PÉCSI TUDOMÁNYEGYETEM
ÁLTALÁNOS ORVOSTUDOMÁNYI KAR

SCIENCE & INNOVATION

CONCEPT

THE ALLIANCE OF EXCELLENCE FOR THE DEVELOPMENT OF MEDICINE

POTE PILLARS

POTE
PILLARS

Working Version

Mission Statement

Our faculty is a center of excellence regarding education, research and patient care. We are developing a special faculty consumed with special individuals. Everyone is a partner in this endeavor, be they lecturers, healthcare professionals, students or administrative staff. We do this in order to meet our social mission of high, internationally recognized standards of medical education and to bring innovative thinkers into the realm of contemporary research. The principles of "Learning, Healing, Research & Development" serve in navigating us through the ever changing socio-economic circumstances of the 21st century, building upon the resources of our community: creativity, innovation and commitment.

Mission Statement, UPMS, 2022

Preamble

The POTEPILLARS is the strategic plan of the Faculty of Medicine of the University of Pécs, which explores and evaluates the current situation representative of our faculty, defines the most important development trends and objectives, and provides concrete tools for their implementation. It guides the Faculty community along the path it has set out in a way which conveys values and provides a framework for the work ahead, enabling us with confidence while assuring we are working towards a common goal, to make our Faculty pleasurable and a source of pride.

Of all the strategic pillars regarding the POTEPILLARS concept, "Science and Innovation" is perhaps the most complex and most cross-cutting, as it seeks to provide focus for the coming years in two areas which are very important. The other particularity is, unlike other Pillars, it also sets a timeframe, specifically, 2022 through 2027. Since both science and innovation are particularly dynamic and evolving fields, including our environment and one in which we ourselves as faculty are changing and evolving, so it is necessary to review this strategy at appropriate intervals, to retain the values and useful results, to evaluate and update the points still valid, and to revise those time has not justified.

Let us dare to change and grant us the courage in adapting to new situations! However, this apparent rigor carries with it two very important characteristics emblematic of "Science and Innovation." Whether it is scientific work or the development of an interesting idea or invention, both are based on constant exploration, searching for and trying out new things, keeping the right results while ruthlessly discarding the wrong ones. Another important characteristic is quality. Research work, innovation activities and developmental projects are to be implemented with only the highest possible level of quality, with the highest possible standards. This is the only way to serve the benefit of our Faculty and University, and the only way to make the effort of our specialists meaningful throughout the fields of medicine, industry, academics and RDI activities.

Certainly, many of the definitions, concepts or processes used in the strategy book can be envisioned in other ways, in search for other sources or "big truths" and good practices. However, it is also certain no other document will be more authentic than the present one in depicting the current situation representative of the UP MS, in ushering a more personalized and realistic path for us and, of course, being an integral part in the development, building and achieving our goals, benefiting both the community and the Faculty. The material here within is closely aligned with the other strategic pillars of POTEPILLARS, most notably the "Learning Culture Concept," in which we continue to strive for success.

Table of Contents

Table of Contents

1. OBJECTIVES AND PRINCIPLES

1.1 The key objectives of the strategy paper are the following:

Definition of scientific objectives and tools: The pursuit of high quality science is essential for all researchers, both for individual and institutional development. The strategy document describes the systems and processes which support scientific activity in our Faculty, outlines the motivation and promotion systems, and identifies the main lines of approach for achieving international excellence. It also provides tools to achieve these objectives and describes how to strengthen professional collaborations and nurture professional partnerships, both within and beyond the Faculty, whether academic or market-related.

National and international ranking: Both science and innovation are seen as highly objective fields, since we can assess the effectiveness of the work done according to a set metric. It is no coincidence scientific and innovation performance is a major factor in national and international rankings and in the evaluation of major national and international proposals. Our aim is ensuring the strategy includes elements which directly or indirectly support rankings, thereby increasing our international visibility, our scientific and market embeddedness, and overall, the prestige and reputation of our Faculty.

Embracing, emphasising and developing systems for innovation: At the University of Pécs, and within the Faculty of Medicine, we face many challenges and difficulties regarding innovative approaches and opportunities. Some of these are beyond our control (regional specifics - demography, corporate culture, infrastructure, transport difficulties, etc.), however, there are a number of factors which can be identified, undergo change and experience optimal transformation at the internal, university level. The vast majority of these are not particularly resource-intensive, yet only require professional decisions and process reorganization. Accordingly, our logic must be reversed. We are not looking for the cause of difficulties and challenges in our environment nor in external factors. We must examine in detail what we can do to ensure innovation as a concept and phenomenon has real substance and represents real, tangible processes which create intrinsic value in the life of the Faculty. An important feature of the Science and Innovation Pillar is to initiate our Faculty's thinking regarding RDI processes along the lines of the challenges and opportunities in which we have a direct influence on, thus, we as a community are able to take the lead in bringing about effective change.

Planning economic exploitation and building business models: Aligned with international standards and practices, the strategy regarding the model transition universities emphasizes the exploitation of research results (translational approach). By exploitation we primarily infer, direct market sales, however, as a medical science faculty it is very

important to bear in mind and perceive the clinical exploitation, the indirect or direct improvement of patient care in the form of measureable value. It is important to learn how to 'turn these results into something productive', it is important to grasp the 'enterpreneurship' approach, and it is important to acquire the tools needed to take a scientific discovery or innovative idea or development in a direction which will result in a successful spin-off entity or business. Perhaps most importantly, our strategic goal is to establish a new way of thinking regarding our faculty, one which makes innovation and economic activity a value and an example to follow.

Integrating external experts, market actors and perspectives: In both science and innovation, one can only succeed when willing to work effectively as a team. This means not only being able to work well as a research community in a particular lab or institute, but also being able to embrace new approaches and methods, and accept there are areas where others perform much better. In the Faculty of Medicine, we have the "difficulty," yes, in quotes, of being the strongest Faculty of the University of Pécs in many aspects, and the dominant player throughout the region, both scientifically and economically (thanks to the income from international education, if but for now). We tend to feel or think we "know how to do everything". This is not the case. Inter- and multi-disciplinary research bears an increasing impact worldwide, and the development of innovative ideas into products or services always requires the collaboration involving several disciplines. Accordingly, the objective of providing tools and opportunities to work with market actors, to bring on board 'outside eyes' to our faculty, and to provide a stable background for the health innovators and inventors of the future is of paramount importance.

Consistency with local, national and international strategic guidelines: In developing the strategy, the authors have drawn on national and international strategic guidelines. In terms of technical and content elements, the S3 National Strategy for Smart Specialization provided valuable support alongside the European Union's HORIZON Program. The operational and sustainability concepts are closely aligned with the Concept for Model Universities and the strategic material on "A Change of Degree in Higher Education". Additionally, it was important to ensure coherence with the PTE Institutional Development Plan and the Science and Innovation Park (SIP) project. It is based on the key strategic objectives regarding POTEPILLARS.

1.2. Main steps of implementation

As described in the previous chapter, this strategic pillar sets a timeframe, as the essence of scientific and innovation activity is continuous change, development and progress. We have to operate and deliver results in an ever-changing international, national and regional environment, within a changing Faculty and University landscape. Accordingly, monitoring and critical evaluation of the work carried out is thereby essential. The following roadmap, which is a mandatory element of all research programs and innovation developments, will help us to successfully complete the period indicated and will provide a reference point for the longer-term planning ahead:

- **2022. 09. 01. – 2022. 12.31. –** Introduction of the Strategy, targeted communication - sensitization and preparation
- **2023. 01. 01 – 2022. 06. 31. –** Forming working groups, consolidating community, completeing strategy and preparing for action
- **2023. 07.01-2024. 12.31. –** Implementing the action points of the strategy
- **2025. 01. 01-2025.06.31.–** Critical evaluation and analysis of the work carried out
- **2025. 07.01-2025.12.31. –** Preparing for the next era

1.3. What is innovation? Possible definitions:

The "Science and Innovation" pillar, as formerly described, bears a specific character in many respects compared to other strategic orientations defined within POTEPILLARS, however, its most striking and significant element has not yet been revealed, namely, all the material of the POTEPILLARS strategic pillars thus far can be built on existing, strong, solid foundations. Consider the "Learning Culture Concept" or the "Built Environment Concept," both of which have a number of starting points, traditions and values. Yet this is only half true regarding the Science and Innovation Strategy Paper. It is true our scientific workshops have produced many famous scientists and researchers over many decades, and have given the country and the world the best publication output of the University. We are, of course, visible in national and, in some areas, international terms, however, it is important we don't stop here. Admittedly, there is plenty of work to be done towards becoming more visible on the international stage. However, the other part of the strategic material, "innovation", is not something we have a strong tradition and background in our Faculty. Thus, we really need to start now. Let's think about it: how many successful firms and corporate entities do we recognize from past decades which have been founded within the walls of the University? Or, going further, do we know of any successful products or services which are currently on the market, either as a university spin-off or working closely within the University? Truthfully, there are not many to boast about. In recent years, innovation became a misunderstood and trite concept. In the last twenty years, thanks to numerous funding schemes, everyone has demonstrated levels of "innovation" yet without any real, sustainable results, limited to local, regional and the university level. Unfortunately, an effective university innovation ecosystem has not been established, until the date of drafting these lines. No wonder many individuals are mistrustful and sceptical regarding this novel concept.

How can the Science and Innovation Strategy help us and how is it different from other documents produced thus far? One reason is it honestly and franky confronts factors and processes we can change internally, on our own initiative and responsibly. There can be no excuses regarding how difficult it is to innovate in the face of perceived or partly real obstacles and difficult external circumstances, however, through these action points we can certainly move in a positive direction - the extent of which is, of course, up to us. The other reason why this material can be helpful is it summarizes knowledge and information deemed beneficial for those new to the concept of innovation. Many experiences are included here, based on real product developments, failed projects, successful venture capital investments and decades of experience in the university innovation ecosystem and these can help us in overcoming initial difficulties for everyone struggling in the act of assimilation.

For starters, it is worth summarizing in broad terms, what is worth knowing in reference to innovation and what innovation truly is.

A bit of history: the concept of innovation was coined in 1934 by Joseph Schumpeter, an Austrian economist and sociologist. The definition of the term is primarily economic and focuses on product development and service development. In summary, innovation, according to Schumpeter, can take on the following forms:

a.) The production of new goods or new qualities of goods not yet known to consumers (product innovation)
b.) The use of a new production or a commercial process linked to a new product (process innovation)
c.) Opening up a new market for a sales task, market entry (market, marketing innovation)
d.) Finding and acquiring new sources of supply of raw materials or semi-finished products (procurement)
e.) Creation of a new type of organization, restructuring of the industry structure (organizational innovation)

This economic approach is still very much in evidence today, despite innovation has evolved and experienced vast changes a in recent decades. The Oslo Manual (OECD and Eurostat; 2005) which, in addition to the business aspects, also covers the technological aspects [technological product and process (TPP)] and sets as a minimum requirement in which innovation is a "product or service new (or significantly improved) to the organization."

One does not necessarily have to think of global novelty when demonstrating innovation or have a good idea. The point is, it creates value, it is sustainable and brings benefits to the actors in the innovation ecosystem.

Thus far, from what we can see in the definitions above combined with current ones, we can identify two basic characteristics regarding innovation:

INNOVATION or **SIGNIFICANT DEVELOPMENT**. This may seem trivial, however, it is very important innovation must have a visible novelty content, at least within the organization. However, this is not sufficient for real innovative activity.

If we look at the publication of the Hungarian Association for Innovation (Interpretation of innovation based on the third edition of the Oslo Manual published in 2005; József Katona, 2006), it highlights the following sentence from the 3rd edition of the Oslo Manual: 'innovation activity is defined as "all scientific, technological, organizational, financial and commercial activities that actually serve or direct the realization of innovation"'

The following lessons can be drawn from this:

INNOVATION MAY BE MULTIPLE (not only technological), and as a consequence, it is explicitly characterized by **INTER- AND MULTIDISCIPLINARITY**. And if you look at any past or present publication or position paper regarding innovation, nearly all, directly or indirectly, refer to the issues of **VALUE** and **SUSTAINABILITY**.

There are many other useful and professionally credible textbooks and national or international published forms of literature available on the subject. It is not the purpose of this paper to compete with these works, but rather to find a definition of innovation which can be adapted to the Faculty of General Medicine on a one-to-one basis.

As we have seen, there are many definitions regarding innovation. What they all have in common is the concept revolves around new or novel ideas, methods, processes and their implementation. Analysis of a series of interviews with a number of innovation experts has led to the following universal formulation of innovation:

”**Executing** an idea which addresses a **specific challenge** and **achieves value** for both the **company** and **customer**” (Source: https://www.ideatovalue.com/)

Considering the content and details of the above sentence in detail, a comprehensive, complex, innovation-related development which meets the following criteria is justified for our Faculty:

”Executing” – A practice-oriented innovation process, at the end of which, the initiative, concept or idea actually becomes feasible

”Idea” – Make room and welcome all ideas and visions

”Specific Challenge” – Innovation can never exist "for its own sake" - it must always be driven by a specific goal

”Achieves Value” – Innovation must create and generate sustainable added value

”Entity” – Our institution, the Faculty of General Medicine, should be part of it

”Client” – It must be shared with the user, the "clients" – which includes students, lecturers and the entire staff of our Faculty

The above may well show we have many opportunities in which to demonstrate innovation, within and around us. For example, whether it is introducing a new process management procedure in one of the Institutes, or trying out a completely new teaching method, or introducing a new patient care method or protocol in one of the clinics, and doing it along the lines described above, we are innovators!

Of course, self-restraint is also important, as it is essential to distinguish between what creates new value and benefits locally, and what is of greater scale (at the overall university level, regionally, nationally and globally). Innovation is diverse, reinvigorating and exciting. It can be built from many things and is both collaborative and integrative. Accordingly, everyone is encouraged to become involved, dare to try new things and dare to dream big!

These chapters aim to summarize the practical aspects regarding innovation which build on the strengths and existing capacities of the Faculty of General Medicine, and guide the development of a professional, radically new, inclusive and interdisciplinary Innovation Ecosystem based on the values of excellence and effectiveness.

2. SCIENCE AT THE UNIVERSITY OF PÉCS MEDICAL SCHOOL

2.1 PAST AND PRESENT ACADEMIC PERFORMANCE OF OUR FACULTY

Science assessment systems

Science assessment systems are constantly changing throughout our world. Currently, one of the most widely accepted and commonly used systems is the Q1-4 rating, taking into account the specificities of the discipline. Dividing the journals in a given discipline into quarters, the top 25% represent Q1, and the balance between the top 25 and 50% represent Q2. Our aim is to maximize the proportion of faculty publications in these two categories. The D1 value represents the top 10% in a similar way, and the aim is to increase this level.

The increase in quality publications has shown a welcome trend in recent years. This is certainly due to the existing incentive schemes and the faculty support which covers the publication costs regarding manuscripts, fully for Q1 publications and 50% for Q2 publications. The number of highly cited publications above 10 impact points has also increased in recent years. The aim is to further increase the number of quality publications.

Impact factor classification and the calculation of impact factors to measure individual performance among researchers are still used, although this system has many drawbacks and is not used in many places. When measuring individual researcher performance,

citation, especially extramural, independent citation, is extremely important and is also of paramount importance regarding overall faculty performance, as it is an important factor in ranking. This is also taken into account by the Hirsch or h-index. Additionally, the recently developed science metrics method (tudomanymetria.com) also takes into account the age of the researchers and the comparison among researchers throughout Hungary. We plan to incorporate this method into our faculty evaluation systems.

The basis for the assessment systems is the MTMT (Hungarian Database of Scientific Works). It is encouraging to note, the MTMT is nearly 100% at full capacity and researchers are aware of its importance. Scopus and other international systems are also constantly monitored by the faculty library staff, and any gaps are filled. This is very important for international rankings.

2.2 INCENTIVE AND PROMOTION SCHEMES

Faculty grant scheme encouraging young researchers

The UP MS has launched several faculty competitions and is continuously expanding its range. The aim is to enable promising research projects to be launched and continued in the absence of other funding sources. The grant provides an incentive regarding publication activity, since international publication is a prerequisite for the acceptance of the report and the award of the following year's grant. Additionally, it encourages external grant activity, since a higher amount can be applied for if an external grant application is rejected due to lack of funds. The aim is to support promising research by researchers at the UP MS and the Clinical Center which cannot be carried out without external funding and thus, cannot be published. The faculty support scheme includes a number of elements to support the work of young researchers. There are also two grants to support young researchers in their PhD studies or following the post-doctoral years. The following **research grants** are currently available in our faculty: **(UP MS Research Fund applications)**

- UP MS Faculty Research Fund (Szolcsányi János research grant)
- UP MS-CC Collaboration Fund (Pintér András research grant)
- UP MS-PhD+1 fund
- UP MS Young Researcher, Dr. Romhányi György -scholarhsip
- External Lecturers at UP MS, Dr. Kispál Gyula proposal
- Transnational Researcher Proposal
- Berde Botond Research Grant
- Collaboration Fund - Sümegi Balázs Shared Research Proposal

Both the number and quality of publications have been on the increase in recent years.

Recognition of excellence, motivational schemes

Two systems are currently in place to recognize publication performance:

IF-Based Reward System

To increase publication performance, financial recognition is awarded annually based on impact factors. The basic calculation and evaluation points are impact factor and first/last authorship. There are also plans to take into account Q-ratings and discipline classifications.

Author's Celebration

The Authors' Celebration is a traditional event honoring the year's most outstanding and accomplished researchers, who are awarded "Outstanding Author" award, which includes an "Owl" statue, a certificate and a financial reward.

Aim: To continue the celebration of authors, continuously revising the evaluation system to adapt it to new trends and to take into account a number of criteria to establish the fairest possible ranking, including a focus on Q1-2 articles, a special emphasis on highly cited publications and a special evaluation of D1 publications. Emphasis will be placed on first/last authorship, and in the future, the inclusion of sciencemetria.com classification and differential scoring systems by discipline.

Career development shcemes

PhD and Habilitation

Recent changes have brought many new challenges in this area. In addition to the clinical workload, the salary system and the lack of career progression encapsulated within may pose new problems regarding the motivation of young researchers to obtain a degree and later to habilitate. The Doctoral and Habilitation Committee is constantly revising and amending the regulations to meet the challenges of the present day.

Between 34-45 PhDs have been awarded from our faculty's doctoral schools annually over the past 10 years, and between 10-20 habilitations are awarded each year.

Since the increase in residency grants, the number of PhD applicants with a medical degree has been falling year by year. The situation will be further aggravated by the current increase in medical salaries and the restructuring of the health care system, with consequently fewer and fewer clinicians being able to fit into the realm regarding higher education structure. The doctoral schools affiliated to the faculty include two clinical schools, and together they are the largest number of doctoral schools. The changes which are expected will have a negative impact on our doctoral training and on medical education in general. The aim is to sustain levels of motivation and provide the background for colleagues to obtain their degrees. An important step in this direction is the recent introduction of the MD-PhD program, which permits high-achieving students to join the PhD program during their undergraduate training, thus encouraging them to remain within

the system.

Hungarian Academy of Sciences Doctoral Degree

The doctoral degree of the Hungarian Academy of Sciences is the highest scientific degree in Hungary, which can be obtained with outstanding achievements and truly indicates the researcher's significant scientific work and school-educational activity.

Several years ago, the number of doctoral degrees in our faculty dipped, however, in the last two years there has been a significant increase.

The aim is definitely to increase the number of doctoral degrees. To this end, the faculty can offer a range of support, such as sabbatical leave, which offers colleagues who are over burdened with routine work and close to submission the opportunity to complete their doctoral work. We plan to encourage and assist colleagues who are close to meeting the criteria.

Undergraduate Research Society

The aim of the Undergraduate Research Society is to introduce and familiarize talented students interested in research work to the scientific research and clinical workflow of the UP MS. Throughout the URS, undergraduate students are directly involved areas of research within our institutes and scientific workshops. The URS is inspiring, both for the undergraduate student doing the research and for the supervisor. Its significance lies not so much in the acquisition of a new scientific result, but in the acquisition of an insight into a field and the development regarding critical thinking. The individual research results also provide an excellent basis for the successful preparation of a medical thesis and for effective postgraduate (PhD) work.

The Undergraduate Research Society is governed by the Undergraduate Research Society Council (URSC), which consists of eight faculty members and is chaired by a professor of the Faculty. The members of the Undergraduate Research Society possess the opportunity to participate in the URS Conferences and URS Salon events, both as speakers and participants, including many other student forums. Students are offered the opportunity to participate in conference visits, thus facilitating their future involvement in academic and professional life abroad.

The most outstanding students will be awarded scholarships for a period of ten months inand will be hosted as an annual scholarship competition. The long-term goal of the Undergraduate Research Society is to develop the next generation of university teachers and researchers. The Outstanding URS students represent future enrollment in Doctoral Schools.

URS work course: The subject can be enrolled up to four semesters in ascending order (URS work course 1, 2, 3 and 4), totalling 8 credits. The course director is the current chair of the URS. The prerequisite for the admission of the subject is the registered URS-membership. The terms and conditions regarding acceptance includes the following: in the case of URS work courses 1,2,3,4. : a verified first-author URS presentation (at a faculty or other event) and/or a Dean's thesis or a first-author presentation at another professional forum. In the case of URS work course 1: the opportunity to report to the subject supervisor regarding the

work carried out and the research methodology used. Grades will be determined by the assessment of the fixed forms highlighting performance. The peer review of the Dean's Coursework will be coordinated by the TDT. The aim of the Mestyán Gyula Mestyán Award is to recognize the work of the most outstanding student of general medicine, dentistry, pharmacy and Medical Biotechnology MSc students who have completed a student research project.

Aims:

- Increase the number of URS students and the intensity of URS work in each department. The URSC works with the heads of the institutes to achieve this goal.
- Increase the involvement of International students in URS work. Organize an informal forum in English for International students to familiarize them with the URS work.
- Renewal of the URS website, production of short videos promoting the URS and presenting the URS work of the institute for the UP YouTube channel and websites, with funding from the grant in support of an effective URS marketing campaign.
- Organization of scientific work among talented and interested secondary school students in the institutes, with the goal of educating an upcoming generation of URS students.
- Organiszing URS Salons in preparation for the URS conference. The Salons provide students with the opportunity to present their results to a professional jury

Science Communication, Publicity Raising Awareness and Marketing

The faculty website is currently under renewal. It is important to allocate more space and to ensure the content is current regarding academic life. This requires the uploading of brief descriptions of the research groups aligned to the institutes, which has already begun. The aim is to complete this objective and to keep it up to date assuring concise information regarding the research groups is available and easy to comprehend on the faculty website. Scientific news has been more prominent on the website in recent years and an overhaul and expansion is needed.

From a social point of view, the dissemination of knowledge is of particular importance. The dissemination of scientific knowledge has always been an important task of the faculty. Several programs have been operating successfully for many years, ranging from educational programs targeting secondary school students (Open Days, Brain Research Week, etc.) to the Researchers' Night, which has been a series of events in which our faculty has been participating for a few years now, with more and more colorful and attractive programs for a large audience every year.

Researchers from our faculty are featured on numerous radio and television programs with varying regularity. These reports and educational programs enhance the reputation of our faculty. The Pécs TV, Univ TV and national channels have already presented several programs with representatives of our faculty, e.g., m5 Felsős műsor and expert interviews on 1-1 topics. In addition to information transfer, another aim of scientific communication is networking. The Institute for Transdisciplinary Research Institute has been organizing public forums for several years regarding "Arts and Science" and on the ageing process. The aim is to expand these and organize future forums. Concrete examples include a wider presentation of the Museum of Medicine, science communication festivals, a "living lab" and a series of science-popularizing reports.

NATIONAL AND INTERNATIONAL RELATIONS ON RESEARCH AND INNOVATION

As we have seen in the introduction, one of the most important criteria for successful scientific and innovation work is collaboration. We can distinguish several levels of collaboration, as follows.

Relationships - Faculty of General Medicine and the Clinical Center:

The internal relations regarding the UP MS-CC have been the basis for countless research and development projects. The Faculty has created the "Tandem" funding opportunity to strengthen research projects among the Faculty and the CC. Through effective exploitation regarding joint strengths, scientific output can be enhanced. The aim is to explore this area and to provide appropriate support. As "problem posers", the clinical units encounter challenges and problems in their daily work, which can form the basis for forward-looking research or innovation and development. Theoretical institutes can be characterized primarily as solution providers, while laboratories and the knowledge base of researchers can be excellent tools for solving scientific or innovation problems. However, sometimes the tools and knowledge available in the field of life sciences are not enough, and we need to look at a broader horizon and take the next step in order to involve other disciplines and other skills deemed essential for the success of the project:

Cooperation with other faculties and departments of the University of Pécs:

Our faculty currently has effective cooperation among the faculties of science and engineering, which has been deepened and strengthened in the last year. The UPMS-CC is currently collaborating in several research projects with researchers from the faculties of natural sciences, pharmacy, health sciences and the arts. There is vast potential for collaboration, since projects will benefit from a multi-disciplinary, multi-perspective approach, inter- and multi-disciplinarity and better exploitation regarding the instrumentation. The CoreFacility system, which will be described in a forthcoming chapter, is an embodiment of effective cooperation.

The Szentágothati János Research Center cannot be entirely separated from the Medical School, as several UPMS researchers and research groups are active within the Center, and the strengthening of this relationship and the enhanced development of its instrumentation and project opportunities through joint research points are planned to be prioritized in the upcoming future.

Expanding and strengthening external and internal cooperation is a key element of this Strategy Paper. To this end, existing relationships need to be assessed and new ones promoted, supported by appropriate means.

National collaborations – Academic and Marketing relationships

The researchers of the UPMS-CC are in contact with nearly all the institutes and universities throughout Hungary which carry out research in the natural sciences through joint proposals and research projects. There is also an increasing tendency to develop active cooperation with technical research centers, however these have not yet fully gelled. Broadening and deepening academic links may also prove to be a general objective. The same is true for market relationsips, however, the challenge is even greater here, since academic and industrial perspectives are often in contrast and it is much more difficult for both parties to understand one another. Moreover, one of the basic principles regarding active engagement in market partnerships is it can only be done effectively through very specific, targeted projects, since every hour spent without real production is a loss for most business entities, thus, it matters where they invest their time. Our aim is to make it entirely "worthwhile" for a market player to cooperate with the UPMS, and for the time committed bear real fruit.

International Collaborations

Researchers at the UPMS-CC possess a plethora of international contacts. It is of particular important for the Faculty to provide opportunities and support for researchers returning from abroad, who already have a significant research background, to start working in their home countries, to form research groups and to develop laboratories. To this end, several supportive initiatives are currently in place, and the faculty management, together with the International Relations Committee, is making efforts to "invite back home" additional researchers. Support for returning researchers is also supported by several internal faculty competitions including the "Bringing External Researchers to the UPMS" and the "UPMS Cross-border Researcher Competition," both of which were created with this goal in mind.

Notably, the recently established Visiting Professorship Grant ("Visiting Professorships for Education-Research Cooperation") provides an opportunity to invite internationally outstanding international researchers and to create living allocations and funding support regarding joint projects. Recently, several such collaborations have been launched, however, the pandemic slowed down or forced this process to be put on hold. The aim is to make wider use of this program in the future. Many of our former students and colleagues who are currently employed in prestigious universities and research institutes abroad realize the potential in rejoining our faculty through such a program. It is imperative we make better use of these existing links. From the perpestive regarding international relations, it is important to ease the bureaucratic steps and administrative paperwork.

Active engagement with global entities at the international level is still relatively limited, however, there are some good initiatives including FOSS Analytical A/S (Soft Flow, Ltd.) or CAE (CAE Engineering and CAE Healthcare, Ltd.), in which research and innovation collaborate among international corporate entities which has produced real results. The scope of these professional collaborations will of course, undergo expansion.

Programs of Excellence, National Laboratories Program

Our aim is to increase participation in these programs. To promote this, research areas in the programs of excellence and those with the potential to do so will be given an even

more favorable position and be encouraged to grow. Given the current funding, scientific performance and R&D opportunities, there is a branch aligned to the neurosciences and translational research in which this potential exists. In addition to basic research, the applied and translational nature of these areas is currently supported on a national level. They can be used to create a serious platform with the potential to compete with international tenders.

National and international research and innovation proposals and industrial proposals

The University of Pécs received a number of GINOP and EFOP proposals, some of which were referred to as, "soft" (not necessarily based on excellence) initiatives, which were partly intended to finance the reduction of budget support. This was compounded in the case of proposals managed at the overall university level in which the technical programs were often diluted and specific developments were not coordinated nor fully optimized. Although indicators have been and are currently being met, few proposals have been able to deliver lasting, sustainable value. Additionally, our international grant writing activity is considerably diminished, as we have only been awarded a minimum number of proposals as a consortium leader, yet we are rarely included as a member of major proposals, e.g., ERC - European Research Council and the Horizon proposals. Therefore, our performance in this area must be improved, in consideration of the next European Union programming period (2021-2024 Horizon, 2021-2027 budget period), in which research, development and innovation will be given top priority, as will the operation of business entities and universities, as our applied research activities must be strengthened.

Recently, there has been an increasing number of calls for proposals supporting applied research and industrial development, either at the individual (Cooperative Doctoral Program) or the institutional level, with the mandatory participant being an enterprise, typically a small and/or medium-sized enterprise (SME) based in Hungary. In addition to the possibility of winning substantial grants to launch or sustain a project, the mutual transfer of knowledge between the university and the market player is of considerable benefit to all participants. In this area, it is worthwhile to increase the level of contracting activity and to develop business entities linked to the Faculty and the University (e.g., in terms of turnover and statistical headcount) enabling healthy competion among potential contractors and encourage the University to initiate a consortium.

CORE-FACILITY SYSTEMS

Scientific progress is accompanied by the rapid development of technology and instrumentation. In most cases, this implies the need to create a core facility, both in terms of funding and expertise, in which modern instrumentation with the appropriate expertise is available for each research team. A core facility is a horizontal organizational unit integrated into the higher education and research institutional system, which supports a cross-departmental and cross-disciplinary research unit with specific infrastructure, carries out developmental activities and manages the resources and assets allocated to the core facility. Aligned with the above objectives, eight such centers (Animal House, Flow Cytometry, Genomics and Bioinformatics, Small Animal Imaging, Molecular Biology, Nano-BioImaging, Tissue Science and Mass Spectrometry) are

currently organized within the UPMS, some of which are located in the buildings aligned to the Research Center.

The creation of core facilities ushers in a number of professional and financial benefits to our faculty, including, but not limited to, the following:

- Coordinated operation of world-class facilities, attracting professionals and students from Hungary and the surrounding countries (undergraduate and postgraduate training), positioning Pécs on the map of internationally renowned biomedical education and research institutions.
- The number of strategic collaborations within the University (research group collaborations and the pooling of competencies) is expected to increase, thus strengthening internal cohesion while increasing both scientific and grant activity. The creation and outsourcing of the core facility business model, in addition to increasing research and innovation revenues, will also contribute to the costs necessary for the continued development of the instrumentation fleet. It may also allow for the repair, service and maintenance of the existing instrumentation.
- Since the core facility's instrumentation also includes prototypes under development, the establishment of core facilities will also be a major step forward in areas of innovation, for example, in the creation of spin-off businesses involved in microscope development.

Thus far, the core facilities recently developed were based on a number of ideally suitable international examples, conceptualized by researchers who developed the operational structure, with the aim of bringing life science R&D up to world-class standards. The secondary objective is to provide a unique and internationally leading development and service in several priority areas. It is necessary to develop the general operating model of the core facility (organizational structure, procedures, financial issues and forms) aligned with the expectations and criteria of the proposal, to summarize the professional tasks and their timing, to develop the general operating principles and criteria and to define the professional processes and teaching materials specific to these areas. It is important to develop a general "core facility" operating model, to define its processes and activities in consideration of its operation as a core facilty, and to do so since it is necessary to present international examples of core facility operation and to describe the operating principles and methods transferred from them to the present model.

The cutting-edge interdisciplinary research profile allows the core facility to serve as a research base from a number of disciplines, from a single, separately managed theme. For several centers, some of the necessary resources (infrastructure and salaries) are available, while other costs (procurement of registration software, office fitting, NBIC administrator's salary, etc.) are under review and the source identified. To ensure the smooth operations regarding the research, the core facility employs highly qualified staff (PhD and Post-doc) who are able to understand the research needs of the various sub-fields, integrate and operate the facilities' target-oriented software applications. Tasks and competences are defined along these lines. It is important to develop an operational and financial model which fits into the internal university structure and organizational functionality, to develop a pricing methodology while creating a fast and efficient business process and usable forms.

Basics of the Core facility (NBIC)

- Its main function is to serve interdisciplinary research activities using high quality, dependable equipment with suitable capacity.
- However, in order to cover the high cost of equipment, absorb operational costs and assure optimal use regarding capacity, it may also be used by external academic and industrial partnerships. The assessment of internal and external (academic and corporate) needs in support of NBIC is ongoing.
- To this end, a well-defined set of operational protocols needs to be established and a registered user base will be targeted. This will be developed in detail by an administrator and two physicists aligned to the NBIC.
- Determination of the tariff structure: the current price structure should be essentially cost-based, adapted to the market price and maintenance costs of the procured equipment and consumables, including the prevailing legal environment (users are to be informed of price changes in a timely manner). The tariff structure will be derived from a price (which can be variable: full price or pro-rate) set on top of the cost price. In the case of NBIC, all users will incur a cost, which will be based on the hourly rate for the use of the instrument. The highest costs are to be assigned to among the industrial partnerships. Pricing will be established once the instruments are received.

Core facility operating model types

Two types of core facility operating models can be distinguished:

- All inclusive service: In this case, the researchers provide their samples and experimental needs to the core facility staff, on the basis, of which, the core's technical experts carry out the experiments and the results are disseminated to the researchers. At the request of the client, the evaluation is also carried out. This type of operation requires a highly qualified and significant number of staff and is extremely labor-intensive.
- User core facility ("User laboratories"): In the case of a user core facility, researchers operate equipment independently after having received specific training. The staff of the core facility act as advisors to researchers, providing a support function. Experimental design, execution and evaluation of experiments are the responsibility of the researchers. This form of research is fast and cost-effective.

Both subtypes are characterized by the organizational unit responsible for the operation of the core facility and perform the following tasks:

- Provides and operates the infrastructure.
- Provides training on the use of the equipment to researchers interested in the core facility.
- Develops workflows and SOPs (standard operating protocols) to carry out standard experiments step-by-step. This will include the development of a website in which reservations are made and the developed workflows and SOPs will be available to authorized users.
- If animal experiments are planned to be carried out by the researcher, the necessary ethical approvals will be examined, verified and registered.
- It will also carry out specific developments and implement new solutions in a

sub-area, adapting to the specific needs of the research user community.

Core facility networks

Distinctively, technological innovation in these areas has dramatically accelerated, of which, even high-value equipment is becoming obsolete in a relatively short period of time, with more modern and advanced systems emerging on the market place. Universities typically do not have sufficient resources to consistently procure state-of-the-art equipment and keep abreast advances made in technology. To overcome this, core facility networks have been created to procure complementary high-value equipment and share knowledge, capacity and instrumentation, thereby reducing redundancy while optimizing resource use.

Consortium, corporate interfaces

As an example, Hungary and the University of Pécs recently joined the EuroBioImaging (EuBi) consortium. In addition to the significant funding available for specific tools, the EuBi network provides the UP with significant research collaborations and a platform for mutual professional support, knowledge sharing and training among consortium members. It is worth mentioning, the networks established by leading business entities which, while essentially serving the business interests of the corporation (increasing sales), are in many ways, similar to a core facility network. A good example is labs@location, the reference laboratory network of one of the world's leading microscope manufacturers. It provides targeted training and advanced services to its clientele, working closely with users to help to identify new technology needs and implement solutions. They also play an important role in assisting the laboratories in the network to develop and test new workflows for the parent business entity. The experience is incorporated into the sales strategy and the new workflow updates previously installed software to support the wider customer base. Naturally, in return for knowledge sharing and developmental collaboration, partnerships are provided with state-of-the-art tools at a significant discount. Concrete steps have been taken, e.g., the acquisition of microscopes for the Nano-Bioimaging Center, which will allow the UP to establish a Nikon microscope center, of which, is additionally planned to become a Nikon reference laboratory.

ACTION POINTS IN THE FIELD OF SCIENCE

The main objective of the Science and Innovation strategy paper is to increase scientific activity, to elevate the quality of articles with a Faculty affiliation and to provide a toolbox to achieve higher rankings in the future. Another key task of the action plan is to design the incentive schemes in such a way as to make them attractive as possible regarding young researchers and academics, to provide a career model and to recognize and support innovation. These objectives can be achieved by the following measures.

Reforming incentive schemes:

Inter- and Multidisciplinary Research Fund: the internal Faculty Bidding system, which is excellent and has a strong track record, can be complemented by a research fund to support inter- and multidisciplinary research. The aim of this is to reinforce high-quality projects in which, in addition to the publication of a high-quality article (Q/D1), the implementation must involve at least one other discipline, which can be demonstrated through affiliation (other faculty, university, research institute and/or market player). A further evaluation criterion is the involvement of external, even international, researchers. This will promote scientific excellence, ensure the emergence of new disciplines in our Faculty while directly and indirectly contribute to the objectives of ranking.

Emphasis on Impact Factor based reward system - Ranking criteria: The IF based reward system is a successful motivational program cemented in place at the Faculty for many years and its impact is fully felt in the academic performance of the Faculty. Its continuation is definitely justified.

Consideration may be given to whether it meets current "ranking" expectations, which may change from year to year, or the relationship between rankings may change. Thus, if a particular disciplinary characteristic, e.g., "Health" may bring a good development in terms of proportions for the Faculty and the Univeristy, scientometric indicator, e.g., Hirsch index coming to the fore or more emphasis on citations, or collaboration parameter (national or international collaboration with another institution in publication) changes, the IF-based reward system may be weighted for the period in question. Naturally, transparent and timely communication regarding this premise is essential

Rethinking the parameters regarding academic career development: Post-graduate education and PhD training has formerly encountered and is likely to face significant challenges in the near future. To this end, decisive interventions are needed in this area. One possible means to do so is to review the career development requirements, yet mindful not to compromise regarding quality and standards.

The only way to achieve good results in the long term is to introduce and accept new elements into the career development systems aligned with established teaching and research parameters. These include the following:

- In addition to full-time PhD training, the possibility to work will be more flexible, aligned with the objectives and the philosophy of the "Cooperative Doctoral Program"
- Certified, real work experience in relevant business entities related to the field of medical RDI (e.g., pharmaceutical corporations, medical technology corporations,

etc.) can be recognized as legitimate credit in the PhD program, in place of coursework.
- Innovation can also be accepted instead of educational indicators, while maintaining academic expectations. Naturally, this may be increasingly more attractive and far more productive area for many willing participants.

More emphasis on innovation regarding the Performance Scheme (TÉR): Another possible way to increase innovation activity is to include this aspect in the Annual Performance Review. It is important these aspects are linked to fair and objective parameters and milestones which create real value for the Faculty and the University.

Expanding the POTECROSS training scheme: The POTECROSS combined training program, launched in 2020, is rich in potential. These courses will ensure talented students can join other courses during their undergraduate training and, following graduation, obtain a full BSc degree in a different discipline within a shorter timeframe. This already operates between medical and law, economics, engineering and arts, however, it is worth exploring which other areas of collaboration can be further developed, taking into account market demand. Another possible action point is to review the conditions of admission to the POTECROSS training program, which can be reconsidered in order to widen the range of students wishing to enroll. This combined training program will also be a significant marketing factor regarding the enrollment program and effectively marketing it requires improvement.

PhD-MD "Joint degree" program: Due to the wage differences in the medical field in recent years, research careers are becoming less popular among our graduates and the number of PhD students is projected to decrease in the near future. To counterbalance this trend and promote the research career field, it may be an appropriate solution to make certain elements of the PhD training (e.g., courses and complex examinations) available to students with an appropriate academic record, thus significantly shortening the time required for PhD training, even by years. This, in addition to making scientific careers more accessible to students, can help train a new generation of researchers while increasing the potential number of clinical PhDs.

Effective support for clinical research: for practicing clinicians, high-quality research requires considerable extra energy, in addition to the already mentally and physically demanding work regarding healing. In order to ensure clinical research can be carried out to the highest possible standards, with optimal time and efficiency for all involved, the Medical Skills Development and Innovation Center (MSDIC) and the Preclinical Research Center of the Faculty of General Medicine, University of Pécs, will provide both professional and scientific management support to researchers aligned to the Clinical Center. The following specific actions are eligible for support, in close cooperation with the thesis leadership:
- Mapping of basic research methods for measurements and experiments, advising on these methods and liaising among theoretical institutes
- Providing practical support and information regarding research-related administrative procedures (e.g., PhD application and complex exams)
- Standardized uniform collection and transfer of documents - regional and national licenses
- Professional cooperation in the analysis of research results

PhD College: In a similar means to the György Romhányi student college, it may be appropriate to establish a PhD College at the Faculty of General Medicine, whose main role will be to nurture talent, mentor and promote research careers. It can also play an active role in the community life of the Faculty and the city, and portrays an advocacy role in cooperation with the Doctoral Students' Council (DSC).

Proposal writing seminar and active proposal monitoring: Increasing national and international proposal activity is a key objective of our Faculty. To this end, the organization of seminars and workshops in support of researchers is worth considering, in which researchers gain insight into the practical aspects of successful proposal writing, including the basics of proposal project management, thus ensuring a complex understanding of the proposal-related processes. The training will be delivered by the relevant departments of the Chancellery, and by senior researchers boasting several years of experience in the field. This activity needs to be complemented by effective monitoring of proposals and appropriate target group-specific information.

Supporting research administration with digital solutions: There are many administrative tasks throughout research currently being carried out in a way considered unfit for the 21st century. These refer to the administrative steps related to PhD training and application, including the documentation of ethics approval processes. These tasks, which are currently carried out slowly and bureaucratically, can all be broken down into well-defined, simple and traceable, step-by-step units, the digitalization of which will greatly facilitate and simplify the work of researchers and administrative staff.

Creating an inventory of assets and services: As a continuation of the work initiated in support of core-facility systems, the structured and ordered collection of RDI capacities including assets, infrastructure and expertise, is a priority element representative of the innovation strategy. Collecting and making accessible the assets, real estate and knowledge assets of the Faculties will vastly increase optimal utilization, generate internal (university) and external (market) revenues and thus contribute to the sustainable operation of the Faculty. Once the appropriate databases have been established, the next important step is to present the capacities in a transparent means, for example, on a relevant web platform. An important aspect is to ensure searchability and appropriate professional grouping. The development of an inventory of assets and services may also involve the introduction of a reservation system, for which excellent market solutions exist (e.g., EzBook).

III. INNOVATION AT THE FACULTY OF GENERAL MEDICINE OF THE UNIVERSITY OF PÉCS

1. CHALLENGES AND POSSIBLE SOLUTIONS

1.1 Linking innovation and science

Innovation and science are too often, wrongly and sharply separated, as are basic and applied areas of research. Both aspects benefit one another when seen inseparable. In some cases they can be understood as a series of iterative, alternating cycles, in others as a series of sequential processes which build upon one another. It is important to bring these processes closer together, to create unity and harmony, establishing alliance among them, since this is the only way to develop and operate an effective innovation profile.

This objective will be supported by the inclusion of new, interdisciplinary scientific fields in the scientific portfolio of our Faculty, which cross sectors and disciplines, creates cohesion and cooperation between basic and applied research and are able to transfer research results to exploitation when effectively marketed. It is important the Faculty's core tasks (Education, Patient Care and Research) are complemented by a Commercialization/Services portfolio. The emergence of new innovation-focused disciplines will help advance the solution regarding this challenge.

1.2 Establishing, strengthening and transferring a culture of innovation

In the past decade, innovation has unfortunately become a "trite" concept. Many actors, both within and beyond the university, have tried and are still trying, in most cases with good intentions, to get involved in these processes and to develop new systems. These are, however, isolated ideas and attempts, without any particular technical content or specifics.

In order to build a solid foundation in support of the new innovation ecosystem regarding our faculty, it is advisable to start disseminating the field at the level of students and, to a certain extent, at the level of high school students. Two basic and obvious means of doing this are to integrate innovation into education and events (e.g., URS Fair, Brain Awarness Week and EIT Health Innovation day (health-focused Hackathon), undergraduate and postgraduate courses, training, clinical innovation workshops, etc.), or to organize thematic independent events.

1.3 Establishment and optimisation of faculty, internal innovation processes

In most cases, idea and project promoters are unable to effectively demonstrate innovation since university innovation processes are simply lacking transparency. Pathways are not defined and we do not have a tradition highlighting an "innovation ecosystem". There are many organizations and individuals involved in innovation, sometimes dedicated, sometimes voluntary, and as a result, innovators are confronted with barriers from the very beginning.

Where do I go with my idea? How do I start implementing it? At what stage, and when can I expect reliable support? Where and how can I acquire funding? How can the Institute in which I am employed or the Faculty support me? Is it worth starting a company? If so, how?... And countless, otherwise very important, questions remain yet unanswered. This leads to a loss of innovative ideas, will power and enthusiasm over the short term.

In order to build a functioning and efficient system for students, researchers, teachers and staff, it is advisable to frame innovation, to use our existing resources in a more organized and optimal means and to make the individual processes transparent and accountable. One way of doing this will be to establish a UPMS Innovation Platform, the UPMS-IP.

Innovation is, as we have seen in the previous introductory sections, a very complex process, comprised of many elements and processes. As such, organizing, managing and sustaining it at an organizational level, whether at the level of a university or a faculty, poses significant challenges for all actors within the innovation ecosystem. In order to embed and consolidate the innovation approach at the UP Faculty of General Medicine, to ensure innovation-related activities a value and to ensure innovation is accessible to all students and staff of the Faculty ("open innovation"). Several interventions are needed, which are summarized below:

2. MAIN OBJECTIVES

2.1 Relationships between innovation and science

In the traditional Hungarian higher education system, 'innovation' is often associated with 'science,' unfortunately, only in name. It appears in various management positions (e.g., Deputy Rector for Science and Innovation) or in organizations, however, it is also not uncommon to be associated with various application activities (e.g., the Office for Application and Innovation). These associations are primarily based on traditions and dated practices, and do not correspond to the requirements of contemporary times, international practices and, above all, professional activities.

What is 'scientific' is not necessarily innovative, and vice versa: what is 'innovative' is not necessarily scientific. The two areas are of course very closely linked and ideally there is an organic transition between them, but this is not always a prerequisite regarding high-impact innovation. **Thinking this through and rationalizing it at organizational, faculty level is an important first step in implementing the strategy.**

2.2 Innovation in organizational culture

In recent decades, the concept of "innovation" has unfortunately become "trite", with many individuals merely shrugging their shoulders when the subject surfaces. One of the many possible reasons for this is many applications, activities, programs or projects have been labelled 'innovative' in recent decades, both at local and national levels, without any significant added value for any of the players in the innovation ecosystem, a criterion which is inherent in the concept regarding innovation. The lack of acceptance of the concept in our faculty is further reinforced by the premise, in which to date, the processes supporting innovation activities have not been well developed, and the frequent questions, "Where can I go with my idea or question?" or "Where can I acquire support or funding?" have often gone unanswered, which has understandably led to a loss of confidence. In addition to the lack of transparency, there are also many real, partially real or even distorted negative accountings of failed ideas and concepts, either at the faculty or university level, with excellent potential, which failed to be commercialized, for the reasons outlined above. **It will be essential in the near future to restore the reputation and prestige regarding the spirit of innovation in our Faculty through a concerted effort.**

2.3 Motivational schemes

Innovation has been under-represented in the Faculty and University career development systems and performance appraisals. It can be stated, innovation activity has had no value until now, and consequently, the time, energy and resources devoted to it have been unorganized and based on individual initiatives. The previous operating models did not value a researcher, teacher, administrator or student working on the practical implementation of new ideas and projects, which is understandable, as we were not prepared to take up and support such an initiative.

In implementing the strategy, efforts will be made, aligned with the concept of the Model Transition Universities, to emphasize and encourage innovation activity in the performance evaluation system, and it is important to ensure measurable results from the field are taken into account regarding the career development of researchers and teachers, and to offer employees a perspective through a motivating, forward-looking system which truly supports and nurtures innovation.

2.4 Innovating and integrating innovation processes into university systems

One of the biggest challenges in the current university-wide and faculty system is those individuals who possess ideas and are motivated to implement them simply do not know how to get started, where to acquire support, help or even relevant and credible information. This is even more pronounced in our Faculty of General Medicine, where, due to the nature of training, such knowledge is not taught and such challenges are not often encountered in the course of everyday teaching and research activities. The situation is made far more complex since innovation is currently included in the activities of a number of units within our University, however, the tasks have not yet been defined and the processes are yet to be coordinated.

Aligned with the organizational transformation, it is an essential step in the implementation of the Strategy to design, develop and framework innovation-related processes and to build natural and organic links with the innovation ecosystem of the university. An important criterion is to ensure the Clinical Center and the Szentágothai János Research Center, with their specific, unique needs, will also provide appropriate support to medical and life science projects.

2.5 Developing an inter- and multidisciplinary approach

Our faculty has made significant progress in recent years towards developing an inter- and multidisciplinary approach. Several institutes and clinical units have initiated RDI activities with other disciplines (e.g., engineering, law and the arts within the university), and there are also good practices regarding collaboration with corportate entities and various markets, either in contracting or developmental projects. However, the number of such initiatives is still relatively small, and most of these are collaborative research programs and projects with a long tradition and a significant scientific and educational output.

In the practical implementation of the Strategy, an inter- and multi-disciplinary approach, a spirit of cooperation and openness towards other subject areas will be an essential element.

2.6 Market exploitation and market relationships

The 'peak' of successful innovation activity is when a project, ideally based on the results of one or more research teams, is commercialized and starts to generate revenue. The road to this point is long, arduous, time-consuming and resource-intensive, however, in the long run the investment pays off big dividends. In a well-functioning system, once a result or project is exploited, all actors within the innovation ecosystem benefit, from the inventor, through the department providing the work, to the University of Pécs as a whole. One of the prerequisites for such success is to be able to act as an "equal partner" within the market, to be a willing negotiator in support of an economic partnership. Lastly,

it is important to present and demonstrate in an appropriate means the values or capacities (be it knowledge, infrastructure, equipment or services) which represent value regarding the market ("sales activity").

To this end, we need to manage market relationships in an organized, integrated and professional means, at the level of the entire university, taking into account the specific challenges of the medical life sciences field, while always bearing in mind its specific needs.

3. POSSIBLE ACTION POINTS

We need to respond to the challenges outlined above, with concrete action points. The Faculty of General Medicine is in a fortunate position it can draw upon a wealth of assets, results and capacities which can be further catalyzed by the processes brought about by the Model Change. In the following section, the action points are grouped into broad categories. As stated in the Introduction, this is not a "carved in stone" blueprint, but rather a guide and inspiration. Admittedly, the action plan will be undoubtedly modified, optimised and adapted to emerging challenges as necessary, and doing so represents flexibilty and leaps in grasping innovation, aligned with the spirit of the Faculty and POTEPILLARS.

3.1 The link between innovation and science - organisational changes

The "Institute of Medical Skills Development and Innovation" (IMSDI) operates at the Faculty of Medicine of the University of Pécs, as of 1 January 2022. For successful operation, it is necessary to define at the organizational level (in the Organizational and Operational Rules) the tasks of the Innovation Office within the University and how it is integrated into the university-level innovation ecosystem. Additionally, it is also essential to distinguish it from other organizational units with parallel nomenclature (e.g., the Office for Proposals and Innovation).

The mission of the new center is to support and assist those involved in medical and health science education with modern, 21st century tools and technologies, to provide a platform for the practical validation and development of innovative ideas in the field of medicine and health science, and to help commercialize basic and applied research. Additionally, our stretch goal is to ensure the skills developed here can be translated into medical training and to further strengthen internal university and external market links and synergies through the development of an independent scientific portfolio. The Center will build upon existing strengths (e.g., Simulation Education Center and the 3D Printing and Visualization Center) to harmonize and optimize innovation processes within the UP Faculty of Medicine and will be organically linked to the overall university RDI ecosystem through appropriate channels. The broad knowledge, tools and expertise base of the new entity will ensure scientific results or practical problems (in medical education, laboratory work or clinical care) in the field of medicine and health sciences are efficiently exploited aligned to effective marketing strategies.

3.1.1 Supporting research and innovation through digitalization

For scientific work to be successful and effective, it is essential a researcher or research team encapsulates its energy into designing experiments, recording measurements, interpreting results and, of course, publishing high-quality manuscripts in respected journals. There are aspects of most research which impose a significant administrative burden upon professionals and, indirectly, onto university systems. Accordingly, researchers need to be supported, aligned with the expectations and opportunities of the 21st century, including the means to devote their time to scientific work. There are a number of routine processes which affect research teams and which can be easily digitialized. In addition to saving considerable time and costs in the medium term, this will make individual documents retrievable and easier to archive, while complying with the relevant data protection requirements. Such possible intervention points include the following:

Digitalization of PhD student application and course administration: An electronic, online system, modelled on modern study systems, will be implemented, either within NEPTUN or as a faculty development, which ensures the application process operates with ease and will be far more trackable for PhD students, lecturers and administrators, including the administration of courses during the first two years of PhD training and the monitoring of research activities.

Supporting research through the digitalization regarding authorizing requests: Most of the research programs at the UP MS actively involve volunteers and patients. Whether it is a simple questionnaire survey or a clinical trial with an intervention, a regional or national research ethics licence is required to initiate research. It will be useful to develop a single internal support system for these protocols, aligned with the relevant regulations and ethical guidelines. Distinctively, the online support system will present the procedures currently in force, summarize the most relevant information, provide templates in force and suppport online management of the processes by implementing a digital signature system. This will vastly enhance not only research, but also the growing number of R,D&I activities expected to emerge on the market, many of which are subject to ethical approval.

Internal research networking system: It is too often the case an experiment or study requires tools, knowledge or other capacities not available within the research team. In such cases, the measurements are either re-designed or external partnerships are sought, which, in principal, may be advantageous regarding external collaborations, however, in many cases it is a forced solution and an additional cost or compromise for the research group, even though it is easy to imagine the capability or capacity is otherwise available within the realm of the univeristy. One way of achieving internal networking at the faculty level can be facilitated by the planned organizational changes and will be an integral part of the research support capacity, which in the case of larger laboratories, will lead directly into the UP's "CoreFacility" system.

3.1.2 Systematic collection of ideas, direct contact with UP innovation departments

A common problem reflects how ideas emerging within the Faculty of General Medicine or the Clinical Center do not make it past the initial brainstorming phase. Several reasons for this, detailed in previous chapters, are easily identified. The following action points are based on the need to ensure ideas generated in the Faculty and the Clinical Center are fed into the overall university innovation ecosystem in a controlled, systematic and professional manner. The steps to do so may include the following:

Consolidation of "upstream", idea-generating events: Currently, a number of parallel Faculty and University events are endeavoring to address and involve the innovation-open target audiences regarding the UPMS and the CC. The experience of the last decade has shown this leads to a narrow range of participants at each event, with a small number of new participants, very few of whom are included in the 'innovation cycle'. To this end, it is necessary to organize and coordinate relevant innovation-related events (e.g., Innovation Day (Chancellery) Hackathon (Simonyi BEDC) and various idea competitions) hosted at the university level, and to integrate the events at the faculty level. Another important criterion is the Faculty initiatives will be channelled through the Marketing Department assuring saturated promotional activity.

Clincal Champion and Discovery Team systems - Mapping ideas and suggestions: The Institute of Transdisciplinary Research (ITD) of the UPMS has launched a successful program in recent years in cooperation with several departments of the Clinical Center (e.g., Ophthalmology Clinic, Surgery Clinic and the 2nd Internal Medicine Clinic). The Clinical Champion system aims to actively involve clinicians in the innovation process, who are also able to facilitate continuous and effective communication among clinicians and innovation experts. The Discovery Team is an interdisciplinary team which works effectively (in collaboration with the Clinical Champion) to identify problems and challenges within the clinical environment ("idea generation" and challenges), which can be addressed in a well-functioning innovation ecosystem. By optimizing the system currently in place, and by better defining the scope of activities, the "channelling" of ideas into innovation processes at both the faculty and university levels can be effectively facilitated.

3.1.3 Channelling market contacts and professional liaison follow-up

Establishing and maintaining market relationships is a time-consuming task for a research team. Within the environment of UP MS, there are many corporate entities open to cooperative initiatives, however, negotiations tend to break down in two ways. One scenario depicts the expert working on the project or research topic tries to build and maintain these relationships, yet does not crystallize, nor prove effectively organized on such a serious scale. The second potential outcome occurs when negotiations are initiated at senior management levels, both academic and corporate, in which case, the substantive work often does not initiate at the level of those responsible for it implementation, and cooperation is limited to the signing of a general agreement or letter of intent. This phenomenon requires steadfast management and support at the faculty level, including cooperation with the relevant university departments, for example, by organizing regular "partnership meetings", inviting individuals to scientific and professional innovative lectures, hosting professional workshops, etc., and bridges need to be built with the relevant university departments enabling processes and statuses to be effectively monitored within the faculty. This also bears a significant role in measuring effectiveness (TÉR), and can vastly improve the quality and content of cooperative initiatives.

3.1.4 Developing a cadastre system, embedding it in the Core facilty system

To effectively promote internal networking and to implement marketable capacities readily available to external market players, it is essential to collect, categorize, list and ensure these capacities are retrievable. Good practices can be found within the University (e.g., Szentágothai Research Center), however, a number of discipline-specific factors still need to be assessed and implemented within these systems, thereby expanding the range of participants. This can be made manageable and sustainable through a suitable web interface and the development of connected databases, linked directly to university-wide databases. This objective needs to be implemented in an organized, pre-defined and agreeable means, taking into account professionally driven marketing campaigns and IT factors.

3.1.5 Pre-assessment of product development

Most innovative ideas and concepts in medical technology involve some form of engineering or IT support. There are situations in which the inventor or team of inventors reaches a certain stage of implementation, however, in most cases the right tools or expertise are not available to acquire the practical portion regarding development. This is an important factor, since the maturity status of a project is an important factor in the evaluation of projects, whether it is a professional competition or a specific venture capital investment, and can have a major impact upon the clarity of the development and its perception. The faculty needs to establish a pre-qualification system including a technological aspect, which is essential when assessing the technologies needed for implementation and the size of the resource requirements, and to signal the needs thus

assessed to the actors in the university innovation ecosystem or even to market partnerships, ensuring development time is reduced and made more efficient. Additionally, an important related activity is the coordinated and structured support of the MDR (Medical Device Regulation) processes at the Faculty level.

3.1.6 Operation of the Innovation Fund

Previously, there was a system of financial support for innovative ideas at both the university and faculty levels. Currently there are no permanent systems in place. To support innovation activity, it is appropriate to create an Innovation Fund, which will be allocated in a similar means to our internal grant initiative, which has been operating successfully for many years. The annual replenishment of the Fund may likely be based on a significant percentage of the revenues from the RDI activities or as a part of the central budget lines of the RDI proposals in the thematic area (principle of recycling, similar to the system of central contributions to the calls for proposals).

3.1.7 Providing assistance in the validation process

One of the cornerstones of any successful development is it meets a real, existing market need, which ultimately, serves as the basis for genuine market demand. The flaw or shortcoming of many ideas is they do not go survive the validation phase in a timely manner, when potential users can provide feedback regarding the strengths and, more importantly, the weaknesses of the product or service, while simultaneously confirm or, on the contrary, refute its development. Validation is a complex and multifaceted process, however, it is one of the most important factors regarding the implementation of innovative ideas. Therefore, it is of paramount importance validation processes are effectively coordinated both within the Faculty and at the University levels. Generally speaking, at the Faculty of Medicine, we primarily carry out professional and technological validation, while the University innovation ecosystem assists in validation from a market perspective by targeting the right audiences.

Internal faculty-level validation in the fields of medtech, medical devices and medical-health IT and biotech solutions: Developments first undergo exploration and are run through preliminary testing during "dry" simulated conditions, for example, using simple simulators or even high-fidelity patient simulators. The next phase of testing is carried out in a "wet" simulation, on cadavers in a simulated operating theater environment, subject to appropriate ethical protocols and subsequent approval. The next step is the technological validation on animal models, in which the Preclinical Research Center plays a pivotal role, while the final phase involves the testing of medical devices within a clinical environment, in which the clinical unit is representative of the relevant speciality. In this interdependent system, with an eye on internal innovation processes, the full technical validation of medical equipment is carried out throughout the development cycle. Following similar logic, in the biotechnology (biotech) field, starting from in-vitro testing in individual laboratories, it is possible to progress gradually to real laboratory testing, in which the role of the JRC figures prominently. Finally, there are the human clinical trials, in which the Faculty of Pharmacy plays a significant and leading role. The Faculty of General Medicine needs to build upon these validation processes.
External market validation: it is advisable to validate each developmental idea with external experts as soon as possible. This can be acheived by using the expert validation method described below. Additionally, a structured customer validation process involving

target audiences, for example, through in-depth interviews, focus group interviews or even online questionnaires, can be implemented with the involvement of the Faculty of Economics. The methodological basis of this must be widely promoted among researchers and inventors, however, its successful implementation requires specialized expertise.

3.2 Innovation in an organisational culture

Of all the responses to the challenges, this is perhaps the most feasible long-term project element, as changing organizational culture and embracing a new phenomenon can take years or even decades of dedicated effort. In implementing the Strategy, we are striving to ensure this can be successfully achieved in the shortest possible time and "innovation" as a concept will soon become one of the slogans or watchwords associated with our Faculty. The main possible points of implementation are as follows:

3.2.1 Innovation office hours and the creation of a permanent contact point

A fundamental method in restoring trust regarding innovation is to have a place and individuals to whom we can turn to with questions and problems concerning university innovation processes. It is useful if this capacity is embedded within the Faculty, this way individuals involved have the opportunity to get to know one another and develop a personal and professional relationship, which greatly enhances the effectiveness of joint efforts and shared thinking. In implementing the strategy, an Innovation Office Hour system will be set up at the Faculty, which offers students and staff aligned to the faculty the opportunity to personally contact the Office or do so online regarding questions. The meetings will take place at a pre-arranged time, focused on a specific topic and guarantees an efficient and constructive discussion. Additionally, it allows for the possibility to invite other experts, such as technical or IT experts, business consultants or even industrial partners, when deemed necessary.

3.2.2 Regular reports and news regarding innovation results (Marketing Office) - professional support for spin-offs - making "good stories" transparent

To offer our faculty community a real incentive to generate new ideas and put them into practice, we need to look at the right amount of marketing activity, neither too little nor too much, as an important tool. It is worth regularly reporting on professionally credible milestones, both on professional platforms and channels, but also by making parts of the RDI results available to the wider general public. Activities in this area converge with the Marketing and Communication Department and, in cooperation with them, it is worthwhile for individual institutes and research groups to regularly communicate their key achievements or even their upcoming strategic plans at regular intervals, such as quarterly or bi-annually, using appropriate science communication tools. This is particularly true in the case of product development and innovation projects, where there is a pressing need for "stories" showcasing the colleagues among us who have become successful based on their ideas, with the help of their entrepreneurial attitude and with the support of the Faculty and the University.

3.2.3 Internal and external promotional events, social responsibility, "third mission"

At regular intervals, it is worthwhile and appropriate to encourage promotional and sensitizing workshops at coordinated, centrally organized events at the university level, of which, the main topic is medical innovation and activities intended to foster and nurture innovation, closely related to the previous point. In addition to presenting success stories, interesting start-up news and good practices, it may be beneficial to present and follow-up, with the help of guest speakers, life paths and career models in which elements of the entrepreneurial career have dominated, building upon the knowledge acquired at medical school. These events also have another important role, namely the "third mission" of the University, in which the continuous dissemination to the wider public and society is of paramount relevance.

3.2.4 Developing an innovation "Alumni" scheme

Internationally, it is very common for some higher education institutions to have close links with graduates who notably achieved significant success in or beyond their professions. Presently, our faculty does not have a well-established, deep-rooted tradition of supporting such an initiative, however, many of our former graduates have a close, personal relationship with the staff of the Student Services Offices, lecturers and researchers. This good practice can be absorbed up through the entire faculty level and formalized at the system level, as our community will undoubtedly benefit from these successful individuals.

3.2.5 Integration into and connection to courses

Education is the most obvious, fundamental and perhaps the most important tool in effectively transforming organizational culture. Based on the formerly launched and initially successful optional course, "Innovative Health Technologies," in both English and Hungarian, this course is ripe for new develoment. As a first step, it can be transformed into an elective course, with a greater emphasis on involving other faculties (Natural Sciences, Engineering and Economics), both from the teaching and student perspectives, which are intrinsically linked to the field. Depending on student interest, the course can demonstrate flexibility in the delivery of additional specialized topics (e.g., a specialized medical AR/VR thematic course or an additive manufacturing course). Additionally, a potential objective is to deliver a stand-alone PhD course in which these skills can be acquired at a higher level and in greater depth by PhD students in an interactive, practice-oriented means.

Long-term curriculum developmental opportunities:

The explosive growth of the IT sector implies learning about innovative technologies is essential for our future doctors. Accordingly, it can be envisaged in which the course regarding Innovative Health Technologies undergoes transformation into a compulsory subject (2 credits), possibly as a prerequisite course.

Another possibility is to share this knowledge with students in the context of a compulsory course, in consultation with the relevant course directors and on the basis of any needs which may arise. The presentation and testing of innovative methods in a lecture or seminar will greatly improve the understanding of the subject, raise students' interest and prepare them for the practical skills they will undoubtedly need in their near future careers.

3.2.6 Entrepreneurship education:

In cooperation with the Simonyi BEDC, it is deemed necessary to organize and establish courses within our Faculty with a specific focus on "enterpreneurship." Many of the students of the MS will soon become managers, comporate or hospital directors and will start their own businesses. To succeed in their future careers, it is important to acquire management and financial skills, including a comprehensive knowledge of basic market strategies.

3.3 Motivational schemes

As previously stated in the Pillar of Science, it is of particular importance to provide appropriate motivation and career development systems and career models for those who are able to create value in support of the Faculty, and thus for the city, the region and the country, through their innovative approach. Depending on the theme of innovation and development, it may be necessary to provide specific career models and solutions for these actors, as the range is considerably broad, both in areas of disciplines and in terms of the maturity level of the projects.

To ensure creative innovators successfully emerge from the faculty, it will be possible to include measurable parameters of innovative activities in career progression (either in academic or institutional management terms) and to make them comparable with teaching and research activities. In the first phase of the strategy's implementation, special and particular attention should be paid to those who are trying to establish a footprint in this area, since, as the introduction shows, it is necessary we build up this area as it is currently without a solid foundation and systems, at least initially.

In the design of motivation systems, effective communication and presentation regarding the results and milestones achieved, after appropriate screening, is an important tool, since it can be used to handsomely demonstrate innovation is worthwhile and success can be achieved. Those who have already achieved success with their ideas and products will be involved in the dissemination process and even implement the elements they have found successful within the faculty innovation ecosystem in the form of "good practice".

3.4 Designing innovation processes

The UPMS Innovation Platform is the "embodiment", and the manifestation of the innovation processes representative of the UP MS. It includes the external and internal actors involved in the innovation process, their roles and responsibilities and provides a reference and framework for each step and support to turn an idea into a realized development. Details will be set out in a professionally drafted internal procedure plan, aligned with current internal and external university rules, yet only containing the most relevant elements. In consideration of this procedure, it is necessary to produce an essentential set of informative material entirely understandable and manageable for researchers, teachers and students alike.

A fundamental condition for strengthening the innovation mindset and increasing efficiency is to institutionalize and consolidate innovation activities and processes. Institutionalization will be based on the existing, thematically closely linked institutes and departments within the Medical School (departments supporting and implementing innovation activities). Networking, through complementing and modifying these activities will be an iteractive process based on internal consultation. These units will support the work of the institutes and departments which have an innovative idea or problem and are looking for a solution (Innovator units), and will liaise among academic and market players in the chain. This will create a "matrix model", which will prove beneficial in terms of both resource management and efficiency, and will also ensure a broader, comprehensive vision.

In order to further strengthen the competitiveness regarding the Faculty of General Medicine, it is essential to develop its own internal innovation ecosystem, building on existing faculty or departmental resources, and organically linking up with relevant academic and non-academic stakeholders. In developing an effective innovation ecosystem, the following aspects need to be kept in mind:

- The different elements and levels will be able to support the innovation activities of all actors of the UPMS (students, teachers, academic and non-academic staff).
- Processes will be clear, simple and easy to communicate. The system will be single-channel.
- The different elements and levels of the processes will be flexible in handling innovative ideas and projects at different stages of maturity.
- The system will absorb projects of different themes, technical content, maturity and nature in a universal means.
- The conditions, obligations and resources of both the Institution and the Inventor will be clearly defined for each part of the process.
- The UPMS Innovation Ecosystem is autonomous, UPMS-driven, yet has a close relationship with the relevant actors in the University Innovation Ecosystem.
- Its thematics are delimited and include fixed content elements.

Taking these considerations into account, the following model, which is expected to be implemented at the UPMS, agrees to the following:

Level 1: Upstream organizations and events - the "Pre-Screen":

On the 'input' side of the model, the commonly referred to 'upstream' organizations and events, of which, historically have proven successful for years, were organized by various university individuals. The events (e.g., Hackathons, KTTF Innovation Days and Simonyi BEDC Pitches) organized by these departments offer innovators a platform to present their ideas, request assistance in developing them, prepare demonstrations and presentations. These events are target group specific (academics and students) and include all Faculty and University organizations and events which support and promote innovation and entrepreneurship

The representatives of these institutions and events will launch their "medTech" or "bioTech" projects and ideas regarding the Innovation Platform, in accordance with the "single channel" criterion. Ideas, concept designs or even finished prototypes can be submitted from the input side.

Level 2: "The Funnel"

The Funnel is where ideas and projects from the upstream organizations are collected. Aligned with the single channel model, it is a public online platform in the form of a website. Similar to the systems associated with market capital investors, the innovator can upload projects according to specific criteria (e.g., problem statement, solution description, highlighting innovative content, competitor analysis and/or cost plan), which are stored in a database. If one has questions or encounters problems, a request for help is forwarded to designated mentors. An individual merely registers his/her networking needs at this website.

In addition to channelling the idea through the web interface, it also serves as a filtering function, since the entry of data and the initial development of the project requires time and energy from the innovator, ensuring ideas which only reach the point of momentary enthusiasm do not overload the system. In the case of clinical projects/ideas, working groups are set up to assist the idea/project owners from the development stage.

Level 3: ”The Board”

The database of project proposals is processed by the "Board". The Innovation Board is a pool of experts originating from academia and industry. Each project is assessed by a small group. The project proposals are screened and reviewed by ad-hoc Groups on a thematic basis, and additional information is requested from the Innovator when necessary. In addition to the technical representatives, the Group always includes an IP lawyer.

In the case of clinical projects, a "Steering Committee" will be set up on a pilot basis including the participation of several clinics, consisting of the Heads of the UPMS and the CC and innovation experts, which will carry out the final screening and make the decision regarding whether the project will be awarded funding and financial resources.

Level 4: ”Incubation”

Depending on the status of the project, or at the Board's discretion, the innovator may voluntarily participate in an incubation process to learn more in regards to entrepreneurship and acquire the technical and non-technical skills to effectively implement in their own research. Participants will also have the opportunity to network and mentor.

At this stage, projects can be presented on an online platform (Project Collection), which has a two-fold objective. First, the Innovator seeks out professional contributors and sponsors, and secondly, it makes the projects accessible to external market players and investors. The OpenUP platform, which is successfully operating in the Faculty of Economics, will be a good solution regarding this initiative.

Participation in the incubation process is conditional (attendance, participation and preparation of a business plan). The incubation process involves the participation of the Innovators in a target group-specific way. At the end of this phase, a "final" pitch will be presented to a short-listed jury of experts to determine the fate of the project. The expected outcome is comprised of a validated business plan, possibly, and if relevant, a prototype. This stage is the second screening stage, with the possible responsibility of the Simonyi BEDC and the UPMS ITD.

Level 5: Idea and product development

During this phase, the Innovator, with the help of mentors and experts, begins to put the idea into practice. This process can also be partially initiated during the Incubation phase. Both external and internal actors may be involved in the process. The outcome can be a validated product concept, a prototype and a presentation suitable for an investor pitch. This can be followed by exploitation under different schemes. At this stage, a decision will be confirmed regarding the form of larger-scale fundraising and exploitation. The end result is a working prototype, MVP, finished product or service.

3.5 Strengthening and developing an inter- and multidisciplinary approach

It is clear in reviewing the above, developmental work consistenly requires the active involvement and co-production of various disciplines. Innovation is, by its very nature a highly inter- and multidisciplinary activity, and strengthening this approach will therefore be a priority in the era ahead. Several of the methods for doing so have already been outlined (e.g., creation of a relevant Research Fund and a change in the organizational culture). In addition to these measures, the following concrete steps can help promote and broaden this approach.

- **Participation in the work of co-working units**: Staff and researchers of the Faculty of General Medicine will be given the opportunity and time to actively participate in the work of the university-wide co-working units (Hatchery, 3DNYVK and FabLab/Makerspace)
- **Organized involvement in project work**: While enrolled in undergraduate and postgraduate (PhD) courses, consideration will be given to providing opportunities for active involvement in development/project work within an organized framework, in cooperation with students and mentors from other faculties. This activity may be rewarded with credits and career milestones.
- **Student and young researcher involvement in proposal development and implementation:** In most cases, large-scale proposal development and implementation is based on effective collaboration between several disciplines and involves many tasks. In the majority of proposal cycles, there are well-defined tasks in which senior students or young researchers (PhD students) can actively participate. This is an advantage for them, as they can acquire the "soft skills" essential for project management and, in some cases, generate additional income. The involvement of a talented young colleague can be of concrete help to the proposal writing team.
- **Presentation of alternative career paths - Lecture series:** The lecture series will include presentations by individuals with a medical degree who have chosen a non-clinical career model (e.g., pharmaceutical research and development, health entrepreneurship, medical equipment and/or software developer), demonstrating the wide range of applications of a medical degree and the level of success achieved in co-professions.

3.6 Market relations, market presence

Aligned with national and international strategic orientations, direct market exploitation is increasingly important for both research programs and product development. The concept of Model Universities is intended to promote and support this process. In order to ensure scientific results and innovations generated in the field of medicine can be successfully exploited to a greater extent than is currently the case, the following steps are recommended:

- **Sales activity:** In consideration of current technologies, products and services at the right maturity level, it is necessary to develop a profession-specific sales activity. At the University, these are currently carried out by a specific market player (UP Inno-Capital) with limited resources, however, medtech and biotech-focused sales activities will be rolled out in a focused, profession-specific manner, since it is beneficial for both the target group and the inventor community, and increases trust and willingness to cooperate, if a dedicated market company with a transparent profile routinely performs these activities.

  The cultivation of market relations will be a priority in the near future, both in terms of promoting applied RDI and increasing market presence. To this end, a number of measures can be taken (partnering and networking activities, continuous and regular contacts), yet it is of paramount importance to provide a permanent web-based platform regarding our partnerships, aligned with the needs of the 21st century. In

support of this goal, it is necessary to create a Faculty level innovation website in which partners can track information regarding ongoing collaborations and projects, search the Inventory of Equipment and Services (see previous relevant sections), and where available technologies and capacities for retail are clearly and transparently displayed.

- **Start-ups and spin-offs:** Another effective way of promoting products and services generated at the Faculty is for researchers to pursue projects at the right technological level within a university spin-off business entity. It is essential, especially at an early stage, to have effective and practical support from the relevant University actors in the start-up phase, especially in the areas of finance, law and management, since most researchers either lack or do not have these competencies.
- **Investor relations:** The University organizes a number of innovation events in which ideas and projects can be presented and communicated. While it is important to be present at these events, it is also important to provide opportunities and platforms for public and private investors with a medtech and biotech focus, in support of promising project promoters which can quickly and efficiently raise funding, of which, in addition to financing, will be provided as "smart money", i.e., not only financial but also management support, to the benefit of all stakeholders.

IV. RUNNING THE INNOVATION SYSTEM

4.1 The 1+1+1 model

Innovation and the introduction of new disciplines is risky and can involve expenditure and runaway costs. To reduce risks and expenditure, it is essential to design a system which manages resources including assets, equipment, infrastructure and human capacity, all in a flexible means. It also offers the possibility of strengthening market relationships and the marketing of the UPMS (Brand marketing - POTEPILLARS Learning Culture Concept). Lastly, it can also be used to provide flexible procurement. The 1+1+1 model ideally serves this purpose.

The model is designed to allow resources to easily flex while aligned with current objectives among the three actors with different legal status and composition, yet with close links to the UPMS.

The actors of the 1+1+1 model and their characteristics:

UP MS as a budgetary entity: The traditional role of the model and the actors which comprise the institutional "leg". Employees have permanent teaching and research status. Their main tasks include teaching, research, university grant writing, including active participation in dissemination and communication of results.

Market player, corporate entity: Incubator entities, majority private, smaller (ca. 10-20%) university-owned, exclusively dedicated to the incubation and commercialization of projects involving the UPMS and CC. An important objective involves the retailing regarding equipment and labor. Its employees are mainly market players who are

employed part-time on campus. Their main tasks are industrial applied RDI activities, meeting internal UPMS needs when required and doing so in full compliance to cooperative initiatives.
Their primary duties include prototyping, product development and marketing.

It will support rapid procurement processes and market contracts, when possible, in consortium with the Faculty and participating members of the University. When necessary, it grants university infrastructure, equipment and assures operational use regarding spare capacity.

Projects: Faculty and University projects which are set up to perform a specific task, typically within the framework of a contract. The staff are employed on a temporary, fixed-term contract, possibly under a multi-tasking contract.

4.2 Marketing and exploitation opportunities

Royalty system – Spin-offs

A significant proportion of products and services can be marketed under a commonly referred to "royalty system". This is characterized by a university spin-off entity built around a particular university product or service compensating a fixed percentage of its turnover back to the university in return for early-stage support and incubation.

Procuring intellectual property

In the case of intellectual properties, an obvious solution, especially for early-stage development, is for a spin-off or start-up entity to start out first as a market entity and "procure" the intellectual product from the university for a fixed, typically larger sum, and are free to exploit the intellectual product thereafter. Alternatively, the intellectual product may be procured by an external, larger entity which generates revenue for the University. Naturally, this can be combined to the aforementioned, "royalty system."

Increased sector-specific sales activity

To effectively sell the resulting products and services, it is crucial to assign sales activities. This is particularly important for developmental products and services which are at least declared as MVP (minimally valuable product) status. Within the framework of the strategy, we consider it essential to build up sector-specific ("medtech/biotech") sales support, for which we plan to set up a spin-off entity based on the activities of the 3D Printing and Visualization Center in the initial phase.

Continuous marketing of services

For some services, especially short-cycle, targeted training, standard laboratory services, a steady stream of income is forecasted. These existing training sessions are continuously undergoing expansion and their corresponding sales channels are in the developmental phase. We plan to expand and strengthen our already successful portfolio of services (e.g., medical 3D printing, medical 3D modelling, prototyping and manufacturing and software development). The scope of activities can be extended to include expert tasks. These can be used by the University, either independently or through the involvement of a retailer.

Laboratories and equipment available for rent

An important source of income for the Faculty is the rental of entire laboratory facilities (infrastructure rental for corporate entities), including the rental of certain machines and equipment on a market basis (for market professionals). This can be relevant not only for the external market but also for internal, university actors (Core Facility System).

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