last evaluation). However, between 2016 and 2018 eleven doctorates were completed in Großbeeren, and only eight between 2021 and 2023. According to the institute, the reason for this decline is primarily the restrictions in place during the COVID-19 pandemic, so the expectation is that there will be an increase in the number of completed doctorates in the future.

Some doctoral researchers at the IGZ benefit from the fact that the head of the Programme Area *Plant Adaptation* (PA ADAPT), the Scientific Director and the head of RG BIOTIC.2 are faculty members of the International Max Planck Research Schools in Potsdam-Golm ("Primary Metabolism and Plant Growth") and in Jena ("Chemical Communication in Ecological

Systems"). **It is welcomed that the IGZ's Graduate Student Programme has been revised under the new leadership. Five years ago, the review board recommended increasing the mandatory aspects of the programme and making the content more challenging. This clearer structuring of the doctoral phase should now lead to a reduction in the time taken to complete doctorates without compromising on the research quality (current median 4.7 years).**

Science supporting staff

The IGZ does good work in the area of **training science-supporting staff**. The institute provides funds for training measures for both scientific and non-scientific staff, e.g. on handling laboratory instruments, and it familiarises staff with new regulations and practices, such as intellectual property protection, patenting processes as well as social media use. Furthermore, the IGZ provides financial support for German and English language courses.

The IGZ offers **vocational training** for chemical and biological laboratory technicians and IT specialists for system administration. As of 31 December 2023, one trainee is employed, and two trainees have completed their training since the last evaluation. It is good to see that the institute plans to offer apprenticeships again in 2025.

Equal opportunities

At the end of 2023, the proportion of **women** among staff in research and scientific services was pleasingly high (56%) and 41% were researchers of foreign nationality. The Scientific Director is a female scientist, who also led a research group. Four of the other eight (junior) research group leaders (50%) and two of the four heads of Programme Areas (50%) were women. Of the 32 scientists in non-executive positions, 20 were female (63%), and of the 13 doctoral candidates directly funded by the IGZ and two doctoral scholarship holders, five were female (33%). An equal opportunities officer (EOO) and a deputy are elected from among the female staff members.

The institute offers its staff suitable options to support **caring responsibilities**, such as flexible working models, a (grand)parent-child room and regular employee appraisals. In 2022, the institute established a gender equality plan for the first time and was re-certified by the *berufundfamilie* audit.

6. Cooperation and environment

Regional cooperation

The IGZ is very well integrated in the local research environment in **Berlin and Brandenburg**. As well as collaborating with universities on joint appointment procedures (see chapter 5), the institute collaborates closely with Brandenburg Technical University (BTU) in Cottbus and the Eberswalde University for Sustainable Development (HNEE) in the areas of research and teaching. Within the BMBF programme "Agricultural systems of the future", the IGZ leads and coordinates the "food4future (f4f)" project, which aims to develop solutions for growing new food sources in an urban environment. This comprises a regional consortium of four Leibniz institutes (ATB, ZMT, DIfE and IGZ), three universities (FU Berlin, HU Berlin and the Technical

University of Applied Sciences Wildau), as well as the Fraunhofer Institute for Applied Polymer Research in Potsdam.

The IGZ uses the JointLabs instrument to intensify cooperation with universities and other institutions and to promote knowledge transfer, science–public dialogue and citizen science. It successfully participates in the JointLab “PhaSe - Phytochemistry and biofunctionality of secondary plant metabolites” (since 2018 with the University of Potsdam and Leibniz Institute DIfE) and "Zero Hunger Lab" (since 2023 with HU Berlin). The *zirkulierBAR* Living Lab on sanitary revolution was established together with HNEE and facilitates transfer and citizen participation.

National and international cooperation

Within the **Leibniz Association**, it is worth highlighting the institute’s involvement as an active member in eight Leibniz Research Networks, e.g. "Biodiversity", "Green Nutrition - Healthy Society", "Immune-Mediated Diseases" and "Mathematical Modelling & Simulation (MMS)". In 2020, the IGZ secured the 3-year project "KETCHUP" in the Leibniz Cooperative Excellence programme. This project was a collaboration with the Leibniz institutes IPK in Gatersleben and IPB in Halle (Saale).

At the **national level**, the institute’s close collaboration with university and non-university partners within the DFG-funded Collaborative Research Centre 1644 and Research Unit FOR 3000 is also particularly noteworthy.

Furthermore, the IGZ is successfully involved in **European consortia** such as the Horizon Europe-funded projects ECO-NUTRI and P2GreeN.

7. Subdivisions of IGZ

Programme Area “Plant Adaptation” (ADAPT)

(11.4 FTE, of whom 7.2 FTE research and scientific services staff, 3 FTE doctoral candidates, and 1.2 FTE service staff)

The PA consists of two research groups. One was established in 2019 and is led by the head of the PA, an internationally renowned scientist who holds a professorship at the University of Potsdam. The other is a junior research group that was established mid of 2023 and is led by an ambitious, talented head. The groups work very closely together and complement each other in their work. PA ADAPT is rated “excellent”.

PA ADAPT conducts cutting-edge molecular research on the adaptation of plants to their environment. This pioneering research helps decode signalling pathways that play a role in temperature sensing and stress adaptation in plants, paving the way for the development of strategies to improve the resilience of crop plants. For that purpose, the researchers use the model plant *Arabidopsis thaliana*, as well as the horticulturally relevant crops tomato and potato. The studies are very relevant in the context of horticultural research and fit perfectly into the overall strategy of the IGZ.

It is appreciated that the PA pursues a multimodal approach, using modelling techniques and the investigation of metabolic pathways. Thanks to these techniques, the research has a high

potential to investigate multiple stresses in the context of resilience and adaptation of plants to heat stress. Working closely together, the two groups also developed genome-editing methods. Highlights of the research are the studies on temperature-dependent protein phase change as well as thermopriming of the shoot apical meristem in *Arabidopsis*.

The outstanding results of the PA are published in internationally highly recognized journals, e.g. *Nature*, and have the potential for translation into stress tolerant horticultural varieties through breeding. It is good to see that the research can be scaled from the laboratory to the greenhouse and the field. Worth highlighting is the fact that the head of the PA was a Highly Cited Researcher every year between 2021 and 2024 and has been funded by an ERC Advanced Grant. The PA also secures a considerable amount of additional third-party funding.

Programme Area "Biotic Interactions" (BIOTIC)

(16.8 FTE, of whom 10.8 FTE research and scientific services staff, 3 FTE doctoral candidates, and 3 FTE service staff)

The research of PA BIOTIC aims to identify the chemical and molecular mechanisms of interactions between plants, microbes and the soil as well as other organisms. The PA consists of the BIOTIC.1 research group, which has been firmly established at the IGZ for a long time and whose leader is also head of the PA, and the BIOTIC.2 research group, a new group set up on the initiative of the Scientific Director at the beginning of 2023. Overall, PA BIOTIC is rated "good to very good".

RG BIOTIC.1 conducts good research on the interactions between plants and microbes, including the application of beneficial microbes to plant production systems. The head of this research group will retire at the end of 2024. For her succession, the IGZ plans to advertise a joint professorship with HU Berlin in 2025 (see chapter 3). This will consolidate the PA's renewal, which started with the establishment of the BIOTIC.2 research group. The new head of the BIOTIC.1 research group should have expertise in genomics, such that they can strengthen the link between PA BIOTIC and PA ADAPT and support translation to improved horticultural varieties. This will play a key role in realising the full potential of the institute's horticultural science strategy (see chapter 3).

RG BIOTIC.2 obtains very good results by investigating the role of plant metabolites that regulate the interaction with aboveground and belowground organisms, in particular with insect herbivores and nematodes. In this context, it investigates the genetic basis for the production of these plant metabolites. In August 2024, shortly before the evaluation visit, the Scientific Director handed over leadership of the research group to a researcher, who joined the IGZ from the Max Planck Institute for Chemical Ecology in Jena. Her research has high potential and will be of great benefit to the PA in the context of addressing biotic stress in horticulture.

Programme Area "Plant Quality and Food Security" (QUALITY)

(24.4 FTE, of whom 12.9 FTE research and scientific services staff, 3.3 FTE doctoral candidates, and 8.2 FTE service staff)

The overall aim of PA QUALITY is to generate interdisciplinary knowledge on plant-human interactions based on the life sciences and social sciences. PA QUALITY brings together three

research groups – one run by an agricultural scientist, one by a food chemist and one by an economist. The content of the social and economic QUALITY.3 research group, in particular, is difficult to link to the other two. The IGZ and its governing bodies should therefore consider how economic and social science work that is relevant to the institute and its different research areas can be properly integrated in the long run. PA QUALITY is rated “good”.

RG QUALITY.1 conducts good research on (alternative) plant-based food for sustainable food production and consumption. The focus is on the biofunctionality of metabolites in plants, alternative food sources and humans, and how they affect food and nutritional security as part of the human diet. Furthermore, the RG studies how to integrate novel recycling fertilisers into circular horticultural production systems. The studies should be more closely aligned with the objectives of the IGZ and should have a better connection to the overarching core theme of horticultural research. The head of the PA will be handing over her leadership position to the head of the QUALITY.2 research group at the beginning of 2025 (see below). Until her retirement in 2028, she will be coordinating the BMBF-funded food4future consortium, which is located at the IGZ (see chapter 6).

RG QUALITY.2 successfully evolved from a junior research group and the group leader was recently jointly appointed to a W2 professorship at TU Berlin that is financed by the Leibniz Programme for Women Professors. The studies contribute to the understanding of the mechanisms that control food quality, and the group is very successful in its exploration of the role of phytonutrients and the mechanisms underlying plant-environment responses. A highlight is the discovery of antioxidant plant compounds that affect thermal glucosinolate degradation mechanisms and deactivate them. This research in a competitive field has relevance to food science and potential to be transferred to the greenhouse and field.

The head of RG QUALITY.3 started at the IGZ in June 2015. In July 2022 he was awarded a grant through the DFG’s Heisenberg Programme and received a W2 professorship at HU Berlin. The group’s involvement in the IGZ is based on research into the role of horticulture in economic development and food security. Nevertheless, the group is quite active in research in other areas that are not really connected to the IGZ objectives, for instance how ethnic inequality shapes victimisation in violent conflicts, labour market integration of refugees in the Near East, and the psycho-social impacts of the COVID-19 pandemic in Germany. Hence, the recommendation to integrate the group more fully into the IGZ has not really been addressed yet. From 2021 to 2023, the group secured only limited third-party funding, and the publication record on topics of relevance to IGZ is limited.

Programme Area “Next-Generation Horticultural Systems” (HORTSYS)

(13.1 FTE, of whom 9.3 FTE research and scientific services staff, 1.3 FTE doctoral candidates, and 2.5 FTE service staff)

PA HORTSYS consists of two research groups that cover basic and applied science in the field and under controlled conditions. It conducts very successful research, developing innovative crop production systems and management strategies for the sustainable use of resources and adaptation to climate change. For this purpose, the researchers make very effective use of decision support systems and other modelling approaches, algorithms, and sensor techniques to optimise plant growth and to describe the interactions between plant and environment. RG

HORTSYS.1 successfully develops innovative crop and soil management strategies for the sustainable use of resources and for adaptation to climate change. RG HORTSYS.2 conducts very good research on resource optimisation of plant production in climate-controlled environments such as greenhouses and indoor farms. The PA is rated “very good”.

The PA’s research work is highly relevant for the institute, for example with regard to alternative production systems. Particularly noteworthy are the mapping and modelling of soil heterogeneity and the use of aquaponic systems in urban contexts. It is good to see that the PA works closely with field applications, in cooperation with local farmers and companies. Moreover, the basic research results have the potential to be translated to breeding resilient and sustainable horticultural varieties. This work could be conducted in close cooperation with PA ADAPT and PA BIOTIC.

The PA is well connected internationally, e.g. within EU projects where the IGZ is a co-leader. Third-party funding levels are high, especially from the EU and from companies. This paves the way for disseminating the very good results with even greater visibility in the future.

The PA has been led by an acting head since March 2018 – the head of the HORTSYS.2 research group. The board welcomes that, under the new Scientific Director, a process has been set up to fill the position of a head of a junior research group in cooperation with the Eberswalde University for Sustainable Development (HNEE). The plans to advertise a professorship with a university in 2025/2026 should also be implemented as quickly as possible to ensure that a permanent head is found for the PA.

8. Handling of recommendations of the last external evaluation

The IGZ addressed most of the recommendations made by the Leibniz Association Senate in 2020 (see status report, p. A-23f). In particular, the scientific achievements evidenced through publications were improved and third-party funding has increased substantially. The recommendations concerning research at the genetic/genomic level (recommendation 1), on implementing the concept of linking all heads of PAs to professorships (recommendation 3) and on the poor integration of the social and economic research (recommendation 7) still apply.

Appendix

1. Review Board

Chair (Member of the Leibniz Senate Evaluation Committee)

Stephan **Clemens**	Chair of Plant Physiology, University of Bayreuth

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

Thiess **Büttner**	Chair of Public Economics, University of Erlangen-Nürnberg

Reviewers

Emmanuel **Gaquerel**	Institute of Molecular Biology of Plants, IBMP, Strasbourg, F
Pirjo **Mäkelä**	Department of Agricultural Sciences, University of Helsinki, FIN
Cathie **Martin**	Department of Biochemistry and Metabolism, John Innes Centre, Norwich, UK
Teun **Munnik**	Swammerdam Institute for Life Sciences, University of Amsterdam, NL
Andrea-Emilio **Rizzoli**	Dalle Molle Institute for Artificial Intelligence, University of Applied Sciences of Southern Switzerland, Lugano, CH
Johannes **Sauer**	Chair of Agricultural Production and Resource Economics, Technical University of Munich
Andrea **Schnepf**	Professor of Soil, Root Systems and Rhizosphere, Forschungszentrum Jülich
Paul **Schulze-Lefert**	Department of Plant Microbe Interactions, Max Planck Institute for Plant Breeding Research, Cologne
Michelle H. **Williams**	Faculty of Technical Sciences, Aarhus University, DK

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)*

Marc **Brüser**	Ministry of Science and Health of Rhineland-Palatinate, Mainz

18 March 2025

Annex C: Statement of the Institution on the Evaluation Report

Leibniz Institute of Vegetable and Ornamental Crops, Großbeeren (IGZ)

We are grateful for the thorough evaluation of the IGZ and the valuable advice provided by the members of the evaluation committee, which the IGZ has started to implement. The IGZ is very pleased with their conclusion that the new scientific director has set a clear strategic course to improve the IGZ's performance and sharpen its missions to cover the full breadth of horticultural sciences. The evaluation committee's report has confirmed our view that this strategic positioning will create a unique scientific niche, which will be reflected in the new name, Leibniz Institute for Horticultural Sciences (IGZ). The evaluation committee concluded that the programme areas and research groups, as well as the IGZ staff and their activities, have significantly improved in terms of performance and quality since the last evaluation in 2019. This confirms that our novel mission to conduct excellent interdisciplinary research on resilient plant-based agri-food systems to provide science-based solutions for horticulture is ideally suited to lead the IGZ into the future. To propel the development of the institute, a new building will provide a professional and sustainable working environment. The evaluation committee explicitly supported our plans to establish joint professorships with the Humboldt University in Berlin and the Eberswalde University for Sustainable Development (HNEE) in Brandenburg. Negotiations for a joint professorship in Phytonutrient Management at the Technical University of Berlin, funded by the competitive SAW programme for Women Professors, were successfully concluded in November 2024 and the head of the Research Group QUALITY.2 was officially appointed on 1 February 2025. These joint professorships will not only strengthen our research capacity in core horticultural sciences as recommended, but will also intensify our strategic alliances with these universities in the region. We are grateful for the substantial support for expanding our core funding through an application for a strategic extension (“Sondertatbestand”). In the proposal, which will be submitted in early 2027 for funding a strategic extension starting in 2029, we will incorporate the specific advice to emphasize the IGZ's distinctive core strengths in horticultural sciences. We appreciate the Committee's positive assessment of our plans for a leaner governance structure and their support for the inclusion of a horticultural industry expert on our Scientific Advisory Board. We are delighted with the positive evaluation of our newly initiated early career programme, which we will continue to develop over the coming years.