Research Evaluation

Bernoulli Institute

Faculty of Science and Engineering

University of Groningen

2015-2021

January 2022

Contents

Research Evaluation Bernoulli Institute

Preface

The research areas of the Bernouilli Institute of the University of Groningen, viz. mathematics, computer science and artificial intelligence, and the products of this research, permeate every aspect of our life and our society. These have improved our lives considerably, but we note there is also increased attention to their negative aspects.

As a result of this, more research is needed to improve these products and to mitigate the negative aspects. At the same time, we need to preserve fundamental research in these disciplines, in order to prepare for future innovations.

The evaluation of the research of the Bernouilli Institute was a challenging, but also a very interesting task. I want to thank the members of the committee, all people of the institute who prepared the evaluation, and all the people we spoke to at the site visit for their work and all the pleasant and informative interactions.

The main conclusion of our findings is that the merger of JBI and ALICE in 2018 has worked out very well. The merger and subsequent hire of new staff has led to a sufficient critical mass that is necessary to achieve the goals and ambitions within the research domains and realize the desired societal relevance and impact. The Bernouilli Institute has taken steps to strengthen exchange between and coherence within the structure.

The Institute has grown as a result of interdisciplinary initiatives and the national Sector Plans, and has managed this very well.

For the immediate and more long-term future, our main recommendation is to develop a masterplan that offers a coherent framework, clear goals and concrete indicators for future development.

As I write this, a new Sectorplan is underway. I trust that the Bernouilli Institute will use this extra funding to hire additional staff, leading to even higher scientific and societal impact.

Jos Baeten, Chair of the Committee

18 January 2023

1. The review committee and the procedures

1.1. Scope of the review

The review committee was asked to perform a research evaluation of the Bernoulli Institute for Mathematics, Computer Science, and Artificial Intelligence of the Faculty of Science and Engineering of University of Groningen, covering the period from 2015 up to and including 2021. This evaluation covers a seven year period due to the merger of the two institutes, and therefore deviates from the six-year period suggested by the SEP protocol. The review committee consisted of eight members. The review committee was requested to assess the quality of research conducted by Bernoulli as well as to offer recommendations in order to improve the quality of research and the strategy, and to answer specific questions posed by the institute.

The committee was requested to carry out the evaluation according to the guidelines specified in the *Strategy Evaluation Protocol 2021-2027* (SEP). The evaluation includes a backward-looking and a forward-looking component. Specifically, the committee was asked to judge the performance of the unit on the main evaluation criteria and offer its written conclusions as well as recommendations based on considerations and arguments. The main evaluation criteria are:
   1.   Research Quality
   2.   Societal Relevance
   3.   Viability

During the evaluation of these criteria, the committee was asked to incorporate four specific aspects. These aspects are as follows:
   1.   Open Science: availability of research output, reuse of data, involvement of societal stakeholders;
   2.   PhD Policy and Training: supervision and instruction of PhD candidates;
   3.   Academic Culture: openness, (social) safety and inclusivity, and research integrity;
   4.   Human Resources Policy: diversity and talent management.

The Executive Board of the FSE provided the review committee with Terms of Reference concerning the evaluation. In this document, the Board asked the committee to pay special attention to and offer recommendations on the joint merger between JBI (Johann Bernoulli Institute for Mathematics and Computer Science) and ALICE (Institute for Artificial Intelligence and Cognitive Engineering) in 2018. The committee was asked to investigate and provide feedback on the following questions:

   1.   To what extent does the current organization provide a good foundation for collaborative research within the institute, while still providing autonomy for its researchers?
   2.   Does the current organization of the Institute support and advance its mission, defined as:
        i.   to perform outstanding academic research and teaching in Math, CS, and AI, and to maintain international leadership therein;
        ii.   to foster these disciplines as a living body of knowledge, and to make them relevant to society in the broadest sense;
        iii. to transfer its results to other areas of science and technology, and initiate and expand inter- and multi-disciplinary research collaborations.
   3.   Does the PRC have suggestions for improvement in (1) and (2)?

1.2. Composition of the committee

The composition of the committee evaluating the Institute was as follows:

Prof. dr. Farhad Arbab, CWI, University of Leiden, NL
Prof. dr. Jos Baeten, CWI Amsterdam, NL (chair)
Prof. dr. Volker Mehrmann, TU Berlijn, DE
Prof. dr. Sonja Hohloch, University of Antwerp, BE
Prof. dr. Elisabetta Di Nitto, Politechnico Milano, IT
Prof. dr. Ann Nowé, VU Brussel, BE
Prof. dr. Max Louwerse, Tilburg, NL
Ms. Vijanti Ramautar, MSc, Utrecht, NL (Phd-member of the Committee)

The review committee was supported by dr. Jesseka Batteau.

1.3. Independence

All members of the review committee signed a statement of impartiality to ensure that they would assess the research quality of the Bernoulli Institute in an unbiased and independent way. All existing personal or professional relationships between committee members and the research unit(s) under review were reported and discussed in the first committee meeting. The committee concluded that there were no unacceptable relations or dependencies and that there was no specific risk in terms of bias or undue influence.

1.4. Information provided to the committee

The committee received the self-evaluation report from the Bernoulli Institute, including all information required by the SEP. Before the site visit, additional information was provided at the request of the committee, pertaining to key publications, PhD policy, stakeholders, tenure track promotions and numbers regarding (gender)diversity at Bernoulli. The Committee also received the previous evaluation reports of JBI and ALICE, the SEP 2021-2027 and the Terms of Reference for the evaluation.

1.5. Procedures followed by the committee

During an online kickoff meeting on 27 June 2022, the committee members were introduced to the Bernoulli Institute by the Director of the Bernoulli Institute. The committee was also briefed on the protocol and framework for research reviews according to the SEP.

Prior to the first meeting, all committee members independently formulated their preliminary findings of the units under review, and additional questions for clarification based on the written information that was provided prior to the site visit. During a preparatory meeting, the committee discussed the preliminary findings and questions, decided upon a number of comments and questions, and agreed upon procedural matters and aspects of the review. After the interviews the committee discussed its findings and comments, allowing the chair to present the preliminary findings to the Institute.

A draft report was presented to the Bernoulli Institute for factual corrections and comments. In close consultation with the chair and other committee members, the comments were reviewed by the

secretary and incorporated in the final report. The final report was presented on 16 January 2023 to the Executive Board of University of Groningen.

2. Evaluation of Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence

2.1 Introduction to Bernoulli Institute

The Bernoulli Institute, BI, is one of the ten research institutes of the Faculty of Science and Engineering (FSE) of the University of Groningen (UG). The FSE is a broad faculty that performs fundamental research and has accredited degree programmes in a wide spectrum of disciplines: astronomy, mathematics, applied mathematics, physics, applied physics, chemistry, chemical engineering, industrial engineering and management, mechanical engineering, computer science, artificial intelligence, biology, life science and technology, and pharmacy.

BI is the only research and educational institution in the Netherlands that combines mathematics, computer science, and artificial intelligence. It was established in 2018 by merging the Johann Bernoulli Institute for Mathematics and Computer Science (JBI) and the Institute of Artificial Intelligence and Cognitive Engineering (ALICE). The institute is home to fifteen research groups clustered within three disciplinary departments:

Mathematics (Math): Algebra; Dynamical Systems, Geometry & Mathematical Physics; Computational & Numerical Mathematics; Probability and Statistics; Systems, Control and Optimization.
Computer Science (CS): Fundamental Computing; Scientific Visualization & Computer Graphics; Intelligent Systems; Information Systems; Distributed Systems; Software Engineering.
Artificial Intelligence (AI): Autonomous Perceptive Systems; Multi-Agent Systems; Cognitive Modeling.

The research groups encapsulate six research topics that received substantial funding from the National Sector Plans for the appointment of new staff positions. Additionally, the groups are connected to three interdisciplinary themes, that are managed by an interdisciplinary committee of researchers: Computing and Cognition; Geometry and its applications; Systems, Data & Society.

At the time of the site visit, Bernoulli's staff comprised 17 full professors, 18 associate professors, and 31 assistant professors. Each of the three departments (Math, CS and AI) has a management team and a department head. All three department heads are members of the BI Board, which consists of five members. The chair of the Board is currently Prof. dr. Jaap Top (Math) and its vice chair is Prof. dr. Paris Avgeriou (CS). The other three members are Prof. dr. Kanat Camlibel (Math), Prof. dr. Bart Verheij (AI), and Prof. dr. Dimka Karastoyanova (CS). The Board meets monthly to decide on matters related to the entire institute (e.g., distribution of new resources, strategy, relation to the higher organizational structures such as the management of the FSE and of the UG).

The Scientific Director of Bernoulli Institute is Prof. dr. Niels Taatgen (AI). He is responsible for the daily management and representation of the institute. The Scientific Director is accountable to the FSE Board and maintains contacts with external stakeholders. The Scientific Director is elected by the staff from among the professors for at most two 3 year-long terms.

The director is assisted by an administrative team: the BI business manager is in charge of budgeting and financial reports: the scientific coordinator facilitates research contacts among staff and other researchers at UG, and assists with funding applications; two PhD coordinators are appointed to support and guide the PhD trajectories at the institute. Finally, the secretarial office provides support for the daily operations at the institute, communication and logistics.

2.2 Aims and strategy

During the evaluation period, the Bernoulli Institute mission has been:

- to perform academic research that pushes scientific boundaries;
- to perform teaching in the areas traditionally covered by Math, CS, and AI;
- to contribute to society in the broadest sense;
- to transfer knowledge to other areas of science and technology;
- to initiate and expand inter- and multidisciplinary research collaborations.

The overall mission was supported by concrete strategic aims, which were also informed by the recommendations made by the previous evaluation committee in 2015. In the audit period, the Bernoulli Institute has:

- focused on a further strengthening of its **research quality and academic impact** through hiring excellent researchers and good career and grant proposal support for all its staff members;
- invested in **inter- and multidisciplinary collaborations** between the research groups and research themes. The merger of ALICE (AI) and JBI (Math and CS) was an important step in the realization of this goal, creating an organizational context in which productive interdisciplinary exchange and collaboration are made possible. To support these aims, the institute has a steering committee for each of the three interdisciplinary themes, which organizes research and pitch meetings, and supervises the development of joint research activities and scientific content;
- acted towards the improvement of **staff diversity**, aiming in particular to improve gender diversity and good representation of women in all successive career stages;
- actively invested in gaining influence in **relevant (inter)national research and innovation agendas** to push the boundaries of science. BI stimulated its staff members to become involved in working groups for academic organizations in the Netherlands and abroad. In addition, Bernoulli hosts honorary professorships to influence and connect with innovation agendas;
- Took a range of measures to **stimulate societal impact** and facilitate transfer and exchange of knowledge between researchers and stakeholders, for example, through partaking in public talks, appointing honorary professorships from the working field, developing student internships and stakeholder assignments, and connecting with the various internal and external networks of the UG to enable exchange between researchers and public/private partners.

2.3 Qualitative Evaluation

The information provided by the institute in its Self-Evaluation Report and additional documents, as well as the open nature of the interviews, allowed the committee to gain good insight into the quality of research, the societal impact, and viability of the Bernoulli Institute. The committee was very satisfied with the constructive and informative conversations it had with all of the representatives of the institute.

2.3.1 Research Quality

In its evaluation of the Bernoulli Institute, the committee encountered an energetic, stimulating and collegial research environment, eager to learn and build upon the steps taken after the merger in 2018. According to the committee, the institute's mission is relevant and timely, and demonstrates a genuine ambition to not only perform excellent research and push scientific boundaries in its three disciplines, but also to develop productive and innovative multi- and interdisciplinary collaborations within and outside the institute, and to achieve significant societal impact.

Organizational structure and governance
The committee is very positive about the merger of JBI and ALICE in 2018 into one institute: the Bernoulli Institute. The committee thinks that this merger and subsequent hiring of new staff have led to a sufficient critical mass that is necessary to achieve the institute's goals and ambitions within its research domains and realize its desired societal relevance and impact. The committee compliments the institute for the steps it has already taken in the past years to strengthen the exchange between and coherence within its new organizational structure. The merger brings together fifteen research groups and therefore necessitates an ongoing investment in this academic community, as well as in favorable conditions for productive collaboration and joint initiatives. In its conversations with the various representatives of Bernoulli, the committee could establish that all participants subscribe to the strategy and ambitions of the institute and value the opportunities for interdisciplinary and multidisciplinary exchange and collaborations following the merger. The committee is appreciative of the governance structure of the institute which consists of a scientific director supported by the Institute Board consisting of representatives from each disciplinary department: Math, CS, and AI. Strategic decisions and the formulation of short-term and long-term goals are therefore always informed by the interests and ambitions of all research areas.

The committee greatly values what the institute has gained from the merger when it comes to the acquisition of staff and funding. It has helped secure funding for one of the faculty-wide interdisciplinary centers, CogniGron, which in turn enabled the appointment of ten new staff positions and a large number of PhD positions. The merger of the two Institutes, support from the Faculty, and the investments from CogniGron created enough critical mass in computer science to be able to participate in the Sector Plans, which provided another six positions for CS/AI. The size of the institute allows it to have significant weight in policy decisions at the faculty level. Additionally, researchers of the institute benefit from the centralized support structure for administrative and financial and scientific matters, as well as PhD coordination.

However, the committee did feel that the current structure of Bernoulli is overly complicated, with fifteen research groups, three departments, six research topics which define Bernoulli at national level and three interdisciplinary research themes that structure collaborations between groups and departments. The committee reckons that this complexity may stand in the way of the formation of a strong and cohesive interdisciplinary institute and be a barrier to productive exchange and interaction among research groups. The committee recommends that the Bernoulli Institute thinks about whether this structure is indeed necessary or even desirable, and it encourages the institute to investigate the possibility to abandon of the six research topics and also of the departmental structures such that research groups and interdisciplinary themes can serve as a starting point for further development of the institute. For example, at most other Dutch universities, CS and AI are part of the same department. As is evidenced in the documentation, CS groups are also working with AI techniques, and vice versa. It may also be beneficial to integrate Math and CS/AI more, as it is done at the national research institute CWI.

The documents and conversations with representatives of the institute testify to robust research lines and productive connections and collaborations within the ecosystem of the institute, with the FSE and UG, as well as with external partners and stakeholders. At the level of the FSE/UG, for example, the BI is co-founder of three interdisciplinary research centers in the period under evaluation: The Center for Data Science and Systems Complexity Research (DSSC); Fundamentals of the Universe (FotU) and Cognitive Systems and Materials Centers (CogniGron), all three of which connect with one or two of the designated interdisciplinary themes at BI. These centers have led to a significant number of publications and educational activities, and prompted several staff appointments. Through the appointment of board members of these centers, the BI was and is able to shape the research agenda of these initiatives in line with BI's interdisciplinary themes. At the DSSC, BI holds a chairmanship position and two board memberships. At CogniGron, the seven-member board includes four members from the BI. The FotU has two board members from the BI. The institute has also lobbied for the participation of the BI in competitions for the assignment of PhD positions funded by these centers.

During the site visit, the committee visited various labs, among which, the Robotics and Visualisation labs as well as CogniGron. The committee was delighted to learn more about the research conducted there and to hear more about the CogniGron goal to develop a new form of computing, based on new materials and electronic components that mimic biological brain synapses. The committee recognizes that the BI is in the first stages of its ambition to establish itself internationally as a center of expertise in cognitive computing and in human and machine intelligence through the CogniGron and the Hybrid Intelligence Gravitation projects.

According to the committee, the BI is embedded in relevant national networks and organizations within the research domains of Math, CS, and AI. Staff members play an active role as representatives of their disciplines in these networks. Participation in these networks ensures that the BI is connected with other institutes in its three disciplines and is able to actively contribute to the research agendas of these fields. Examples of these networks are the Research Committee of the Platform Mathematics Netherlands (PNW); the four national research clusters for Mathematics (DIAMANT, GQT, NDNS+, STAR); the Netherlands Institute for Research in ICT (NIRICT); and the ICT Research Platform Netherlands (IPN), which also connects with public-private networks and the school for Information and Knowledge Systems (SIKS). The BI advocates for curiosity-driven science and for pushing disciplinary boundaries through innovation. Accordingly, the BI hosts honorary professorships and dispatches staff members to academic-stakeholder initiatives that concern transferring scientific insights to society and industry. Another example of this orientation and investment in innovation agendas is the participation of the institute director in the establishment of the Jantina Tammes School as a UG-wide interdisciplinary platform focused on digital innovation, artificial intelligence, and technological progress.

Internationally, the BI has a substantial number of contacts and joint projects with universities abroad (through grant proposals, joint doctorates, etc.), and memberships in international professional organizations (such as IEEE, etc.). In addition, the institute has been involved in the High-Performance Computing subproject of the Human Brain, one of the large size six flagship projects funded in 2013 by the H2020 Future and Emerging Technologies. The BI was also involved in the establishment of a European Digital Innovation Hub in Groningen that, as part of a continental network, is supported by the European Commission to accelerate the digital transformation and uptake of digital technologies by SMEs.

One of the main ambitions of the Bernoulli Institute is to develop common areas of strength and interdisciplinary collaboration, next to the continuation of the disciplinary research within its research groups. To realize this goal, the institute has appointed a steering committee for each of its three

interdisciplinary themes. These committees organize research and pitch meetings, and supervise the development of joint research activities and scientific content. Since 2018, multiple meetings have taken place to jointly discuss new BSc/MSc and PhD projects, new courses, and joint funding proposals. The BI staff retreat in 2022 included special sessions dedicated to the shaping of research lines within the institute's themes. The development of joint funding proposals is encouraged by means of funding that the Faculty of Science and Engineering assigned to all its institutes for proposal preparation, and which the Bernoulli Institute makes available to its three themes. In its conversations with representatives of the institute, the committee observed that all researchers value the opportunities they are offered for exchange with other groups and disciplines within the institute. They indicated that the institute motivates them to look across disciplinary boundaries when developing new research lines, especially since interdisciplinary perspectives are increasingly important when applying for grants. Also, researchers from different research groups and disciplines are more often able to share PhD-students, thanks to the new organizational structure of the institute. The participants the committee spoke to expressed that they experience interaction and exchange with colleagues from other disciplines as very natural.

The committee is positive about the institute's active engagement in, and contributions with, national and international research networks and organizations, which testify to the BI's ambition to push disciplinary boundaries and curiosity-drive science. The committee also praises the BI's ambition to foster productive inter- and multi-disciplinary exchange between its three disciplines and its research groups. Overall, researchers appreciate their working environment, indicating that they feel at home in the institute and value their interactions with their colleagues. The committee also learned that the formation of a cohesive, close-knit, research community is an ongoing effort and that the restrictive measures due to the COVID-19 pandemic have led to some delays in this process of community building. With the staff retreat in 2022, Bernoulli has made a fresh start and is taking steps to further develop an infrastructure supportive of a cross-cutting interdisciplinary research orientation.

The committee encourages the institute to continue on its envisioned path, building further on its strengths and its opportunities for development. An important tool in this regard is a joint development of a masterplan that offers a coherent framework, clear goals, and concrete indicators for progress in the near and more distant future. This masterplan can serve as a guideline for what the institute wants to achieve when it comes to interdisciplinary collaboration among research groups; as well as with external (inter)national partners and stakeholders; the selection and direction of research lines; funding and grant acquisition; and human resources (see also the sections on output, funding and grants, as well as the human resources below). The committee highly recommends that the institute develops this masterplan as soon as possible, so that everyone involved is aware of what the Bernoulli Institute aims to achieve and what the time frames are for these goals. This way, researchers and staff members will be able to make informed choices and actively contribute to the strengthening of the institute's multi- and inter-disciplinary synergy.

Academic Culture and Open Science
The committee is positive about the manner in which Bernoulli Institute invests in good academic culture. Its policies and scientific practice comply with the Code of Conduct for Scientific Practice of the UG, which sets the standard for care, reliability, verifiability, and independence in scientific research. The UG has its own regulations for the protection of academic integrity and provides a confidential advisor for questions pertaining to issues of integrity. Research integrity is also an integral part of the performance evaluation interview for all staff members, as well as an important topic in the training courses for Master students and PhD candidates. A Steering Committee 'Research Integrity' advises the FSE Board, also with regard to issues of data management. In alignment with the UG and FSE policies, the BI implements its own Research and Data Management Policy (RDM), which describes the conditions and processes for data use, storage and accessibility.

The committee is pleased to observe that the institute actively strives for a culture in which principles of scientific integrity and independence are integral to all research activities. The institute has gained a lot from its efforts in this regard and has come a long way. However, the committee also noted that there is room for improvement on this front. Although no major issues with research integrity have been noted in the past 6 years, the committee encourages continued attention to the awareness of research integrity issues, at all levels of the organization. The major organizational restructuring of the institute, significant changes in regulation, and the rapid transition from closed to open science call for clear communication on the work floor, ensuring that everyone is on board and knows what is expected.

With regards to Open Science principles, the committee compliments the institute for the steps it has taken with regard to open access publishing and research ethics. The institute informs and connects its staff to the UG Data Competence Center, which provides services to researchers interested in making their publications open access. The BI staff lunches have also included information sessions on Open Science and responsible bibliometric measures. During the reporting period, the institute has increasingly published its research as Open Access (from 57% in 2017, to 88% in 2020). Although Green Open Access publications are still predominant, the number of Golden Open Access publications is rising (from 12% in 2018 to 20% in 2022). This substantial increase demonstrates that the institute is indeed committed to the principles of Open Science. The committee encourages the BI to set concrete goals when it comes to open access publishing and to ensure clear communication of these ambitions to all involved. It also urges the institute to help researchers navigate options of open access publishing, so as not to rely too much on existing deals with commercial publishers, as these might be undergoing changes over time. The BI has established a Research Ethics Committee that assesses the ethical permissibility of proposed research with a data-centric focus. It gives recommendations about the secure, fair and transparent treatment (collection, processing and storage) of sensitive data based on EU guidelines. At the level of the UG, the BI participates in the inter-faculty ethics committee, and two of its members have been part of the Open Science Community Groningen, which is the branch at the UG of the International Network of Open Science and Scholarship Communities. The assessment of ethical aspects of projects involving human subjects is handled by a committee outside of the BI called CETO. The FSE manages all ethical requests for research involving human subjects through CETO
The committee is happy with the policy in place for ensuring good ethical standards for research, but again emphasizes the necessity for clear communication of these principles to all researchers at the BI.

Output quality
The committee observes that, overall, the BI has performed well, enabling and stimulating impactful research in its three disciplines, Mathematics, Computer Science, and Artificial Intelligence. According to the committee, research quality within the three directions is on par with that at other Dutch universities. Research at the BI ranges from fundamental to applied and from disciplinary to interdisciplinary, while also providing methods and tools for many other science areas, such as astronomy, physics, medicine, economics, and psychology, as well as for engineering and the humanities (computational linguistics, digital humanities). Objective evidence for the quality of research at the Bernoulli Institute is the increase in output of publications (including conference papers), the number of impactful peer-reviewed publications, the number of research products resulting from interdisciplinary collaborations, the acquisition of grants, and honorable memberships and distinctions for its staff members.

During the period under review, the output of Bernoulli increased from 253 research products in 2015 to 293 in 2021. This rise in numbers can in part be attributed to an increase in staff members but is also the result of the strategic decision to recruit researchers with a strong scientific profile. Furthermore, the institute's publication profile is characterized by notable papers in the six self-

defined focal areas: Geometry & its Applications, Systems & Dynamical Data, Computer Interaction & Visualization, Cognitive AI, Software Intensive Systems, and Machine Learning & Pattern Recognition. Publications and citations were benchmarked with the UG online tool SciVal, which is based on Elsevier's database Scopus. The publications numbers and citations in these six areas are comparable to those of the top-10 active research institutions worldwide.

The committee recognizes that although numbers and citations may give an approximate indication of research quality, they do not give insight into the content of the publications and why these are thought to be of importance by the Bernoulli Institute. Moreover, the SciVal, is limited to the Elsevier's database Scopus Therefore, the committee requested the institute to select several key publications per discipline and provide more background information on why these research products serve as evidence of high research quality. After receiving this additional information, and in combination with the numbers of its output, the committee could indeed conclude that the institute's quality of research, research portfolios, and (inter)national academic reputation in its different scientific disciplines (Math, AI, CS) are comparable to those of the other Dutch universities.

Publications resulting from multi- and inter-disciplinary collaborations also serve as evidence of the quality of research at the Bernoulli Institute and showcase that it indeed is able to achieve the goals it has set for itself in this regard. In the period under review, the number of collaborative research products and grants has increased significantly compared with the period prior. This can be explained by the involvement of the BI researchers in collaborations with staff from other UG institutes through the DSSC and CogniGron. Thirty out of all 219 PhD projects started at the BI since 2016 have been funded through the DSSC, FotU, and CogniGron. In all three disciplines, the committee sees evidence of productive multi- and inter-disciplinary research initiatives, such as projects for DSSC, FotU and Cognigron, collaborative research training projects (COFUND and ITN), collaborative grant applications in astronomy and medical imaging (ICT), and collaborations of AI research groups with other schools at UG, including behavioral and medical sciences. Another example is the ERC-awarded project CardioZoom, a collaboration between Math, CS and UMCG.

The number of significant memberships on boards, grant selection committees, programme committees and editorial boards are also indicators of research quality and academic reputation. These mark recognition from peers and indicators of the influence of the BI in decision-making bodies. The BI researchers hold memberships and distinctions in the following selective academic organizations: Membership in the Royal Netherlands Academy of Arts and Sciences (since 2021); fellowship in 2015 in the Institute of Electrical and Electronics Engineers (IEEE); membership for three BI researchers (AI, 2017; CS, 2019; Math, 2021) in the Young Academy Groningen (YAG). Several staff members also have prominent roles as advisors to the Dutch government. According to the committee, the overview of memberships on editorial committees, involvement in the committees of conferences and scientific organizations that advise on academic quality and strategy and/or evaluate performance shows that Bernoulli researchers are involved in the management and organization of major publication venues for their fields, and that each of the BI research topics has a substantial representation in each of these venues.

Funding and grants

The number of grants acquired also shows to what extent the research quality of the institute is recognized nationally and internationally. The BI finances during the period under review consisted of internal funding via the FSE allocation model for the hiring of tenure-track staff, external funding through the governmental initiative Sector Plans, and an external contribution to CogniGron. The Sector Plan investment (€3 in Math and €3.9 million in CS/AI) was directed to fund new staff positions at different career levels in the BI areas of strength and priority (e.g., Computer architecture, Explainable cognitive AI, Responsible AI, Cognitive robotics, Human-computer interaction, Human-

computer collaboration, Algorithms and formal methods, Machine learning for information assurance, Algebraic/Differential/Stochastic Geometry, Security, Dynamical systems, Systems theory and Optimization). CogniGron funding was channeled to hire 10 additional positions with immediate relevance to the BI theme Computing & Cognition. In five years, the positions acquired within CogniGron will become structural. The BI also obtained funding from the FSE for the appointment of PhD positions via the themes DSSC and FotU. Seventeen such positions were awarded via open calls for interdisciplinary project proposals involving BI members and researchers from other institutes.

The BI staff has acquired multiple personal grants that are awarded for excellent research through the NWO's Open Competition, TOP subsidy for Free Research, and Talent Programmes (3 VENI, 6 VIDI, 2 TOP, 2 Klein, 2 M), as well as through Horizon2020 (H2020)/HorizonEurope (HEU) and other funding agencies. The BI also acquired a total funding of €5.4 million euros through collaborative research and training, focused grants such as NWO Gravitation (1, the Hybrid Intelligence project) and European Research Council and HEU MSCA (ERC: 1 Stg; MSCA: 1 IF, 5 COFUND and ITN as PI and co-applicant). Compared to the previous reporting period, competitive external funding at the BI has grown significantly: the total amount of national grants has grown from 14% of the total budget in 2015 (€1,049,767) to 16% (€1,867,217) in 2021; international grants have grown from 1% (€740,545) in 2015 to 17% (€1,988,981) in 2021.

The committee is positive about the funding and grants acquired by the Bernoulli Institute. The merger in 2018 led to the necessary critical mass to compete successfully for major grants such as the Sector Plan and CogniGron. Also, the individual grants procured by the Bernoulli researchers testify to their scientific reputation and the quality of their research. There is good balance between the three disciplines when it comes to funding and grants. Furthermore, the committee is pleased to hear that FSE provides individual funding for researchers whose grant applications received excellent reviews but were not awarded. This being said, the committee urges the institute to work towards a financial plan for the long-term in which it identifies potential sources of funding for promising research directions, in alignment with its multi- and inter-disciplinary research ambitions.

2.3.2 Societal relevance

For the Bernoulli Institute, societal impact can take on various forms, ranging from improving societal awareness among the general public, education in its various scientific areas, to transferring novel scientific insights to public and private societal stakeholders, be they regional, (inter)national. The BI impact strategy is to allow researchers to identify impactful activities most suitable to their research, to help them establish contacts with stakeholders by coordinating with relevant FSE and UG centers and networks (e.g., the FSE business developer, the GEBC, the GDBC, the Industrial Relations office, ScienceLinx, which is a UG office in charge of popularizing science), and to facilitate the transfer of knowledge between stakeholders and researchers. In addition, there is an Industrial Advisory Board for educational programmes in CS. Such involvement of stakeholders at the BI is intended to help the institute fine-tune its programmes according to the knowledge demands of the job market.

In the documentation and during the site visit, the committee was presented with examples and case studies of the societal impact of research at the Bernoulli Institute. Evidence of societal impact can be found in the number of data sets made available for societal stakeholders in the period 2015-2021, a total of 41, and the patents filed by BI researchers (three in total). The institute has also been credited with 66 external patent applications worldwide. In addition, the substantial number of grants bridging research and innovation reflects Bernoulli's investment in working with societal stakeholders.

Student internships also function as bridges between science and public and private companies (such as TNO, IBM, Philips Drachten, Belsimpel, Cadmatic, ProRail, as well as SMEs) allowing these stakeholders to benefit from the scientific knowledge developed within the institute. Student internships, stakeholder assignments, and master theses, serve as preferred instruments for BI staff to

test a potential collaboration with societal partners, and to probe together new scientific insights in application fields. These projects also provide opportunities for the BI staff and students to identify technological needs that are not yet met scientifically and commercially.

Several BI members and students established spinoffs and startups that are steadily building their influence in larger networks such as the public-private collaboration "Dutch AI Coalition" (Researchable) or the Data Federation Hub that support scientists and third parties to deliver excellent research by enabling state-of-the-art IT solutions and data expertise. Overall, BI has become a more visible partner for research collaborations in the (North of the) Netherlands, with approximately thirty companies involved in various collaborations.

Next to these activities, Bernoulli researchers are involved in outreach and education, for example, developing lectures and learning material for secondary school teachers and students, coaching and training math teachers, and contribute to public events such as the regional and national Math Olympiad. Researchers in CS and AI designed courses and teaching packages on "Ethical hacking and data security" and "Programme Correctness." The BI staff are also involved in two projects that develop tools to enable teachers and learners to assess the benefits and pitfalls of AI. Furthermore, the (social) media exposure of BI researchers has become more visible in the past years.

The committee is positive about the various forms of societal impact realized by the BI. It was very enthusiastic about the societal relevance of the research presented in the lab tours during the site visit. The visualization of blood streams flowing from the aorta to the heart chamber in order to model deterioration is highly supportive of medical diagnostics. Also, experimentation with VR visualization is another example of research that can lead to a new application or product. The same is true for the development of a new generation of leg prostheses that allows amputees to walk more naturally, with their new leg adapting to different walking patterns being controlled by electrical impulses from the brain. The contribution of the BI to the mathematical education of students in the topics of the BI and also to most other study programmes of Groningen University is commendable. Finally, the experimental work done in the CogniGron Lab has the potential for far-reaching societal impact if it fundamentally changes our methods and materials for computing.

While acknowledging these important examples of (potential) societal impact, the committee misses a more coherent strategy for achieving structural and durable societal impact, particularly when it comes to partnerships with industry. The committee understands that researchers are reluctant to do service research, but thinks the institute is missing opportunities to do valuable and relevant research in industrial contexts, for example via EU training programmes. It urges the institute to rethink its strategy in this regard and to build up experience in productive research collaborations with industrial partners. To further strengthen the structural and durable societal relevance of its research, the committee advises ensuring a clear vision and shared reflection on societal impact as part of an overarching masterplan, making clear what it aspires to, and setting clear goals and making explicit expectations. At present, the committee found that each programme defines societal impact differently, and that even between researchers there are differences in interpretation. A shared vision and reflection on societal impact would be helpful in setting shared goals for the future.

2.3.3 Viability

In the period under review, Bernoulli has been successful in achieving many of its goals. As described in previous sections, the merger between JBI and ALICE has benefited the institute with regard to its critical mass, its opportunities for funding, and the possibility to strategically position itself both within the FSE and the University of Groningen, as well as in relation to external partners and stakeholders. This restructuring has also put the institute in a good position to stimulate and enable productive multi- and inter-disciplinary collaborations among its research groups. With regard to overall research funding, the viability of Bernoulli is sound, according to the committee. The financial viability of the institute is based on substantial funding for the interfaculty collaborative research project Cognigron,

and the funding acquired via the Sectorplan, as well as on many national and European individual grants for researchers. Being a multidisciplinary institute is in this respect indeed a major advantage, allowing different research groups to tap into funding from different sources.

As discussed under Research Quality, the committee highly recommends that the institute develops a masterplan that serves as a guideline for the direction in which it is heading, with clear goals and indicators for success with regard to the research directions and the opportunities for funding, the balance between interdisciplinary and disciplinary research, the ambitions for growth and its collaboration with societal partners. A point of concern (also identified by the previous review committee) is the threat posed by the success of ICT to fundamental computer science research in the Netherlands. The success of the BI in its interdisciplinary endeavor may exacerbate the neglect and decline of research in theoretical computer science. According to the committee, maintaining a core competence in fundamental computer science and software engineering as well as mathematics is a prerequisite for both further advancement of ICT, as well as future success of interdisciplinary endeavors. Maintaining this core competence and how to nurture it further also requires deliberate attention in the long-term master plan recommended by the committee.

Additionally, this masterplan should include a long-term vision on human resource policy, measures to support diversity and talent development, as well as PhD Policy. These topics are discussed in what follows.

Human Resource Policy

For the Bernoulli Institute, research quality is achieved by appointing and retaining researchers of excellent quality, and by offering its staff members good support structures for grant application and career development. Talent selection at the institute is very competitive and offers good start-up packages for those that are hired, in alignment with FSE recruiting policy. The institute is currently one of the largest institutes within the FSE. With the growth in personnel, from 29.7 research fte in 2015 to 42.3 research fte (in Feb. 2022) the institute has been able to strengthen its research and areas of expertise, and engage in new initiatives such as CogniGron. Also, the FSE is redeveloping the tenure track procedures, with profiles for research, education and impact, and earlier opportunities for tenure, both of which will benefit staff acquisition and retention. The committee compliments the institute for the way it has been able to attract and appoint outstanding researchers in the relevant research areas. It also sees good potential in the junior research staff members, which speaks to the viability of the research at Bernoulli.

The committee took note of the very high teaching load of the researchers involved, particularly in the study programmes taught by the CS/AI departments. This issue can have potentially negative effects on the viability of the institute. A sufficient number of teaching staff is of great importance, and this is why it is crucial to think of ways to remedy this, for example through recruitment of staff members to help address the high teaching load. The committee is pleased to learn that this issue is indeed on the radar of the Bernoulli Institute and that recruitment is aimed at mitigating the pressure of teaching on its staff. Another point of concern is the fact that the policy with regard to the new tenure track profiles is not always clear to the people involved. At the moment, the staff members with an educational profile have different, less competitive, starting packages which put them at a disadvantage when it comes to grants and career perspectives. The management of FSE is aware of this inequality in the evaluation and advancement criteria and is in the process of remedying this. Also, the committee learned that there was no midterm evaluation for many tenure-track staff members, which makes it difficult for them to have insight into their progress and to know if they are indeed 'on track'. The committee urges the institute to address these points of concern, ensuring that the inequalities between tenure-track profiles are remedied, that researchers receive the guidance they need and are aware of the changes being implemented in the criteria for tenure and promotion.

Diversity

The committee appreciates the efforts the institute has made during the period under review to improve diversity and inclusion within its staff composition. The BI has adjusted its selection procedure to benefit female and gender minority applicants, and all the members of the BI selection committees have followed special diversity training. The BI participates in the Rosalind Franklin fellowship, a UG programme for the advancement of talented international female researchers. Specifically, the first batch of positions awarded to the BI through the Sector Plans were recruited through the Rosalind Franklin procedures. Representing diversity of staff members (regarding gender and career level) is also implemented in the management structures; selection committees must always include at least one female member.

Though these efforts have resulted in a significant increase of female staff members in different career levels (now an average 31% female staff in CS/AI; and 10% in Math), doubling the presence of female staff in the period 2015-2021, the number of women at various senior levels and in leadership positions in the institute still lags behind other comparable institutes within FSE and UG, and those of other universities in the Netherlands. With regard to averages of female staff, the CS/AI departments at the BI are doing better than most CS/AI departments at other universities. However, with only 10% of female representation, Math clearly lags behind – departments at other universities have an average of 20% or more of female staff representation.

The committee observes that the Bernoulli Institute shows awareness of the need for gender equality and that it takes active measures for a more inclusive HRM policy, although specific performance indicators have not yet been set. The committee encourages the institute to set these goals and formulate concrete paths and timelines to achieve these ambitions. Also, it struck the committee that cultural and other aspects of diversity seem to be less clear on the radar. The documentation reflects on cultural diversity, but this term seems to be narrowed down to the presence of international staff. The committee would welcome a broader interpretation of the term ``diversity'' and encourages the development of policies that include other types of, and approaches to, diversity.

Talent selection and development

The committee explored how the Bernoulli Institute recruits young talent and manages career tracks of its early career and senior researchers. Attracting, retaining and supporting excellent researchers stands at the foundation of high research quality, according to the institute. The Bernoulli Institute benefits from the UG partner programme (job opportunities for partners of researchers) and good start-up packages.

The BI places great emphasis on supporting its tenure-track professors, since they form the next generation of leaders in science. The tenure track staff members' progress is discussed in the annual evaluation cycle, and also during a mid-year preview meeting with the BI group leaders, scientific and education directors and the scientific coordinator. The institute has a special coaching programme for both assistant and associate professors, which consists of approximately three meetings a year with tenure track staff, more senior researchers, and sometimes other guests to discuss the various aspects that contribute to a successful academic career. Over the period under review, the Institute hired 17 tenure-trackers at assistant professor level, and 7 tenure track associate professors; of the first category, almost half received tenure and promotion, only one person resigned, and one other person was not promoted. Of the second category, two have been promoted to full professor, one person was denied this promotion and the rest is in the process of evaluation to be promoted to full professorship. The BI has lobbied at faculty level for the adaptation of the requirements for tenure track promotion to account for the limited funding possibilities present in Math, and the variety of talent in science. The three tenure track profiles – research, education, and societal – are being further developed and fine-tuned.

The BI aims to show-case talent and supports its staff at all career levels. To this end, it provides researchers with guidelines for their publication and research collaboration strategies and created a Prize and Awards Committee that scouts and prepares researchers (from PhD candidates to senior staff) for prestigious titles and memberships in (inter)national academic organizations. Furthermore, the institute offers a variety of support structures for grant writing, including coaching and editing services via UG and FSE. It organizes information sessions with the national contact points in the Horizon Europe Programme, which provide details about the various types of European grants. It also offers a small bonus (500 euros) for each proposal submitted, which the staff can use to hire professional editors for the preparation of future grant applications. Of those interviewed, the committee was pleased to note that early career and senior researchers at the institute feel supported by their peers and supervisors and that they receive personal mentoring and are stimulated to find their own research paths. Support is offered at Faculty/University level, and there is also good peer-support from colleagues.

In its conversations with postdocs, the committee noted that they feel very much included in the BI community. They indicated that the institute puts a lot of time into bringing them into contact with other disciplines and groups. Through retreats, network meetings, and lunch seminars, they are exposed to research conducted in other groups and departments. Postdocs feel themselves to be treated as faculty. They did however indicate that their teaching load is high, especially for those with an extra teaching appointment, and that in most cases they are not able to have their own PhD candidates. This affects the potential of postdocs for applying for tenure-track positions and prestigious grants.

Overall, the committee appreciates the BI's focus on talent, and the guidance and support that it offers to both its senior and early career professors. The BI is clearly committed to giving all its researchers the support, mentoring, and funding they need to take the necessary and important steps in their careers. However, as mentioned in the previous section, the researchers in tenure tracks were not aware of the revisions being made in the criteria for tenure and promotion within the three profiles – this needs to be communicated clearly to avoid misunderstandings and unnecessary anxiety. Introducing a midterm review is also important to help researchers gain insight into their progress and chances for promotion. The specific targets for funded projects should also be clear. The committee also sees room for improvement with regard to the support offered to postdocs. It recommends that postdocs are offered a more structurally supportive framework in which they can develop their talent, share experiences and prepare for future steps in their careers.

PhD Policy and training
PhD candidates at the Bernoulli Institute are recruited through open calls by potential supervisors (with funding from their appointment startup packages at the BI, from grants, and from the FSE via DSSC, FotU and CogniGron), and through selection from among recipients of international governments' scholarships. The management of the PhD candidates of the institute is shared between the BI, which provides research supervision, and the Graduate School of FSE (GSSE), which provides training and professionalization activities. At the institute, a PhD candidate gets assigned at least two supervisors, for example, a promotor and a co-promotor. PhD candidates are coached by the research group and supervisors encourage them to attend and give talks at relevant conferences, co-author publications for scientific journals, and give presentations at the institute. They can also attend the training activities of the national research schools in their disciplines, and at the GSSE.

In collaboration with the supervisor, each PhD candidate enrolled in GSSE must compile a Training and Supervision Plan (TSP) that describes both the research project and the training programme. The training programme is tailor-made and covers 10-15% of the total duration of the PhD programme. Candidates enrolled in a four-year PhD programme are expected to complete a 30-ECTS training

programme; for candidates with a shorter PhD programme, the size of the training programme is reduced proportionally. GSSE organizes regular Result and Development interviews. Following university regulations, these meetings are scheduled after 6 and 9 months, and after 2, 3 and 4 years of the PhD. The interview after 9 months is called the go/no-go interview; at this point in the project, the supervisors need to decide whether or not the PhD candidate has a fair chance of successfully finishing the project within 4 years. To support PhD candidates and improve completion times, the GSSE offers the possibility for PhD candidates to receive individual coaching (5-10 one-on-one sessions with an experienced professional with an academic background). Furthermore, to reduce the workload of the senior researchers, GSSE plays a role in improving the academic skills of the PhD candidates (writing and proficiency in English) as well as training their soft skills. The Bernoulli institute has two positions for PhD-counsellors, who act as an ombudspersons and confidential advisors, to whom PhD candidates can turn if they encounter specific problems.

Based on the documentation and the conversations with PhD candidates, the committee concludes that PhDs are well taken care of at the Bernoulli institute. The PhD candidates were appreciative of the initiatives that are taken to improve their well-being and spoke highly of the many ways in which they are guided, mentored, and supervised. PhD candidates that the committee spoke to are aware of where they can go for support and questions, and they feel heard by their supervisors and mentors. PhD candidates see their PhD-coordinators regularly and receive good support from their supervisors and promotors. For psychological and mental support, students receive periodical messages about support groups and the availability of a psychologist with whom they can book an appointment through the information system. Most PhD-candidates finish their research trajectory within five years, which is in line with most other institutes at FSE. The drop-out rate is low: 10%. If extra funding is needed to finish the research project after 4 years, the institute makes an effort to help the student in finding these resources. Only 5% of the PhD candidates continue in academia, the other 95% find work in industry or other professions. The PhD candidates indicated that even though good support and guidance structures are in place, they would appreciate it if the BI investing more in organizing events for socializing and sharing experiences at institute level so that they can meet fellow PhD-students and other colleagues.

When it comes to diversity of PhD candidates, the gender balance needs to be improved. In the math department there is only one female PhD candidate in a group of 20. In the CS group it is 2 out of 20. In the AI the balance is substantially better, with an equal distribution of male and female PhD candidates. With regard to backgrounds, the majority of PhD candidates comes from outside the Netherlands (75%). This allows for a very diverse community, but it can also sometimes lead to misunderstandings when it comes to expectations and independence. The GSSE is aware of this issue and is actively looking for ways to support PhD-students from different international backgrounds. The committee also observed that the go/no go moment at 9 months is quite early in the process to decide whether a PhD candidate should continue. Supervisors may more be inclined to give a go at this stage because of the incentives connected to the supervision of PhD candidates. Finally, the committee observed that the institute does not have concrete insight into the further career paths of the PhD-students after graduation. It recommends getting in touch with its graduates at least once after a reasonable period to know what they are doing and acquire useful statistics.

In conclusion, the committee states that the Bernoulli institute is without a doubt contributing to talent development and that it provides a well-organized, coherent, and stimulating research environment in which PhD candidates are trained to become independent researchers.

Facilities
In the period under review, the Bernoulli Institute was able to provide good material and technical facilities for its researchers. However, as a whole, the FSE is facing a shortage of research and office

space. Within the faculty, the shortage of the BI is the largest. The institute shares one building (the Bernoulliborg) with the FSE Board and support services. Given the growth of its staff, it is now in the situation where scientific staff need to share office, and soon PhD candidates will need to share desks. This situation is compounded by the fact that the BI was not assigned lab space and had to convert several offices into lab rooms for its research in robotics, visualization, or cognitive modeling. The committee supports the institute's concerns and confirms that sufficient space, and good research and lab facilities are necessary for achieving its goals and ambitions. The committee recommends that remedies for this space crunch be found and implemented as soon as possible.

2.4 Recommendations

Research Quality
- The committee reckons that the complex structure of the institute may stand in the way of developing a strong and cohesive research community in which productive exchange and interaction among its research groups come naturally. The committee encourages the institute to investigate the possibility of letting go of the departmental structures and to investigate how its research groups and interdisciplinary themes may serve as a base for the further development of the institute.
- The committee recommends the institute develop an overarching masterplan that offers a coherent framework and clear goals for the near and more distant future. This masterplan can serve as a guideline for what the institute wants to achieve when it comes to interdisciplinary collaboration among its research groups as well as with external (inter)national partners and stakeholders, the selection and direction of research lines, funding and grant acquisition, and human resources.
- Although no major issues with research integrity have been noted in the past 6 years, the committee encourages continued attention to the awareness of scientific integrity and independence, among all staff members, including PhD candidates. The same holds for communication goals and expectations with regard to Open Science and FAIR principles.

Societal relevance
- To further strengthen the structural and durable societal relevance of its research, the committee advises ensuring a clear vision and shared reflection on social impact as part of the overarching masterplan, making clear what it aspires to, setting clear goals and making its expectations explicit for all researchers involved.
- The committee recommends that the Bernoulli Institute create a coherent strategy to build up more experience in research within industrial contexts.

Viability
- The continued transformational success of ICT poses a threat to fundamental computer science research, especially in the Netherlands. In this environment, the success of the BI in its interdisciplinary endeavor may exacerbate the neglect of research in fundamental computer science. Maintaining a core competence in fundamental computer science, software engineering, mathematics and fundamental aspects of AI is a prerequisite for both further advancement of ICT, as well as future success of interdisciplinary endeavors. Maintaining this core competence and nurturing it further requires deliberate attention in a long-term master plan of the BI.

- The committee urges the institute to ensure that the inequalities in career perspective for education-oriented and research-oriented tenure-track staff members are remedied so that all tenure-track researchers receive the guidance they need with regard to their progress (midterm reviews), and are made aware of the changes being implemented in the criteria for tenure and promotion.
- The committee is happy to note that the BI is aware of the high teaching load of its staff members, especially in AI/CS, and recommends that it continue to address this issue, for example through the recruitment of staff members with additional teaching assignments.
- The committee urges the institute to invest in more support structures for its postdocs.
- Support and guidance of PhD candidates are well organized at the BI. To further strengthen this aspect, the committee recommends improving the gender balance of BI PhD candidates, particularly in the Math and CS departments, through institute-wide recruitment strategies. Furthermore, more opportunities for exchange and socializing at the institute level would contribute to the development of an institute-wide research community.
- Since 95% of the PhD-students continue their careers outside of academia, the committee urges the institute to actively track the careers of its alumni to gain more insight into how they develop and in what way the BI is contributing to the professional working fields wherein they are involved.
- The committee shares the institute's concerns regarding the shortage of office and research/lab space and emphasizes the strategic importance of good facilities for the realization of the BI's goals and ambitions.

Appendices

1. Programme Site Visit of the Bernoulli Institute, October 5th – 6th 2022

Day 1: October 5th, 2022
Location: Prinsenhof Hotel Groningen
Martinikerkhof 23
9712JH Groningen

Time	Event	Location
After 14:00	PRC Members may check into hotel room	Hotel Prinsenhof
17:00	Reception and Welcome from the Director of the Bernoulli Institute and Faculty	Hotel Prinsenhof Tuinkamer
18:00 – 21:00	Dinner for the members of the PRC	Hotel Prinsenhof Tuinkamer
21:00	Approximate end and return to rooms	

Day 2: October 6th 2022
Location: Bernoulliborg, Nijenborgh 9, 9747 AG Groningen

Time	Event	Location	
7:00	Breakfast + checkout	Hotel Prinsenhof Grand Cafe	
Approx 8:30	Travel to Zernike Campus		
Begin Site Visit Programme			
Approx 9:00	PRC members arrive at Zernike Campus, Bernoulliborg	Faculty room	
9:15 – 9:30	Closed session with PRC members	Faculty Room	PRC
9:30 – 10:15	Interviews with Management	Faculty Room	BI Management plus Dean: Niels Taatgen, Jaap Top, Paris Avgeriou, Dimka Karastoyanova, Kanat Camlibel, Bart Verheij, Stefania Costache. Joost Frenken and Alicia Brandt also.

10:15 – 10:30	Short break PRC (Coffee/tea provided)	Faculty Room	Move to rooms for parallel sessions
Parallel Session Group 1			
10:30 – 11:00	Interviews with Director GSSE and BI PhD Coordinator	Faculty Room	**PRC Group 1** Jos Baeten, Vijanti Ramautar, Elisabetta Dinitto, Sonja Hochloch Sabeth Verpoorte Tanja van der Woude
11:00 – 11:30	Interviews with PhD candidates	Faculty Room	Anne-Men Huijzer (Math), Dennis da Silva (CS), Luis Venegas Pineda (Math), Mian Li (CS), Mi Tang (AI), Reidmen Aróstica Barrera, (Math)
Parallel Session Group 2			
10:30 - 11:00	Interviews with Postdocs	VIP Room	Stefania escorts them to the VIP room **PRC Group 2:** Ann Nowe, Max Louwerse, Volker Mehrmann, Farhad Arbab Celestine Lawrence (AI), Fadi Mohsen (CS), Francesca Bianchi (Math), Mohammed Soliman (CS), Stephen Jones (AI)
11:00 – 11:30	Interviews with External partners	VIP Room	Matthijs Vonder (TNO) Marie-José van Tol (UMCG)
11:30 – 11:40	Short break (Coffee/tea provided)		
Session 2			
11:40 – 12:20	Senior Staff	Faculty Room	All PRC members Alexander Lazovik (CS), Cecilia Salgado (Math), Georgi Gaydadjiev (CS), Herbert Jaeger (AI), Rineke Verbrugge (AI), Cristobal Bertoglio (Math), Helle Hansen (CS), Holger Waalkens (Math), Jiri Kosinka (CS), Raffaella Carloni (AI), Michael Biehl (CS)
12:20 – 13:00	Junior Staff	Faculty Room	All PRC members

			Andreea Sburlea (educational profile, AI), Daniel Feitosa (educational profile, CS), George Azzopardi (CS), Hamidreza Kasaei (AI), Marcello Seri (Math), Pinar Kilicer (educational profile, Math), Steffen Frey (CS)
13:00 – 13:45	Lunch plus reflection PRC	Faculty Room	
13:45 – 14:30	Lab tour BI Robotics and Visualisation labs and CogniGron **13:45 – 14:05** **14:05 – 14:30**	Bernoulliborg, Nijenborgh 4 **Robotics Lab (**BB238) **(**guide: Stefania Costache/Ineke) **Visualisation Lab** BB426 (guide: Alicia Brandt) **CogniGron lab** 5117.0016 guide: Herbert Jaeger	**Split into to Groups,** **Group 1 (**Jos Baeten, Vijanti Ramautar, Elisabetta Dinitto, Sonja Hochloch) **Robotics Labs,** **Group 2 (**Ann Nowe, Max Louwerse, Volker Mehrmann, Farhad Arbab**) Visualisation labs** **All PRC members** Meet at Faculty Room
14:30 – 15:00	2nd meeting with Management	Faculty Room Bernoulliborg	BI Management (Niels Taatgen, Jaap Top, Paris Avgeriou, Dimka Karastoyanova, Kanat Camlibel, Bart Verheij, Stefania Costache) Joost Frenken and Alicia Brandt
15:00– 16:15	Committee discusses findings (Refreshments provided)	Faculty Room	PRC members only
16:15 – 16:30	Feedback and Initial findings with management	Faculty Room	PRC BI Management (Niels Taatgen, Jaap Top, Paris Avgeriou, Dimka

			Karastoyanova, Kanat Camlibel, Bart Verheij, Stefania Costache) Joost Frenken and Alicia Brandt
16:30	END OF PROGRAMME		
Taxis will be available to take members to the train station			

Research staff

	2015	2016	2017	2018	2019	2020	2021
Research unit							
Scientific staff (1)	#/fte	#/fte	#/fte	#/fte	#/fte	#/fte	#/fte
Assistant professor	18 / 8 fte	17 / 7,6 fte	22 / 10,40 fte	23 / 11,8 fte	23 / 10,9 fte	27 / 13,8 fte	31 / 15,4 fte
Associate professor	9 / 3,6 fte	10 / 3,9 fte	11 / 3,7 fte	11 / 4,4 fte	14 / 5,6 fte	15 / 5,9 fte	18 / 7,1 fte
Full professor	14 / 5,3 fte	14 / 5,1 fte	16 / 5,7 fte	15 / 5,6 fte	16 / 5,2 fte	17 / 6,2 fte	17 / 6,4 fte
Postdocs (2)	17 / 12,8 fte	14 / 9,5 fte	11 / 6,9 fte	19 / 9,1 fte	24 / 14,7 fte	24 / 16.4 fte	22 / 13,4 fte
PhD candidates (3)	87	90	89,5	122	125	136,5	143
Total research staff	145 / 29,7 fte	145 / 26,1 fte	149,5 / 26,7 fte	190 / 30,7 fte	202 / 36,4 fte	219,5 / 42,4 fte	231 / 42,3 fte
Support staff	9 / 5 fte	10 / 5,6 fte	10 / 5,5 fte	14 / 8,9 fte	17 / 9,4 fte	14 / 9,1 fte	15 / 10,9 fte
Visiting fellows	76	74	68	109	101	21	13
Total staff	230 / 34,7 fte	230 / 31,7 fte	227,5 / 32,1 fte	313 / 39,6 fte	320 / 45,8	254,5 / 51,6 fte	259 / 53,1 fte

Table 2. PhD candidate numbers

PhD students enrolled at the BI between 2013 and 2017 and their graduation rate

Enrolment			Success rates					
Starting year	Enrolment (male/female)	Total (M+F)	Graduation year					Discontinued
			≤4	4<Defense≤5	5<Defense≤6	6<Defense≤7	Not yet finished	
2013	18 M 11 F	29	6 / 20,7%	8 / 27,6%	4 / 13,8%	4 / 13,8%	3 / 10,3%	4 / 13,8%
2014	15 M 5 F	20	4 / 20%	5 / 25%	3 / 15%	1 / 5%	6 / 30%	1 / 5%
2015	14 M 4 F	18	3 / 16,7%	8 / 44,4%	5 / 27,8%	0 / 0%	1 / 5,6%	1 / 5,6%
2016	23 M 6 F	29	4 / 13,8%	9 / 31%	5 / 17,2%	1 / 3,4%	6 / 20,7%	4 / 13,8%
2017	18 M 8 F	26	1 / 3,9%	9 / 34,6%	-	-	16 / 61,5%	0 / 0%
Total 2013-2017	**88 M 34 F**	**122**	**18 / 14,8%**	**39 / 32%**	**17 / 14%**	**6 / 5%**	**32 / 26%**	**10 / 8,2%**

- *The table provides data about PhD candidates for the years indicated in the SEP. For the number of PhDs recruited until 2021 please check table below.*
- *The table comprises all PhD students, including external PhD students who perform most of their research outside of the Faculty.*
- *The data in the table is from 28 Mar. 2022. PhD students who graduated after this date are counted as not yet graduated.*

PhD students enrolled at the BI between 2018 and 2021

Enrolment 2018-2021		
Starting year	Enrolment (male/female)	Total (M+F)
2018	37 M 13 F	50
2019	18 M 7 F	25
2020	28 M 6 F	34
2021	20 M 6 F	26
Total 2018-2021	**103 M 32 F**	**135**

Table 3. Funding 2015-2020 Bernoulli Institute

	EU	2015		2016		2017		2018		2019		2020		2021	
Funding:															
Direct funding (1)		5,506,436	76%	5,651,296	7%	5,910,692	76%	6,526,653	71%	5,188,459	51%	6,116,046	56%	6,839,132	57%
National grants(2)		1,049,767	14%	1,671,330	21%	1,148,883	15%	1,206,485	13%	1,625,976	16%	2,058,562	16%	1,867,217	16%
International grants (3)	ERC	306,294	4%	235,292	3%	42,163	1%	62,770	1%	66,17	1%	408,37	3%	148,654	1%
	EU other	164,278	2%	347,307	4%	567,055	7%	1,144,173	12%	1,766,014	17%	2,144,284	17%	1,399,600	12%
	Other	236,24	3%	157,946	2%	146,543	2%	257,89	3%	996,25	1%	884,985	7%	440,727	4%
Total (3)		**706,812**	**1%**	**740,545**	**9%**	**755,761**	**1%**	**1,464,833**	**16%**	**2,828,434**	**28%**	**3,437,639**	**27%**	**1,988,981**	**17%**
Other (CogniGron)								6,008		463,107	5%	946,105	8%	1,259,260	11%
Total funding		7,263,015		8,063,172		7,815,226		9,203,980		10,105,976		12,558,352		11,954,690	
Expenditure:															
Personnel costs		6,194,916	85%	6,342,449	79%	6,744,877	86%	7,835,014	85	8,651,312	86%	11,198,065	89%	11,122,920	93%
Other costs		1,068,099	14%	1,720,723	21%	1,070,459	14%	1,368,965	15%	1,454,664	14%	1,360,277	11%	831,77	7%
Total expenditure		**7,263,015**		**8,063,172**		**7,815,336**		**9,203,980**		**10,105,976**		**12,558,342**		**11,954,690**	

*Figures are rounded to the nearest one; **Sector Plan funding is included in (1) Direct funding