



Amsterdam Movement Sciences (AMS)

Amsterdam UMC

Vrije Universiteit Amsterdam

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info@academion.nl

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1. Foreword by the committee chair

Human movement is key to healthy longevity. The understanding of how to optimize human movement can therefore contribute to the reduction of morbidity and mortality and contribute to the functional ability over the lifespan. Research into human movement includes both, the inquiry into how human movement can be optimized and how human movement can contribute to participation and well-being at the individual and societal level.

From a societal perspective, the investment in human movement research and more broadly how to optimize functioning over the lifespan has been identified as a priority. Human movement and more broadly functioning are the link between biological health and well-being in light of sustainable development goal number three (SDG 3). Movement and more broadly functioning, are instrumental for the strengthening of rehabilitation in global health systems, as called for by the WHO Resolution "Strengthening Rehabilitation in Health Systems" in 2023 as well as for the healthy aging agenda by the WHO.

The current evaluation was done by an independent committee, based on a self-assessment and a site visit. During the site visit, the committee discussed with representatives of the Amsterdam Movement Sciences (AMS) institute about possibilities for AMS to contribute to societal challenges related to healthy longevity. These discussions took place in a pleasant and open atmosphere. AMS, an interdisciplinary research institute focused on human movement aiming to contribute to participation and well-being is uniquely positioned to drive research in human movement from an academic perspective, but also in interaction with practitioners and policymakers in the Amsterdam region, in the Netherlands and internationally.

Our recommendations in this report start from this strong current position and should be read as opportunities designed to help the institute connecting the institute's research capabilities to societal challenges, aimed at pursuing research that leads to societal impact.

Prof. Gerold Stucki, MD, PD, MS, Dipl.
Committee chair

2. Procedure

2.1 Scope of the review

The executive boards of Vrije Universiteit Amsterdam and Amsterdam UMC asked a review committee of external peers to perform a review of the research conducted at Amsterdam Movement Sciences (AMS) over the period 2017-2022. In accordance with the Strategy Evaluation Protocol 2021-2027 (SEP) for research reviews in the Netherlands, the committee was requested to carry out the assessment according to a number of guidelines. The assessment was to include a backward-looking and a forward-looking component. The committee was asked to judge the performance of AMS on the main assessment criteria specified in the SEP and to offer its written conclusions as well as recommendations based on considerations and arguments. The main assessment criteria are:

- Research Quality;
- Societal Relevance;
- Viability of the Unit.

During the evaluation of these criteria, the committee was asked to incorporate four specific aspects relating to how the unit organises and actually performs its research, its composition in terms of leadership and personnel, and how the unit is run on a daily basis. These aspects are:

- Open Science;
- PhD Policy and Training;
- Academic Culture;
- Human Resources Policy.

AMS is a network institute: researchers are employed by their respective departments or academic partners. AMS facilitates research and devises strategies for research directions and societal impact. Policies such as talent management, PhD supervision and training and academic culture are the responsibility of the institution where the staff members are employed. Therefore, this report considers the strategy of AMS to align itself with these policies rather than the policies itself.

Furthermore, the institute provided the committee with five additional questions to consider during the evaluation of AMS. These were:

1. How can we improve the institute's visibility? Should the institute be the main external brand, or is this better left to the expertise centers, with their applied skills and expertise?
2. How translational is the research within Amsterdam Movement Sciences? How can we improve?
3. Where are the opportunities in the area of exercise as lifestyle intervention for physical fitness, mental health and longevity, and how can we contribute more to this field?
4. Where do you see new research focus areas for the institute within the current developments in the field of movement sciences?
5. In line with SEP (p.10 about Talent Management) and the national Recognition and Rewards program (R&R) the committee is asked to pay attention to and offer its assessment and recommendations on the research unit's policies on talent management.

For more information on the criteria and categories of the Strategy Evaluation Protocol 2021-2027, see Appendix 1.

2.2 Composition of the committee

The composition of the committee was as follows:

- Prof. dr. Gerold Stucki, University of Lucerne (chair), expertise: human functioning and rehabilitation research, spinal cord & ageing;
- Prof. dr. Richard Faragher, University of Brighton, expertise: the mechanisms and consequences of cellular senescence; longevity, fibroblasts, a UK leading expert on ageing,
- Prof. dr. Hanna Isaksson, Lund University, expertise: bone biomechanics and mechanobiology, focusing on functional imaging and statistical shape modelling of bone, characterization of bone damage and fracture mechanisms as well as on improvement of bone quality during fracture repair;
- Dr. Eline Lievens, Ghent University, expertise: muscle physiology and its relation to fatigue, injury and talent identification, using a non-invasive screening of the muscle fibre typology based on H-MRS, also called the muscle talent scan. Interested in exercise physiology, exercise is medicine and nutrition.
- Prof. dr. Edwin Oei, Erasmus Medical Center, Rotterdam, expertise: Musculoskeletal radiology; quantitative musculoskeletal imaging; musculoskeletal imaging in population studies; imaging of degenerative joint disease (osteoarthritis), osteoporosis, and sports injuries; musculoskeletal imaging with radiography, MRI, CT, ultrasound and nuclear medicine techniques including PET/MRI; artificial intelligence applied to musculoskeletal imaging.
- Prof. dr. Øyvind Sandbakk, Norwegian University of Science and Technology, expertise: sport performance (integrative physiology and biomechanics, the effects of strength and endurance training), the utilization of new technology to gain understanding of these aspects in real-life environments.
- Anneke van Zanen-Nieberg, NOC*NSF, Arnhem, expertise: sports, management, policy making.
- Louk Timmer MSc, Hubrecht Institute, Utrecht (PhD candidate), expertise: Cell biology and Human Movement Sciences.

The committee was supported by Peter Hilderling MSc, who acted as secretary on behalf of evaluation bureau Academion. Due to unforeseen circumstances, prof. Sandbakk could not attend the evaluation on-site and participated in the interviews online.

2.3 Independence

All members of the committee signed a statement of independence to guarantee an unbiased and independent assessment of the quality of the research performed at AMS. Personal or professional relationships between committee members and the research unit under review were reported and discussed at the start of the site visit among the committee members. The committee concluded that no specific risk in terms of bias or undue influence existed and that all members were sufficiently independent.

2.4 Data provided to the committee

The committee received the self-evaluation report from AMS, including all the information required by the SEP. The committee also received the following documents:

- The Terms of Reference

- The SEP 2021-2027
- Governance structure
- Description Research Programmes
- Funding / Obtained (External) Research Grants
- Information on the Knowledge Centres
- Start-up and technology transfer ventures
- Research Facilities
- AMS Membership Base
- Founding organizations
- Academic Culture and AMS Annual Events
- Testimonials mentorship program

2.5 Procedures followed by the committee

The committee proceeded according to the SEP 2021-2027. In its first online meeting, on 19 December 2023, the committee was briefed by Academion about research reviews according to the SEP 2021-2027. It agreed upon procedural matters and aspects of the review. All committee members independently formulated a preliminary evaluation of the units under review based on the written information that was provided before the site visit. In its online preliminary meeting on 2 February 2024, the committee discussed these preliminary evaluations and identified questions to be raised during the site visit.

The site visit took place on 5-6 February 2024 (see the schedule in Appendix 2). After the interviews, the committee discussed its findings and comments in order to allow the chair to present the preliminary findings and to provide the secretary with argumentation to draft a first version of the review report. The final review is based on both the documentation provided by AMS and the information gathered during the interviews with management and representatives of the research unit during the site visit.

The draft report by the committee and secretary was presented to AMS for factual corrections and comments. In close consultation with the chair and other committee members, the comments received were reviewed to draft the final report. The final report was presented to the Executive board of Vrije Universiteit Amsterdam, the Board of Amsterdam UMC and to the management of the research unit on 24 April 2024.

3. Research review of AMS

3.1 Description of AMS

Amsterdam Movement Sciences (AMS) is an interdisciplinary research institute focused on the human motor system and human movement. It was created in 2017 from the VU institute MOVE and is an interfaculty research institute in which Amsterdam University Medical Center (Amsterdam UMC) and the Faculty of Behavioural and Movement Sciences (FBMS) and the Faculty of Science (Beta) of the Vrije Universiteit Amsterdam (VU) collaborate. It is a network institute that includes not only researchers from FBMS, Beta, and Amsterdam UMC, but also from affiliated partners that currently include the Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam University of Applied Sciences (HvA) and Hogeschool Inholland. Joining AMS is voluntary: researchers join AMS when they feel that their research interests and expertise align with those of AMS. There are currently more than 600 clinicians and scientists associated with AMS. 330 of those are PhD candidates.

Research institutes

To encourage interdisciplinary research, VU Amsterdam and Amsterdam UMC have established interdisciplinary research institutes. The research at VU Amsterdam that is affiliated with AMS, is from the department of Human Movement Sciences of FBMS, and the department of Health Sciences of Beta. At each VU faculty and department, the Dean and the respective department heads are responsible for education and research, as well as for management, finances and personnel.

The creation of the AMS institute coincided with the merger of AMC and VUmc into the Amsterdam UMC. As a result of the merger, Amsterdam UMC research is organized in a matrix with divisions and research institutes. Amsterdam UMC has ten divisions, each headed by a division chair, and encompasses multiple departments and sub-departments. Each department/sub-department head has integral responsibility for patient care, education and research, as well as for management, finances and personnel. To enhance focus and stimulate interdisciplinary collaboration between departmental research groups as well as between faculties there are eight research institutes: Amsterdam Gastroenterology Endocrinology Metabolism, Cancer Centre Amsterdam, Amsterdam Cardiovascular Sciences, Amsterdam institute for Infection and Immunity, Amsterdam Movement Sciences, Amsterdam Neuroscience, Amsterdam Public Health and Amsterdam Reproduction and Development.

The research institutes together cover the whole spectrum from basic biomedical research, through translational and clinical research to the assessment of innovations in actual clinical practice. Each institute has its own directors, and an annual budget to stimulate innovation based upon the specific project plan. The directors discuss progress and strategic issues during the board meetings. AMS includes Amsterdam UMC and the VU Faculties FBMS and Beta.

Governance

The AMS institute is headed by two directors: one from FBMS and one from Amsterdam UMC. Next to the two directors, the management team consists of the programme managers of AMS's five research programmes: *Sports, Musculoskeletal Health, Tissue Function & Regeneration, Ageing & Vitality* and *Rehabilitation & Development*, as well as representatives of the support staff and junior researchers. The main purpose of these research programmes is to unite researchers and clinicians around a selection of specific research topics. Within each research programme, there are several research lines. These mostly consist of networks of researchers and clinicians who regularly meet to discuss research and funding opportunities, and

possibilities for collaboration. The activities of AMS are supported by a number of support staff members that manage the organization of AMS events and network meetings. Recently, the support staff team has been expanded with two business developers, who will explore and pursue opportunities for collaboration with external stakeholders.

The AMS management has a strategic budget of 950 k€ that is currently spent on operational costs (300 k€), talent development and innovation (600 k€) and investments in equipment (50 k€). The talent development and innovation budget is divided among the research programmes, that can use these funds for strategic investments in staff or projects. The way in which the funds are distributed differs per programme, but in general the funding is used to accelerate promising research projects, or as a driving force to attract funding or talented staff to the Amsterdam UMC.

Knowledge centres

The societal impact of AMS research is facilitated through knowledge centres. These knowledge centres are the linking pin between theory and practice, most prominently the clinical setting and the sports field. They are focused on a specific application area and provide a network or platform for AMS researchers to interact with external stakeholders within the application area. There are currently five knowledge centres:

- *Amsterdam Institute of Sports Sciences (AISS)*, a centre that studies applied questions in sports, movement and health, including science-based support to athletes and sports professionals;
- *MSG Science Netwerk Fysiotherapie*, a national network of physiotherapists and researchers aiming to drive innovation in physiotherapeutic diagnostics and treatment;
- *Amsterdam Bone Center (ABC)*, connecting researchers and clinicians working on rare bone diseases;
- *Voeding & Beweging.NU (VBNU)*, a network of experts on nutrition and movement that emerged from a collaboration between Amsterdam UMC and the HvA;
- *RehabNet Amsterdam*, aiming to improve collaboration with rehabilitation centres and research.

Each knowledge centre has a different set-up, based on the scope and size of the centre. AISS is the oldest knowledge centre, pre-dating AMS, and has its own support staff and physical location, whereas others organize themselves primarily through communication and events.

3.2 Mission, vision and strategy

AMS is dedicated to advancing physical and mental performance, both in health and disease. It aims to contribute to well-being and societal participation, based on a fundamental understanding of human movement. The institute's vision is that all humans benefit from physical activity, whether they are healthy or dealing with disease, pain or physical and mental limitations. AMS aims to contribute to optimal physical performance in daily life through research on the human motor system.

To achieve this mission, AMS fosters a broad spectrum of research, encompassing fundamental, translational and applied movement sciences. A central goal is to build translational research lines through collaborative efforts across multiple disciplines. The institute actively supports innovative research that makes direct impact in sports, as well as medical and paramedical fields. The five research programmes (Sports, Musculoskeletal Health, Tissue Function & Regeneration, Ageing & Vitality and Rehabilitation & Development) represent the areas that align with the available research expertise within VU and AMS, and in which the institute aims to make a difference in view of its mission. The main strategic instruments that AMS has at its disposal are (1) actively forming networks and communities for researchers and clinicians around specific research topics through establishing platforms and events, (2) direct funding of talented early career researchers and promising research projects associated with the research programmes, and (3) setting up

and maintaining relations with external stakeholders, both through the knowledge centres and through other means.

The committee studied the mission, vision and strategy of AMS and discussed this at various moments throughout the site visit. The committee finds that AMS has formulated a very relevant mission and vision, and associated strategy to pursue these. As became apparent during the site visit, AMS views human movement as an outcome: everybody should be able to move, whether they are disabled, injured, inactive, healthy, ill or a pro athlete. The committee considers this to be a very inspiring and clear mission and vision. According to the committee, the potential of AMS as a network institute is excellent. It has the opportunity and ability to facilitate a collaborative environment. Its broad network of researchers, clinicians and external stakeholders ranges from fundamental researchers to those at the patient's bedside. AMS functions as an interdisciplinary, interfaculty and interorganizational network that unites participants around a shared goal. Notwithstanding the relatively modest size of the institute's governance and budget, the institute has set up an impressive structure for connecting researchers, clinicians and stakeholders, and encouraging relevant research projects. All participants from the senior to the junior level that the committee interviewed acknowledged the added value of AMS. The committee noted that AMS is very active in providing support for early career researchers: a major part of the available research budget is spent on research projects and support for junior staff members.

From this strong current position, the committee thinks that the institute is now ready for the next step, which is to connect the institute's research capabilities to societal challenges, aimed at pursuing further societal impact. This, as well as other strategic issues, will be discussed in the following chapter.

3.3 Research Quality

Current research

Based on the documentation provided as well as the interactions during the site visit, the committee was able to establish that the researchers associated with AMS have an impressive track record, and that the research quality of AMS is outstanding without any doubt. The committee noted a relevant distribution of research topics over the field of movement sciences, which were clearly related to use fundamental understanding of human movement to contribute to an optimal physical performance in daily life. This includes for instance research contributing to preventing injuries and safeguarding health for top athletes, the causes and prevention of low back pain, conditions relevant for regeneration of damaged tissue, reducing physiological decline through movement for healthy aging, and optimizing performance of people with musculoskeletal injuries, disorders and disabilities. The institute provided the committee with an analysis which demonstrated that the impact of the publications that researchers associated with AMS produced in the past six years is significantly above the world-wide average, both in terms of number and frequency of citations in the field. This was the case for all of the five research programmes.

Furthermore, AMS researchers have been able to generate a substantial amount of competitive external funding, amounting to 40 M€ in the past six years. This includes a number of individual research grants such as ERC and the NWO Veni-Vidi-Vici scheme, as well as collaborative (e.g. ZonMW, Horizon2020/Horizon Europe) and contract research with external parties. The committee considers the funding level to be on par with top research centres internationally. If anything, the committee thinks that given the size and excellence of AMS, there could be more opportunities to acquire individual research grants. In this regard, the committee was happy to learn that there are support structures within Amsterdam UMC to help researchers with grant applications.

During the site visit, the committee had the opportunity to visit several of AMS's research facilities, such as the Human Performance Labs and the wetlabs for muscle and bone tissue. The committee was impressed by the high-quality facilities at the disposal of AMS's researchers and concludes that AMS is well-equipped to realize its research ambitions.

Directions for future research

The institute's mission and vision views human movement as an outcome: research is aimed at enabling everybody to move to the best of their abilities, ranging from movement aids for the disabled to performance optimization for top athletes. The committee welcomes this vision and thinks that this is very relevant and meaningful aim. At the same time, it wants to complement this vision with the notion that movement can also be a determinant. Movement is one of the key elements for a healthy life and is instrumental for wellbeing on a personal as well as a societal level. Public health is increasingly viewed in terms of promoting a healthy lifestyle, focusing on preventing diseases next to curing illness and conditions. This is connected to a number of major societal challenges, such as the feasibility and affordability of the health system in an aging population, the prevalence of obesity and related diseases and economic participation through adaptation and rehabilitation.

According to the committee, AMS is in an excellent position to use its knowledge of human movement to contribute to these societal challenges. To be able to contribute to this broader shift in focus on human movement for a healthy society, the committee considers that the research focus of AMS could be expanded to include health systems policies. This does not necessarily mean that AMS itself should invest in this area of research, but it could also mean a strengthened collaboration with the Public Health Institute of Amsterdam UMC on translational research aimed at using insights from movement sciences to achieve impact on health policy and behavioural change.

3.4 Societal Relevance

Current societal relevance

To demonstrate its relevance to society, the institute presented the committee with an overview of publications of its researchers that were cited in contexts such as policy documents, news articles, patents and clinical guidelines, as well as current collaborations with industry, governments and societal organizations. Furthermore, the institute demonstrated its knowledge centres (see chapter 3.1) that are aimed at providing a platform for collaboration with external stakeholders. The committee was impressed by the many links that AMS has with society. On the institute-wide level (knowledge centres) as well as on an individual level, the institute has relevant networks in place with societal stakeholders such as sports organizations, paramedics and clinicians in many specializations.

These connections ensure that AMS's research remains aligned with societal challenges, and often promotes direct involvement of societal stakeholders in the research of AMS in interdisciplinary research. These interdisciplinary research projects cover a wide area of topics, such as prevention and treatment of sports injuries with top sports organizations, performing under pressure, developing personalized treatment for low-back pain with physiotherapists, the impact of sports on people with a disability and many more.

During the site visit, the committee noted that the five knowledge centres are a very heterogeneous group, with some having a specialized academic focus (ABC) or a focus on a specific network (MSG Science Network Fysiotherapie, RehabNet Amsterdam), whereas AISS is a broader organization with its own staff and physical location. The committee thinks that although these knowledge centres work well within their own pillar, there could be added value to unite these efforts under a broader initiative that is devoted to

implementation of the institute's knowledge on human movement in relation to health (further discussed in the next section). This would also help the Knowledge Centres in learning from each other and sharing best practices.

The committee concluded that the research of AMS has an outstanding societal relevance, and that the institute is well-connected to relevant stakeholders, researchers, clinicians, paramedics and organizations, in particular in the Amsterdam region. It therefore considers that AMS is in a very good position to further connect its research and networks to aim for impact on public policies and the stakeholders relevant to these, which will be discussed below.

Aiming for societal impact

To realize the abovementioned opportunity and use the potential of AMS to stronger connect to societal challenges, the committee invites the institute to formulate an impact strategy based on existing public policies and frameworks. Speaking the language of policy makers is essential to be able to realize societal impact, and this language is that of frameworks, action plans and agreements.

The committee recommends tying the general focus of this impact strategy on the United Nations Sustainable Development Goal 'Good Health and Wellbeing' (SDG 3). This means interpreting human movement as fundamental for the prevention and treatment of many health conditions, the reduction of mortality and morbidity and the optimization of functioning over the life course, both for individuals and populations. On top of that, human movement in exercise and sports also directly contributes to well-being. On an international level, the committee suggests several frameworks and policies that AMS could use to inspire its impact strategy. These are for instance Learning Health Systems initiatives in various countries and the 2023 WHO resolution on strengthening rehabilitation in the health system. On a national level, the *Nationaal Preventieakkoord* offers various opportunities to contribute knowledge and insights in human movement to national policies and initiatives.

The committee recommends determining in the impact strategy which societal goals AMS wants to contribute to and focus on, and determine what stakeholders are relevant to realizing this strategy. As a next step, an organizational structure should be created to organize the implementation of this strategy.

Organizing societal impact

In order to organize impact on public policies and implement an impact strategy, the committee suggests to develop a so called 'implementation centre' for movement and health. This implementation centre could formulate and execute the AMS impact strategy, engage in stakeholder dialogues on movement and health, formulate policy briefs for local, national, and international policy makers and proactively contribute to societal discussions. According to the committee, such an implementation centre would fulfil a societal need. Governments as well as insurance companies are increasingly focusing on preventive medicine and healthy aging to keep the current health system affordable. This also means that there will be opportunities for external commitments and funding for this an initiative.

The committee advises to investigate whether the existing knowledge centres could be utilized to set up the abovementioned implementation centre. It suggests that AISS, as the most established of the five knowledge centres, could be a good blueprint. AMS could even consider reshaping the AISS institute for this purpose under a new name rather than creating a new centre, as the committee considers the current AISS structure and staff to be fitting for a broader purpose. In collaboration with the AMS business developers, such a new centre could be the focus point for the impact strategy of AMS. As a concluding remark, the committee wants to stress that the current networks such as those with physiotherapists and rehabilitation centres remain

important, and that an implementation centre should complement rather than replace existing networks within AMS.

Visibility of AMS

During the site visit, the committee discussed with various participants to what extent the AMS institute should be an external brand, and whether this branding should extend beyond the Amsterdam region. The committee considers that as a network institute, the main focus of the AMS brand is on the internal collaboration between participants of the network, i.e. the researchers and clinicians in VU and Amsterdam UMC, and other connected research institutes. For collaboration with external stakeholders such as paramedics, policy makers and industry, the existing external networks and knowledge centres are the main point of visibility. According to the committee, that means that communication to societal stakeholders should focus, next to the overall Amsterdam UMC and VU branding, on the networks and knowledge centres. The implementation centre discussed above could be the main external brand for impact and collaboration.

Furthermore, the committee noted that one of the main strengths of AMS is its strong embedding in the Amsterdam region. The institute and its activities are very well recognized in the academic and medical communities within the region. The committee therefore agrees that the focus point of AMS's academic network should be regional. At the same time, many of the policy frameworks discussed earlier have a national or international focus, meaning that this network should be able to connect to broader initiatives and topics where necessary. The same applies to specific research programmes that are also pursued at other universities and medical centres: collaborative academic networks could be strengthened across the Netherlands wherever gains can be made by bundling forces.

3.5 Viability

Based on the current position of AMS, as well as its staff, funding and opportunities for research and societal impact, the committee concludes that AMS is very well equipped for the future. The institute provides a unique selling point in the shape of a broad network from fundamental research to clinical care and has the potential to further connect this to societal challenges as discussed above. The discussions with the AMS management as well as the researchers and support staff gave the committee full confidence in the ability of the institute to maintain a viable organization in the coming years, with appropriate focus and priorities.

The main strength of AMS lies in its ability to create networks between researchers, clinicians and external stakeholders. In terms of direct funding, the capabilities of AMS are limited. The committee advises to use the resources wisely in areas where the largest influence can be made. In the coming years, this might be the kick-start money for launching the impact strategy and the structures necessary to pursue this.

The future success of AMS hinges on the condition that the leadership involved has sufficient time for the activities necessary to pursue the strategy of AMS. The committee understood from the interviews that opportunities for collaborations within and outside of AMS are numerous, but that the time to follow up on leads is often limited. The committee recommends ensuring that there is sufficient time for the directors, leaders and staff of the knowledge centres as well as programme leaders, support staff and other staff involved in AMS.

To increase the capacity of the board of directors, as well as to promote societal impact on public health systems, the committee suggests adapting the governance structure of AMS to reflect this focus. Next to a co-director with a clinical background, the institute could introduce a second co-director with a link to public health systems. Together with a director with a movement sciences background, this team of directors could

together shape the impact strategy of AMS. The institute could even consider appointing this second co-director together with the Public Health institute of Amsterdam UMC to institutionalize collaboration on this topic between the two institutes.

To assist the board of directors in monitoring the realization of AMS's strategy, the committee suggests investing in software that provides relevant metrics to make informed management decisions. Rather than a time-intensive manual monitoring of collaborations, which is now often the case, software such as InCites could provide automated management information.

One of the bottlenecks for future success as identified by AMS is the availability of clinicians for research. Although this is not the primary responsibility of AMS, as clinicians are employed within the clinical departments of Amsterdam UMC, the committee endorses the efforts of AMS to pursue broader engagement of clinicians in research. In this regard, the committee highlights the importance of individuals that can form a bridge between AMS and the clinical departments: clinicians that are outspoken supporters of AMS's activities and can attract other clinicians from their department to the AMS network. The committee recommends fostering and promoting such connections within Amsterdam UMC.

One of the key stakeholders that the committee thinks AMS should reach out to as part of its impact strategy are general practitioners. AMS currently has a very strong clinical network in primary care and a number of paramedic fields such as physiotherapy and rehabilitation, whereas general practitioners also play an important role in primary care for movement conditions in the Netherlands. The committee therefore recommends strengthening these connections, for instance by connecting general practitioners in the Amsterdam region for a research line on the role of movement in preventive care.

3.6 Specific aspects

During the site visit, the committee discussed the specific aspects as described in the SEP protocol. As a network institute, AMS is not directly responsible for most of these aspects. Policies such as talent management, PhD supervision and training and academic culture are the responsibility of the institution (either VU or Amsterdam UMC) where the staff members are employed. Therefore, this chapter does not discuss and evaluate these policies in-depth, but rather focuses on the added value of AMS in these policies.

Open Science

AMS supports the VU and Amsterdam UMC policies on open science and encourages open access publishing and data sharing. The institute has organized several workshops on open access and FAIR data within its networks. Since 2020, approximately 80% of AMS's publications are open access, which the committee considers to be a favourable amount. The committee supports efforts to further increase this percentage. For instance, the committee understood from the interviews that VU and Amsterdam UMC usually fund additional fees for open access publishing, which it considers a good mechanism to promote this. The committee considers the workshops on open access and FAIR data to be a good mechanism to draw attention to these topics and advises to keep organizing these on a regular basis due to the high turnover of young researchers.

Regarding the broader definition of open science, the committee noted that AMS is very open to sharing its knowledge and research priorities with society. Much of the institute's efforts are focused on engaging in research together with clinicians, patient organizations and other stakeholders close to practice. In this sense, the committee considers open science to be a particularly strong characteristic of AMS.

Academic culture

From the documentation provided to the committee as well as from examples provided during the site visit, the committee noted that there are several initiatives in VU and Amsterdam UMC that promote a healthy and safe academic culture. AMS adds to this by organizing annual workshops with discussions on integrity where researchers discuss dilemmas they encountered and offering research integrity courses to PhD candidates. The committee understood that some of the Amsterdam UMC institutes have a diversity & inclusivity officer or committee that promotes a diverse and inclusive research environment. The committee gives AMS into consideration to determine whether this could be a valuable addition to the institute.

PhD training and policies

The PhD candidates in AMS fall under the PhD policies of either VU or Amsterdam UMC, which covers guidance supervision and professionalization opportunities. The committee noted with appreciation that supervisors have the opportunity to follow a course focused on PhD supervision, and that this opportunity is often used. PhD candidates mentioned to the committee that they appreciate the supervision and support in both institutions as well as within AMS. They feel that this support is highly personalized and takes into account whether the candidates have an academic or clinical background, and whether they pursue a fulltime or parttime PhD. The committee also appreciated the AMS PhD Committee. This committee organizes social events several times a year, featuring specific themes relevant to the PhD community. These events aim to build an academic network and learn from other disciplines.

When asked about any discrepancies between VU and Amsterdam UMC policies, PhD candidates indicated that they are not substantive, and that this rarely causes friction within the departments. If anything, the opportunities for attending conferences and other professionalization activities can differ between VU and Amsterdam UMC. PhD candidates at both VU and Amsterdam UMC make an individual training plan together with their supervisors with activities to attend and courses to follow. At Amsterdam UMC the PhD candidates can choose which courses to take, offered by the doctoral school, but there are no predefined topics. At VU Amsterdam there is a compulsory training component of 30 ECTS which includes various topics such as research integrity and methods etc. The committee suggests investigating whether more equal opportunities can be created, either by advocating more structured training plans at VU or by using a small part of the AMS funding for this goal.

AMS supplements the PhD policies of VU and Amsterdam UMC with a mentorship programme where researchers from different groups within AMS are paired to work together on for instance career guidance and advice, work/life balance and time management. This mentorship programme is not limited to PhD candidates but is available for researchers on all levels of their academic career. The junior researchers that the committee interviewed were very positive on the mentorship programme, which they considered to be a very good support mechanism in launching their academic career. The committee noted that the mentorship programme is less suited for PhD candidates who are considering a career outside academia, as all available mentors are researchers. The committee suggests investigating whether clinicians or AMS alumni who are working outside academia could be given a role in the mentorship programme to help PhD candidates pursue other careers.

Talent development

Next to the support that junior researchers receive from VU and Amsterdam UMC, AMS actively supports talented young researchers that want to stay in academia after their PhD graduation. As discussed in chapter 3.2, part of AMS's funding is used to directly fund projects for promising young researchers in the hope that these projects can kick-start a further career. Senior researchers also assist junior researchers in applying for personal grants, such as the Dutch talent programme and the ERC programme. In general, the committee

concludes that talent development within AMS is a major focus of attention. Next to the abovementioned support and funding systems, AMS actively pursues having junior staff member representation in boards and committees. The chair of the AMS PhD committee as well as an early career researcher join the AMS Management Team to ensure that the junior researcher's point of view is represented. The junior researchers at AMS echoed the positive impressions of the committee and mentioned that they feel very well supported at AMS.

The committee noted that AMS is actively working on introducing the national Recognition and Reward policies in accordance with the academic partners' policies. Recognition and Rewards focuses on diversifying career paths in academia where excellence in a variety of areas, including research, education, leadership and impact can be part of an academic career. Whereas formal recognition and rewarding of staff members is the responsibility of the institutions, AMS aims to explicitly highlight a variety of achievements of its researchers. For instance, AMS has introduced an annual outreach award in recognition of researchers that invest in valorization. The committee supports these efforts.

According to the committee, specific attention should be paid to researchers at the postdoc and assistant professor stage, who are starting up their own independent research line. While aiming to increase diversification in academic careers, the Recognition and Reward policies in the Netherlands have also increased the span of activities that starting researchers have to consider, such as grant writing, education, outreach and leadership. In this regard, the committee thinks that it would be helpful to monitor the effects of Recognition and Reward on career choices and hirings over a longer period of time. This could help determining whether these policies indeed lead to broader career paths within VU and Amsterdam UMC. Furthermore, researchers in such career paths could provide their younger colleagues with advice on how to navigate the challenges and opportunities offered by Recognition and Reward.

One issue mentioned by PhD candidates and early career researchers is that the AMS network is the strongest on the senior level. Within the individual research programmes, there are sufficient opportunities to interact with researchers of different career levels, but this is less the case for collaborations across programmes. AMS interactions of PhD candidates in particular are usually limited to activities of the AMS PhD Committee and the annual AMS meeting where all AMS participants are invited. The committee advises AMS to ensure that the networking opportunities also trickle down to the junior level, for instance by deliberately inviting researchers from different career levels to networking events.

4. Executive summary

The committee is impressed by the overall research quality and societal relevance of the Amsterdam Movement Sciences institute. AMS builds and maintains a strong network of researchers and clinicians at the Vrije Universiteit (VU), the Amsterdam University Medical Centre (Amsterdam UMC) and beyond. Participants in AMS are united in an interdisciplinary setting around the mission and vision of AMS, which is to contribute to well-being and societal participation through a fundamental understanding of human movement. Next to that, AMS is a breeding ground for talented young researchers, supporting them to grow.

From this strong current position, the committee thinks that the institute is now ready for the next step, which is to connect the institute's research capabilities to societal challenges, aimed at pursuing research that leads to societal impact. In order to achieve this, the committee challenges AMS to view movement as starting point: human movement as a key element for a healthy lifestyle, healthy aging and as a contributor to individual and societal wellbeing. It recommends expanding the research focus to include health systems policies, where possible in collaboration with the Amsterdam UMC Public Health institute. To realize this opportunity, the committee invites the institute to formulate an impact strategy based on existing public policies and frameworks. Speaking the language of policy makers is integral to be able to realize societal impact, and this language is that of frameworks, action plans and agreements. The committee recommends determining in the impact strategy which societal goals AMS wants to contribute to, and determine what stakeholders are relevant to realize this strategy.

To realize and implement this strategy, the committee advises to:

- consider the development of an implementation centre devoted to connecting knowledge on human movement to impact on health systems policies and initiative. This centre could formulate and execute the AMS impact strategy, engage in stakeholder dialogues on movement and health, formulate policy briefs for local, national and international policy makers and proactively contribute to societal discussions;
- keep focusing on the role of AMS as a platform for internal collaboration and use the implementation centre as the main external brand. This centre should complement existing networks within AMS, which are and remain important;
- foster the strong embedding in the Amsterdam region, but pursue national and international collaboration where this can be of added value;
- expand the board of directors with a second co-director with a public health systems background, and ensure that the leadership of AMS has sufficient time to pursue the AMS strategy;
- keep investing in attracting clinicians to AMS, and expand this network beyond the hospitals to include general practitioners, who are the main players in the treatment and prevention of movement conditions and diseases;
- ensure that the strong collaboration on the senior level within AMS trickles down to the junior level, especially in collaboration between research programmes.

Appendix 1: The SEP 2021-2027 Criteria and Categories

The committee was requested to assess the quality of research conducted by AMS as well as to offer recommendations in order to improve the quality of research and the strategy of AMS. The committee was requested to carry out the assessment according to the guidelines specified in the Strategy Evaluation Protocol. The evaluation included a backward-looking and a forward-looking component. Specifically, the committee was asked to judge the performance of the unit on the main assessment criteria and offer its written conclusions as well as recommendations based on considerations and arguments. The main assessment criteria are:

- 1) **Research Quality:** the quality of the unit's research over the past six-year period is assessed in its international, national or – where appropriate – regional context. The assessment committee does so by assessing a research unit in light of its own aims and strategy. Central in this assessment are the contributions to the body of scientific knowledge. The assessment committee reflects on the quality and scientific relevance of the research. Moreover, the academic reputation and leadership within the field is assessed. The committee's assessment is grounded in a narrative argument and supported by evidence of the scientific achievements of the unit in the context of the national or international research field, as appropriate to the specific claims made in the narrative.
- 2) **Societal Relevance:** the societal relevance of the unit's research in terms of impact, public engagement and uptake of the unit's research is assessed in economic, social, cultural, educational or any other terms that may be relevant. Societal impact may often take longer to become apparent. Societal impact that became evident in the past six years may therefore well be due to research done by the unit long before. The assessment committee reflects on societal relevance by assessing a research unit's accomplishments in light of its own aims and strategy. The assessment committee also reflects, where applicable, on the teaching-research nexus. The assessment is grounded in a narrative argument that describes the key research findings and their implications, while it also includes evidence for the societal relevance in terms of impact and engagement of the research unit.
- 3) **Viability of the Unit:** the extent to which the research unit's goals for the coming six-year period remain scientifically and societally relevant is assessed. It is also assessed whether its aims and strategy as well as the foresight of its leadership and its overall management are optimal to attain these goals. Finally, it is assessed whether the plans and resources are adequate to implement this strategy. The assessment committee also reflects on the viability of the research unit in relation to the expected developments in the field and societal developments as well as on the wider institutional context of the research unit

During the evaluation of these criteria, the assessment committee was asked to incorporate four specific aspects. These aspects were included, as they are becoming increasingly important in the current scientific context and help to shape the past as well as future quality of the research unit. These four aspects relate to how the unit organises and actually performs its research, how it is composed in terms of leadership and personnel, and how the unit is being run on a daily basis. These aspects are as follows:

- 4) **Open Science:** availability of research output, reuse of data, involvement of societal stakeholders;
- 5) **PhD Policy and Training:** supervision and instruction of PhD candidates;
- 6) **Academic Culture:** openness, (social) safety and inclusivity; and research integrity;
- 7) **Human Resources Policy:** diversity and talent management.

Appendix 2: Programme of the site visit

Fri 2 Feb 2024

09.30 - 11.00 Preliminary panel meeting (online)

Mon 5 Feb 2024

08.45 – 09.00 Welcome

09.00 – 10.00 **Interview AMS Management Team**

10.00 – 10.30 Break

10.30 – 12.10 **Interview with representatives from translational research projects**

12.10 – 14.10 Lunch / internal panel meeting

14.10 – 15.00 **Interview with early career researchers / postdocs**

15.00 – 15.30 Break

15.30 – 17.30 **Tour of the research facilities**

Tue 6 Feb 2024

09.00 – 09.45 **Interview on PhD and HRM policies**

09.45 – 10.30 **Interview with PhD candidates and RMA students**

10.30 – 10.50 Break

10.50 – 12.20 **Interview with researchers from the knowledge centres**

12.20 – 12.50 **Interview about AMS future research policy**

12.50 – 15.00 Lunch / internal panel meeting

15.00 – 15.30 **Concluding session with AMS Management Team**

15.30 – 16.00 **Presentation of preliminary findings and closure**

Appendix 3: Quantitative data

The Strategy Evaluation Protocol requires every self-evaluation report to include quantitative information on the input of research staff, funding and PhD candidates. However, due to the fact that AMS researchers are associated with different organizations and departments/faculties within these organization, these numbers should be considered as an indication of the order of magnitude of certain aspects, rather than as an exact truth. Reliable information on the performance of PhD candidates was not available on the level of AMS.

AMS membership base	2017	2018	2019	2020	2021	2022
Scientific core staff	84	93	87	96	106	104
Other scientific staff	166	162	161	175	193	124
PhD candidates	236	280	271	353	328	332
Total	486	535	519	624	627	560

Funding over the years 2017- 2022

Funding	2017	2018	2019	2020	2021	2022	Total per cash flow
1st	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 364,800	€ 364,800
2nd	€ 6,302,682	€ 2,934,733	€ 3,468,003	€ 2,171,297	€ 4,281,116	€ 3,514,642	€ 22,672,473
3rd	€ 3,375,781	€ 3,120,996	€ 1,181,922	€ 761,667	€ 3,456,663	€ 1,664,101	€ 13,561,130
4th	€ 2,003,757	€ 1,249,781	€ 477,488	€ 296,006	€ 103,321	€ 419,608	€ 4,549,961
Total per year	€ 11,682,220	€ 7,305,510	€ 5,127,413	€ 3,228,970	€ 7,841,100	€ 5,963,151	€ 41,148,364