

Blueprint for Innovation and Entrepreneurship in BIOHEALTH sector



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BIOHEALTH GEAR BOX ALLIANCE

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1 Summary for non-specialists



The BIO-ALL project, in the framework of KA2: Cooperation for innovation and the exchange of good practices - Knowledge Alliances within the Erasmus+ program aims to promote new skills and competencies in the BIOHEALTH sector.

This Blueprint for Innovation and Entrepreneurship in BIOHEALTH sector has been developed together with key-actors and end-users based on an exhaustive mapping of the current landscapes, trends and lessons learned. It

will present possible evolution scenarios, related strategies and actions and provide recommendations for a brighter future of University-Business Cooperation and entrepreneurial and innovative processes within the sector.

The present document is structured as follows: first, there is an overall introduction to the bigger picture of the BIOHEALTH sector in the three target countries: Italy, Portugal and Spain.

Following, the Objectives and the Methodology of the Blueprint are then exemplified in two different chapters.

Next, the results from the semi-structured interviewees are presented. The first paragraph illustrates the quantity and typology of people interviewed during, and then all the results are exemplified in tables and graphs: a short discussion is then presented.

Then, we present the feedback and insights that were given by the students enrolled in the Joint International Post-Graduation on "Advanced Skills for Innovation and Entrepreneurship in the BIOHEALTH Sector", to whom this Blueprint was presented.

Finally, the final considerations wrap up the document.

2 Introduction

2.1 Current Status

The biohealth sector is currently undergoing its greatest test. During the preparation of this deliverable, a pandemic (Covid-19) spread across the planet, with the world's attention focused on the responses that the biohealth sector could find. On the one hand, this change in the "game" will bring new responsibilities and an increase of media attention. On the other hand, it should also bring changes in public health management, assuring that pandemics such as this will always be preventively fought in laboratories and through innovations, and not in hospitals, as unfortunately is occurring.

All these circumstances have changed and will change the paradigm of the biohealth sector. However, there is an urgent need to characterize the sector to date, make the connection between entrepreneurship and innovation with companies and universities in the biohealth sector, in addition to understanding the visions, scenarios and strategies for the biohealth sector. Moreover, and since there is a lack of information and resources on the sector, the Roadmap has utilised the information from the biotech sector, which is directly connected to biohealth.

The theme of entrepreneurship is constantly being debated and discussed in various areas of society. But why is entrepreneurship so important for societies? Certainly due not only to the need to revitalize the economic measures (using, for example, the one advocated by Schumpeter (1943) and for its concept of "creative destruction" where entrepreneurs create new products or ways of producing causing changes in the economy and consequently in society), plus the capacity of creating more jobs or generating new professions, but also for the possibility/capacity to spread and generate more innovation or even for the creation of wealth and development of regions.

In this sense, Universities have a very important role since they should aim to encourage economic and social development, largely through education for entrepreneurship, since they are able to stimulate students' entrepreneurial skills and their entrepreneurial intentions. This is in line with the promoted by the European Commission (2015) in its "Entrepreneurship Action Plan 2020", where entrepreneurship education reflects as one of the pillars of this action plan in order to stimulate the creation of companies and their growth. Still according to this same plan, entrepreneurship education makes a difference since young people who attend entrepreneurship programs and activities to stimulate entrepreneurship, create more companies and earlier than those who do not attend these programs. The European Commission even claims that the percentage of alumni who become entrepreneurs 3 to 5 years after leaving university is between 3 and 5%, with students who participated in entrepreneurial education programs rising to 15-20%.

European economic growth and increased employment depend on the ability to support business growth. As for that, the creation of new companies through betting on entrepreneurship and innovation opens the door to new markets and fosters new fields of technology (European Commission, 2016). As Drucker (1993) stated, "innovation is the specific tool of entrepreneurs, the means by which they explore changes as an opportunity for a different business or service.

Entrepreneurs need to look for changes and their symptoms that indicate opportunities for the success of innovation as sources of innovation". It can thus be said that entrepreneurship education leverages entrepreneurial intent, fuelling the creation of entrepreneurial ecosystems, and that entrepreneurial activity is a vehicle for stimulating economic growth and the capacity for innovation in a country. And it is in this sense that Universities must be a guiding light as disseminators and stimulators of the entrepreneurship knowledge and, consequently, of entrepreneurial intent and innovation, thus helping to develop these business ecosystems.

According to the OECD report (2009), it is expected that the biotechnology sector will offer technological solutions for existing and emerging health-related problems. Furthermore, the emergence of a "bioeconomy" is expected in the 2030s, where it is possible that in the OECD region, biotechnology will contribute to 2,7% of GDP, being the largest expected economic contribution in industry and primary production. Biotechnology is thus considered as a prime area of investment in Europe, where the European Commission has already developed a "strategy for the bioeconomy" and an action plan in order to be able to develop technological processes, as well as the markets and the competitiveness of companies that operate in the sector, for the purpose of adding value to stakeholders (European Commission, 2016).

The BIOHEALTH sector has been described as important for the modernization of the European industry and economy. Le Deu and Da Silva (2019) even claim that Europe produces roughly the same number of scientific articles (related to the biotech sector) as the USA in the top 10 scientific journals, and three times more than China. However, this does not translate into patents for new drugs, for example. This is because the USA manages to do about three times more and China about nine times more than Europe. This translates into the failure of European biotech companies, and thus having difficulty retaining talent or just the need for publication and the failure to move from theory to practice per se. It is therefore necessary to have a direct cooperation between the academic and the business, so that everything that is developed in terms of research and development (R&D) in the academy can be translated into innovation and new products in the Biotech/Biohealth sectors by companies.

As such, there are already several Universities that hold in their programs several courses related to entrepreneurship in various areas, including those related to biotechnology. This is reflected in the increase in business incubators associated with the Universities themselves. However, there are still several differences in the approach to entrepreneurship programs in the various Universities and in the different countries. It is important to point out that there is still a big gap between the disruptive technological innovations that are made at Universities and the way they manage to reach the market. In this sense, the BIO-ALL project aims to create a vision, a common strategic plan that can fit several educational and business acceleration tools in a fundamental sector, which is BIOHEALTH.

There is a need for a concise thread on the part of the European Universities in order to be able to guide the future of innovation and entrepreneurship in the field of Biohealth. And this is where the ambition of the BIO-ALL project resides,

which is to strengthen the higher education system, in order to meet the needs of entrepreneurs in the Biohealth sector.

To this end, we believe that there is a need to create a plan for the Biohealth sector, developed in conjunction with the main market players, based on a screening of the current scenario, current trends and good practices, presenting possible scenarios for evolution, possible strategies and actions for a future with a better cooperation University/Business/Entrepreneurs, qualifying innovation in the sector and defining common goals for encouraging entrepreneurship in the sector. It is this strategic plan that will be developed, identifying the visions, scenarios and strategies, taking into consideration the activities already developed to date.

2.2 Characterization of the biohealth sector at the European level

Technological innovation is the engine that propels economic growth and fosters higher living standards. The growth record of the past 100 years was an unprecedented event, as a series of technological breakthroughs have improved the quality of life and generated a widespread material prosperity throughout the world. Even so, some national economies have seen faster and more effective growth than others. Geographical distribution and the spread of innovation activities through technology or knowledge-generating go a long way to explaining why some economies have developed faster than others. New technologies, in turn, have shaped where and how innovation has taken place and will certainly shape the future.

There is a huge need in healthcare for new and innovative ways to meet the needs of the populations. Biotechnology enables cheaper, safer and more ethical production of a growing number of traditional, as well as new drugs and medical services. It is shifting paradigms in disease management, going towards preventive medicine, combining personal information to diagnosis and innovative treatments. This will be the core of future biohealth.

In Europe, for instance, biotechnology and life sciences are one of the main contributors to the modernisation of European industry. The European economy aims to grow as biotechnology and life sciences grow, and expects to be able to provide new jobs, while also supporting sustainable development, public health and environmental protection.

The ever-growing biohealth innovation ecosystem is supported by ongoing policy framework developments, incentives, and regulatory bodies. In addition, the emergence and development of the biotech sector (which is a complex, high-tech sector), hosts several successful export firms. The evolving pro-innovation ecosystem has achieved effective policy and regulatory synergies and has also supported the supply and demand side of biotech innovation. As for that, it is also important to know what the common success factors of medical and technological innovation are, nowadays in Europe, but also the ways to mitigate barriers to further innovation. But first, it is important to clarify and detail the biotech and biohealth sector in Europe.

As previously said, the EU recognizes biotechnology to be the next wave of the knowledge-based economy which will create new opportunities for societies and economies. And as for that, the European Commission implemented a broad

strategy and action plan for the development of biotechnology-based products, setting priorities for better access to finance and technology transfer for biotechnology.

Table 2.1: European biotechnology at a glance, 2015-2016 (US\$b)

| | 2015 | 2016 | % change |
|-------------------------------------|--------|--------|----------|
| Public Company Data | | | |
| Revenues | 22,8 | 27,2 | 19% |
| R&D Expenditures | 6,7 | 6,9 | 3% |
| Net Income (loss) | 1,0 | (1,3) | -235% |
| Market Capitalization | 150,1 | 164,2 | 9% |
| Number of Employees | 48.590 | 67.460 | 39% |
| Financing | | | |
| Capital Raised by Public Companies | 7,4 | 3,6 | -52% |
| Number of IPOs | 33 | 23 | -30% |
| Capital Raised by Private Companies | 2,5 | 2,1 | -18% |
| Number of Companies | | | |
| Public Companies | 238 | 259 | 9% |

Source: Ernst & Young (2017)

According to Table 2.1, in Europe there is a strong and growing biotech industry. This growth is reflected on the revenues' increase of up to 19% when comparing the years 2015 and 2016. On the other hand, R&D expenses have grown up to 3% in 2016 in comparison to the year before. The most significant difference concerning the good health of the biotech sector is referring to the net income losses. As for that, the European biotech companies had a net income loss of US\$b 1,3. It is important to also point out that the number of companies has augmented by 9% which has also reflected a growth of the number of employees of about 39% comparing 2015 and 2016.

But what about the landscape concerning biotech companies across Europe? Is there any unconformity throughout Europe's countries? The OECD analyses key biotechnology indicators, distinguishing three kinds of firms:

- Biotech firm: defined as a firm that is engaged in biotechnology by using at least one biotechnology technique to produce goods or services and/or to perform biotechnology R&D
- Dedicated biotech firm: defined as a biotechnology firm whose predominant activity involves the application of biotechnology techniques to produce goods or services and/or to perform biotechnology R&D.
- Biotech R&D firm: defined as a firm that performs biotechnology R&D. Dedicated biotechnology R&D firms, a subset of this group, are defined as firms that devote 75% or more of their total R&D to biotechnology R&D.

Table 2.2: Number of biotechnology companies by country, year 2018 or last year available

| Country | Biotech Firms | Dedicated Biotech Firms | Year | Predominant Biotech Companies | Biotech Dedication % |
|-----------------|---------------|-------------------------|-------------|---|----------------------|
| Austria | 172 | 127 | 2017 | Biotech Firms | 74% |
| Belgium | 279 | 131 | 2017 | Biotech R&D Firms | 47% |
| Czech R. | 117 | 83 | 2017 | Biotech R&D Firms | 71% |
| Denmark | 123 | 71 | 2015 | Biotech R&D Firms | 58% |
| Estonia | 38 | 31 | 2017 | Biotech R&D Firms | 82% |
| Finland | 170 | 91 | 2015 | Biotech R&D Firms | 54% |
| France | 2082 | 1409 | 2017 | Biotech R&D Firms | 68% |
| Germany | 820 | 679 | 2018 | Biotech Firms | 83% |
| Ireland | 112 | 55 | 2017 | Biotech R&D Firms | 49% |
| Italy | 657 | 367 | 2017 | Biotech R&D Firms // Biotech Firms | 56% |
| Latvia | 12 | 10 | 2017 | Biotech R&D Firms | 83% |
| Lithuania | 82 | 30 | 2017 | Biotech Firms | 37% |
| Norway | 288 | 160 | 2017 | Biotech R&D Firms | 56% |
| Poland | 188 | 111 | 2017 | Biotech Firms | 59% |
| Portugal | 176 | 101 | 2017 | Biotech R&D Firms | 57% |
| Slovak R. | 15 | 13 | 2011 | Biotech R&D Firms | 87% |
| Slovenia | 30 | 18 | 2017 | Biotech R&D Firms | 60% |
| Spain | 1056 | 551 | 2017 | Biotech R&D Firms // Biotech Firms | 52% |
| Sweden | 133 | 81 | 2015 | Biotech R&D Firms | 61% |
| Switzerland | 282 | 195 | 2017 | Biotech R&D Firms | 69% |

Source: OECD.org

In Table 2.2 presented above, we can observe there is a vast diversity on the biotech dedication percentage throughout Europe. Although there are countries where the majority of companies are mostly dedicated to biotechnology (exceeding even 80%), the majority is ranging from 50%-60%. In most countries with percentages above 80%, they have few biotechnology companies (cases like Slovak R. or Latvia), whereas the case of Germany is effectively a different part, since it has 83% of dedication but far more companies than other countries with a similar profile.

The three countries that are represented in the consortium of BIO-ALL (that is, Italy, Portugal and Spain) have all different behaviours. For instance, Spain has largely the majority of biotech firms of the three countries (1056 firms) but has also the lowest Biotech dedication percentage (52%). On the other hand, Portugal has the lowest number of biotech firms of the three countries (176 firms) but has the highest percentage on Biotech dedication (57%). Italy lands in the middle both in number of biotech firms (657) and in Biotech dedication percentage (56%).

But what about expenditures? Are there any differences between countries in Europe? Table 2.3 provides an overview about the different profiles of European countries.

Table 2.3: Biotechnology R&D expenditures in the business sector, year 2018 or last year available (US\$m)

| Country | Expenditures | % of BERD * | As a % of Industry value added | Year | Predominant Biotech Companies |
|-----------------|----------------|-------------|--------------------------------|-------------|-------------------------------|
| Austria | 213,3 | 2,2 | 0,072 | 2017 | Dedicated biotech R&D firms |
| Belgium | 3.460,8 | 32,4 | 1,005 | 2017 | Biotech R&D Firms |
| Czech R. | 168,6 | 3,7 | 0,065 | 2017 | Biotech R&D Firms |
| Denmark | 1.111,8 | 22,5 | 0,733 | 2013 | Biotech R&D Firms |
| Estonia | 34,1 | 12,7 | 0,127 | 2017 | Biotech R&D Firms |
| Finland | 72,1 | 1,6 | 0,055 | 2015 | Biotech R&D Firms |
| France | 3.791,9 | 8,9 | 0,224 | 2017 | Biotech R&D Firms |
| Germany | 1.572,3 | 1,7 | 0,056 | 2018 | Dedicated biotech R&D firms |
| Ireland | 437,4 | 12,6 | 0,153 | 2017 | Biotech R&D Firms |
| Italy | 727,5 | 3,5 | 0,048 | 2017 | Biotech R&D Firms |
| Latvia | 1,8 | 2,3 | 0,005 | 2017 | Biotech R&D Firms |
| Lithuania | 55,5 | 17,9 | 0,083 | 2017 | Biotech R&D firms |
| Norway | 246,8 | 6,8 | 0,124 | 2017 | Biotech R&D Firms |
| Poland | 240,4 | 3,2 | 0,030 | 2017 | Biotech R&D firms |
| Portugal | 57,9 | 2,6 | 0,030 | 2017 | Biotech R&D Firms |
| Slovak R. | 10,5 | 3,0 | 0,010 | 2011 | Biotech R&D Firms |
| Slovenia | 63,9 | 6,1 | 0,129 | 2017 | Biotech R&D Firms |
| Spain | 1.059,8 | 8,8 | 0,092 | 2017 | Biotech R&D Firms |
| Sweden | 492,7 | 4,6 | 0,169 | 2015 | Biotech R&D Firms |
| Switzerland | 3.307,4 | 29,7 | 0,988 | 2017 | Biotech R&D Firms |

Source: OECD.org; * BERD – Business Enterprise Expenditures on Research and Development

Table 2.3 is important to understand that the majority of the expenditures are mostly made by Biotechnology R&D Firms. Biotechnology BERD as a share of total BERD is an indicator of the country's research focus on biotechnology. On average, biotechnology BERD accounted for 10.06% of total BERD. Belgium spends the most as a percentage of BERD (32,4%). Switzerland and Denmark follow recording BERD, spending of 29,7% and 22,5%. Biotechnology R&D intensity (biotechnology R&D as a percentage of industry value added) is also the highest in Belgium (1,005%), followed by Switzerland (0,988%) and Belgium (0,733%).

If we analyse the three BIO-ALL countries, Spain is also the leader in Biotechnology R&D expenditures in the business sector (US\$m 1.059,8) and also in percentage of BERD with 8,8%. It is followed by Italy who spends US\$m 727,5 and has a share of 3,5%. Lastly, we find Portugal with US\$m 57,9 and 2,6% of share.

It is also important to point out intramural biotechnology R&D expenditures in the government and higher education sectors. As for in Table 4 the OECD points out the expenses of each government on biotechnology R&D on higher education and as a percentage of its total expenditures.

Table 2.4: Intramural biotechnology R&D expenditures in the government and higher education sectors, year 2018 or last year available (US\$m)

| Country | Expenditure | As % of total gvnmt and h.e. sectors | Year | Predominant Biotech Companies |
|-----------------|----------------|--------------------------------------|-------------|-------------------------------|
| Austria | N.A. | N.A. | N.A. | Dedicated biotech R&D firms |
| Belgium | 606,9 | 13,7 | 2017 | Biotech R&D Firms |
| Czech R. | 335,4 | 12,6 | 2017 | Biotech R&D Firms |
| Denmark | 71,5 | 2,6 | 2013 | Biotech R&D Firms |
| Estonia | N.A. | N.A. | N.A. | Biotech R&D Firms |
| Finland | 119,0 | 5,2 | 2015 | Biotech R&D Firms |
| France | N.A. | N.A. | N.A. | Biotech R&D Firms |
| Germany | 370,3 | 2,1 | 2017 | Dedicated biotech R&D firms |
| Ireland | 25,0 | 2,3 | 2017 | Biotech R&D Firms |
| Italy | 299,9 | 7,0 | 2017 | Biotech R&D Firms |
| Latvia | 3,3 | 1,6 | 2017 | Biotech R&D Firms |
| Lithuania | 44,1 | 8,3 | 2017 | Biotech R&D firms |
| Norway | 248,0 | 7,6 | 2017 | Biotech R&D Firms |
| Poland | 239,6 | 5,8 | 2017 | Biotech R&D firms |
| Portugal | 68,4 | 3,4 | 2014 | Biotech R&D Firms |
| Slovak R. | 33,3 | 5,8 | 2011 | Biotech R&D Firms |
| Slovenia | 7,6 | 2,2 | 2017 | Biotech R&D Firms |
| Spain | 1.572,6 | 16,0 | 2017 | Biotech R&D Firms |
| Sweden | N.A. | N.A. | N.A. | Biotech R&D Firms |
| Switzerland | N.A. | N.A. | N.A. | Biotech R&D Firms |

Source: OECD.org

According to the previously presented Table 2.4, we can retain that the expenditure on Intramural biotechnology R&D expenditures in the government and higher education sector is much higher on Spain (1.572,6), being followed by Belgium (606,9) and Germany (370,3).

As a percentage of total government expenditure in higher education biotech R&D, Spain also denotes the highest value (16.0%), followed by Belgium (13.7%) and by the Czech R. (12.6%).

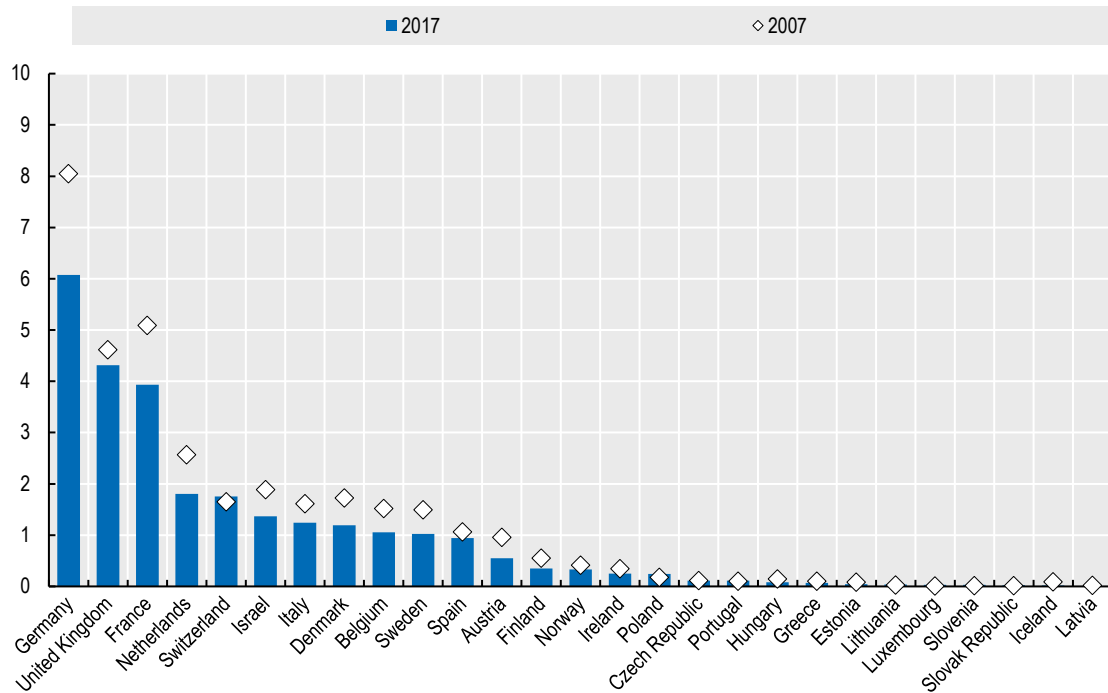
The three countries of BIO-ALL are ranked in expenditure being (of course) led by Spain with US\$m 1.572,6 of expenditure, followed by Italy with US\$m 299,9 and then by Portugal with US\$m 68,4. As a percentage of total government

expenditure in higher education biotech R&D, Spain leads as seen before, being followed by Italy (7.0%) and then by Portugal (3.4%).

Certainly, the investment made by European countries in companies and in education with R&D on biotechnology sector will affect the production of patents. In this sense, it is also important to analyse the evolution of patent registration in recent years.

Therefore, figure 1 illustrates the evolution of the patents share in biotechnology from 2007 to 2017.

Figure 1 Economies' share in biotechnology related patents 2007-2017



Source: OECD.org

As we can understand through Figure 1, the top 3 countries in Europe are the traditionally top 3 economies: Germany, U.K. and France. But it is important to point out the evolution of this share, because on Figure 1 we can understand that this share is coming down on the majority of European Countries. On Table 5 we can see the shares' direction.

Table 2.5: Economies' share evolution in biotechnology related patent 2007-2017

| Country | 2007 | Rank 2007 | 2017 | Rank 2017 | Share Evo | Rank Direction |
|----------|------|-----------|------|-----------|-----------|----------------|
| Austria | 1,0 | 12 | 0,6 | 12 | -0,4 | = |
| Belgium | 1,5 | 9 | 1,1 | 9 | -0,4 | = |
| Czech R. | 0,1 | 18 | 0,1 | 17 | 0,0 | +1 |
| Denmark | 1,7 | 6 | 1,2 | 8 | -0,5 | -2 |
| Estonia | 0,1 | 22 | 0,04 | 21 | -0,06 | +1 |
| Finland | 0,6 | 13 | 0,3 | 13 | -0,3 | = |
| France | 5,1 | 2 | 3,9 | 3 | -1,2 | -1 |
| Germany | 8,0 | 1 | 6,1 | 1 | -1,9 | = |

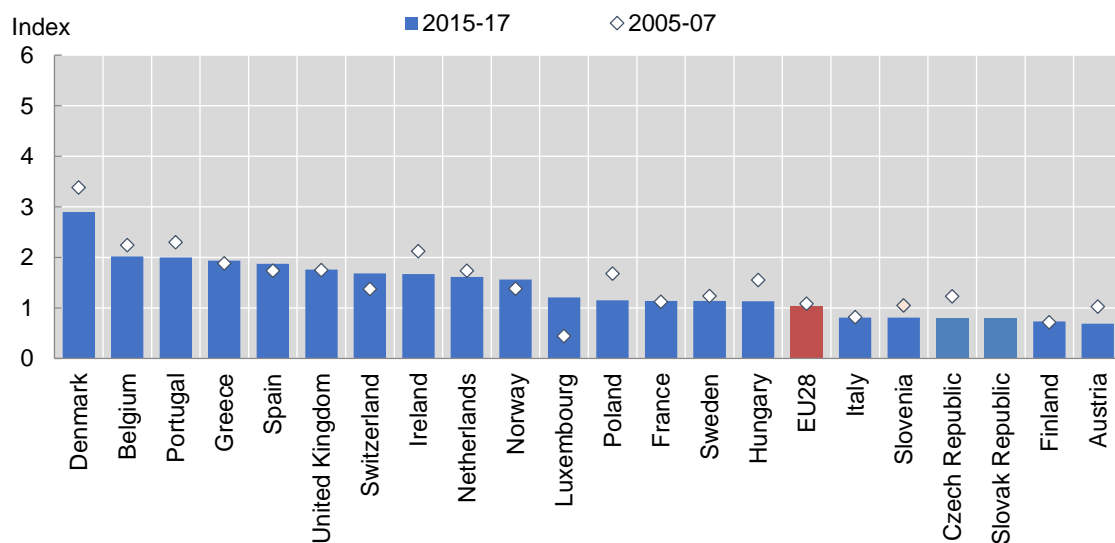
| | | | | | | |
|-----------------|------------|-----------|------------|-----------|-------------|-----------|
| Greece | 0,1 | 20 | 0,1 | 20 | 0,0 | = |
| Hungary | 0,1 | 17 | 0,1 | 19 | 0,0 | -2 |
| Iceland | 0,1 | 21 | 0,02 | 26 | -0,08 | -5 |
| Ireland | 0,3 | 15 | 0,2 | 15 | -0,1 | = |
| Israel | 1,9 | 5 | 1,4 | 6 | -0,5 | -1 |
| Italy | 1,6 | 8 | 1,2 | 7 | -0,4 | +1 |
| Latvia | 0,02 | 24 | 0,01 | 27 | -0,01 | -3 |
| Lithuania | 0,02 | 23 | 0,04 | 22 | -0,02 | +1 |
| Luxembourg | 0,01 | 27 | 0,03 | 23 | +0,02 | +4 |
| Netherlands | 2,6 | 4 | 1,8 | 4 | -0,8 | = |
| Norway | 0,4 | 14 | 0,3 | 14 | -0,1 | = |
| Poland | 0,2 | 16 | 0,2 | 16 | 0,0 | = |
| Portugal | 0,1 | 19 | 0,1 | 18 | 0,0 | +1 |
| Slovak R. | 0,01 | 26 | 0,03 | 25 | +0,02 | +1 |
| Slovenia | 0,01 | 25 | 0,02 | 24 | +0,01 | +1 |
| Spain | 1,1 | 11 | 0,9 | 11 | -0,2 | = |
| Sweden | 1,5 | 10 | 1,0 | 10 | -0,5 | = |
| Switzerland | 1,6 | 7 | 1,8 | 5 | +0,2 | +2 |
| U.K. | 4,6 | 3 | 4,3 | 2 | -0,3 | +1 |

Source: OECD.org

From figure 1 and Table 2.5 we can point out that there has been a general decrease on the shares of biotechnology related patents of the European countries.

If we analyse the BIO-ALL countries, we can see that Italy is ranking higher, being placed in 7th in this ranking, followed by Spain (11th) and Portugal (18th). It's also important to point out the revealed technological index, which is calculated as the share of the country (or economy) in biotechnology patents relative to the share of the country (or economy) in total patents. Figure 2 and Table 2.6 illustrate this information.

Figure 2 Revealed technological advantage in biotechnologies, 2005-07 and 2015-17



Source: OECD.org

As we can understand through figure 2, the top 3 countries in Europe are not the traditionally top economies in Europe, as we have Denmark, Belgium and Portugal leading the rank and above the EU28 average. On Table 2.6 we can see the shares' evolution.

Table 2.6: Economies' share evolution in revealed technological advantage in biotechnologies, 2005-07 and 2015-17

| Country | 2005-2007 | 2015-2017 | Rank 2017 |
|-----------------|------------|------------|-----------|
| Austria | 1,0 | 0,7 | 21 |
| Belgium | 2,2 | 2,0 | 2 |
| Czech R. | 1,2 | 0,8 | 18 |
| Denmark | 3,4 | 2,9 | 1 |
| E.U. 28 | 1,1 | 1,0 | -- |
| Finland | 0,7 | 0,7 | 20 |
| France | 1,1 | 1,1 | 13 |
| Greece | 1,9 | 1,9 | 4 |
| Hungary | 1,5 | 1,1 | 15 |
| Ireland | 2,1 | 1,7 | 8 |
| Italy | 0,8 | 0,8 | 16 |
| Luxembourg | 0,4 | 1,2 | 11 |
| Netherlands | 1,7 | 1,6 | 9 |
| Norway | 1,4 | 1,6 | 10 |
| Poland | 1,7 | 1,2 | 12 |
| Portugal | 2,3 | 2,0 | 3 |
| Slovak R. | N.A. | 0,8 | 19 |
| Slovenia | 1,0 | 0,8 | 17 |
| Spain | 1,7 | 1,9 | 5 |
| Sweden | 1,2 | 1,1 | 14 |
| Switzerland | 1,4 | 1,7 | 7 |
| U.K. | 1,7 | 1,8 | 6 |

Source: OECD.org

Of the three countries participating in BIO-ALL, Portugal is leading as we've seen before, followed by Spain (ranked 5th) and by Italy (ranked 16th). It is worthy to note that from the same reference group of countries, only Italy remains below E.U. average.

From all the information above, we can conclude that the biotech landscape in Europe is complex. In fact, there are different innovation pathways, as well as distinct strategic positions from all countries in Europe. We can almost say that Europe is moving at "two different speeds", and as such there is a need to have a blueprint in order to reach a more homogeneous scenario and speed up the necessary convergence.

2.3 Characterization of the biohealth sector in Italy

According to Deloitte (2018), the health biotechnology sector is one of the most research-intensive sectors in Italy. It is currently experiencing a period of growth. This is a sector driven by biotechnological pharmaceutical innovation and it has led to the development of numerous therapies to tackle unmet clinical needs. Since 2016, Italy shows a substantial growth in the total number of biotechnology companies, on the total of over 500 companies operating in the sector. The Italian entrepreneurial community, linked to biotechnologies, is mostly made up of micro or small sized companies.

It is also important to look into the level of territorial diffusion, since over 90% of the companies involved in biotechnology in Italy are located between the regions of Lombardy, Lazio and Tuscany. Furthermore, regarding total internal R&D spending, there has been some contraction in recent years. Considering the Health Biotech sector, Italy shows a recognized leadership position in the field of personalized therapy, advanced therapies, vaccines and orphan drugs for rare diseases. Given these positive elements, Italy's great opportunities to consolidate its leadership position in the sector could come from the creation of a system able to exploit even the smallest realities, which are the majority. Doing so, Italy could be competitive on a global scale.

Coletta *et al.* (2018) corroborate the previous statement, stating that the biotechnology sector is following an undergoing consolidation in Italy. On Table 2.7 we can see some key figures of the Italian Biotech Sector.

Table 2.7: Key figures of the Italian Biotech Sector 2018

| | Total Firms | Dedicated Biotech R&D Firms | Italian capital dedicated Biotech R&D Firms |
|--------------------------|--------------|-----------------------------|---|
| Number of Firms | 641 | 360 | 334 |
| Biotech Turnover | € 11.572.414 | € 3.415.647 | € 874.606 |
| Total R&D Invest | € 2.056.734 | € 507.764 | € 240.196 |
| Total Biotech R&D Invest | € 723.828 | € 479.969 | € 226.648 |
| Biotech Employees | 12.950 | 5.392 | 4.197 |
| Biotech R&D Employees | 4.317 | 2.903 | 1.933 |

Source: Coletta *et al.* (2019)

Since 2015, the biotech turnover grew up to 16%, more than twice the rate observed in the manufacturing sector, for instance. The medical and healthcare industry is the most developed sector among the biotech fields of application with half of the total firms recording 86% of the total biotech R&D investment and generating almost 75% of the entire biotech industry turnover (Coletta *et al.*, 2019).

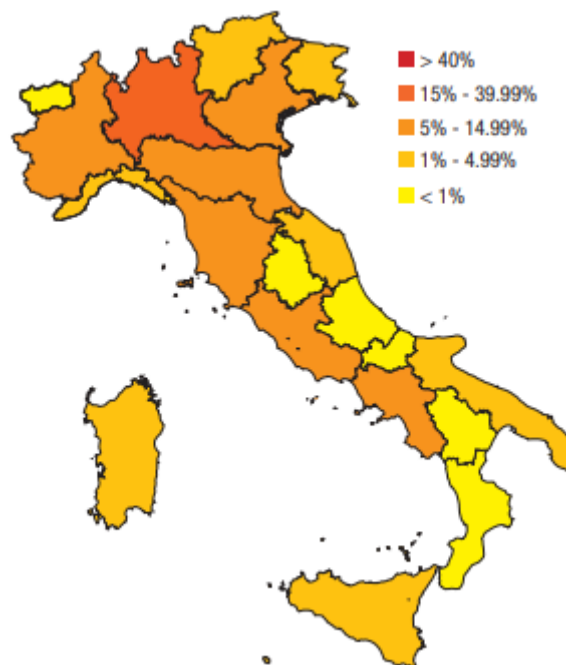
According to Table 2.7, at the end of 2018, 641 biotech firms were counted in Italy. More than half of these (56%, corresponding to 360 firms) are dedicated biotech R&D firms that devote at least 75% of their intra-muros R&D investments to biotech research activities.

The Italian biotech sector includes firms active in terms of R&D activities from a broad range of cutting-edge technologies for several application fields. The main target markets are represented by human Healthcare, Industry and Environment, but also Agriculture and Veterinary.

Analysing by dimension, over the last few years there has been a shrinking trend in the percentage of micro firms on the total biotech firms. According to Coletta *et al.* (2018), this contraction is probably linked both to the sector's consolidation and the economic deceleration observed in Italy. Micro or small-sized firms account for almost 80% of biotechnology sector, while large-sized companies represent a share of 9%. The firm average size in the biotechnology sector is, therefore, higher than in the manufacturing sector, where micro-small and large-sized enterprises represent respectively 97% and 0,3% of the total (Coletta *et al.*, 2018).

The Italian biotech firms are spread throughout the national territory, with more than 80% located in the Northern Centre part of the country (figure 3). Almost 90% of the biotech activity turnover is concentrated in 3 regions and 87% of the R&D investments in only 5 regions. Lombardy, which boasts the bulk of Italy's industrial fabric and the main national financial centre, ranks first among the other regions in all the indicators of the industry, followed by Tuscany, in terms of R&D investment, and by Latium, in terms of turnover. The ranking of Tuscany in terms of R&D investment is even more relevant considering the fact that the region ranks only 6th in terms of number of firms (Coletta *et al.*, 2019).

Figure 3 Biotech firms, registered offices Italy 2018



Source: Coletta *et al.* (2019)

If we look only the biotech healthcare sector, according to Coletta *et al.* (2018), at the end of 2017, 295 biotech firms were counted in Italy. Around 62% (corresponding to 183 firms) are dedicated biotech R&D firms, which devote at least 75% of their internal R&D investments to biotech research activities, as it can be observed in Table 8.

Table 2.8: Key figures of the Italian Biotech Sector – Healthcare 2017

| | Total Firms | Dedicated Biotech R&D Firms | Italian capital dedicated Biotech R&D Firms |
|--------------------------|-------------|-----------------------------|---|
| Number of Firms | 295 | 183 | 161 |
| Biotech Turnover | € 8.583.049 | € 4.362.434 | € 940.447 |
| Total R&D Invest | € 1.807.895 | € 500.169 | € 261.506 |
| Total Biotech R&D Invest | € 698.083 | € 455.429 | € 243.012 |
| Biotech Employees | 8.513 | 4.853 | 3.122 |
| Biotech R&D Employees | 2.877 | 2.369 | 1.397 |

Source: Coletta et al. (2018)

It is also important to point out that the majority of turnovers, investments and employees in the biotech area are related to firms in the health sector. Combining the information provided in tables 2.7 & 2.8, we can observe that near 65% of the employees work in Biotech Healthcare areas and the turnover is almost 75% of the whole biotech sector, for instance. It obviously makes a stand as for the importance of the biohealth sector in Italy.

2.4 Characterization of the biohealth sector in Portugal

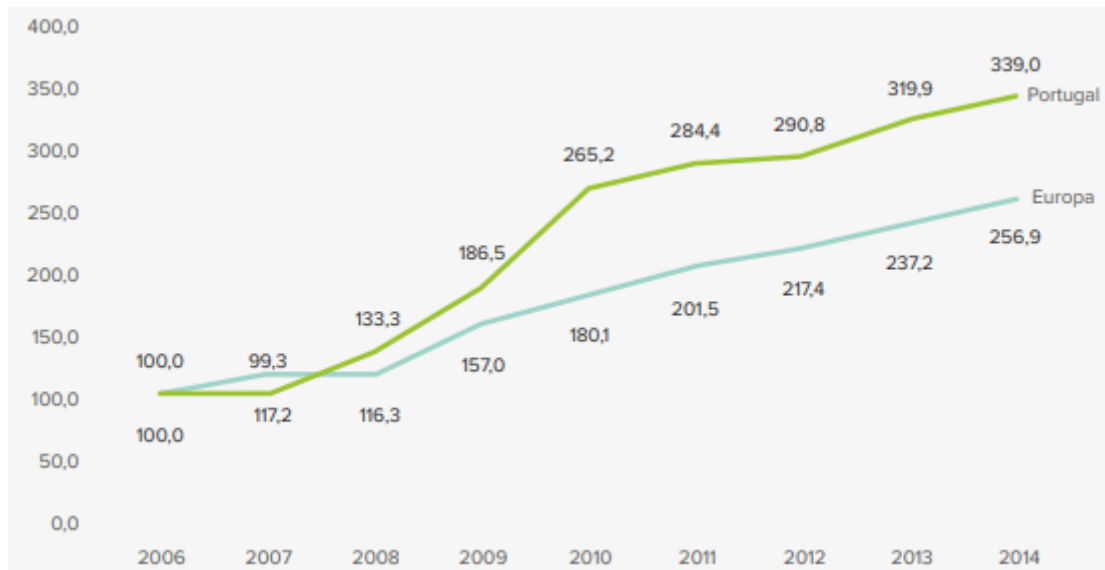
The biotechnology sector in Portugal is still quite recent, with the first company related to the field of biotechnology dating from 1989. Still, in recent years, with the focus on high quality education, training of several doctorates in the areas of health sciences, medical sciences or engineering, in recent years it has provided an increase in investment both by the government and by private individuals (P-Bio, 2016).

As a result of the relevant installed capacity and its growth potential future, clinical research and translational research are now assumed to be strategic areas in Portugal. Portugal's investment in Biotech and Health R&D is almost 500 million dollars and has almost 6.000 professionals dedicated to R&D activities and almost 5.000 researchers, with many Portuguese researchers being awarded for their discoveries (AICEP, 2019).

The Portuguese scenario, as told before, had a paradigm shift in the last decades of the XX century. The number of researchers, doctorates and scientific publications has increased considerably, as well as the global amount invested in R&D. The number of PhD researchers in the field of biotechnologies has also grown. Between 1979 and 2000, 62 PhDs in biotechnology were carried out or recognized in Portugal: 54 in Agricultural and Food Biotechnology, 3 in Industrial Biotechnology and 5 in Medical Biotechnology (Correia & Garcia, 2016).

Since then, and according to P-Bio (2016), from 2006 to 2014 there was a strong growth of employment in the biotechnology sector in Portugal, with a growth of 240% over an 8-year period, above the average growth verified in Europe (157%), as we can understand from figure 4.

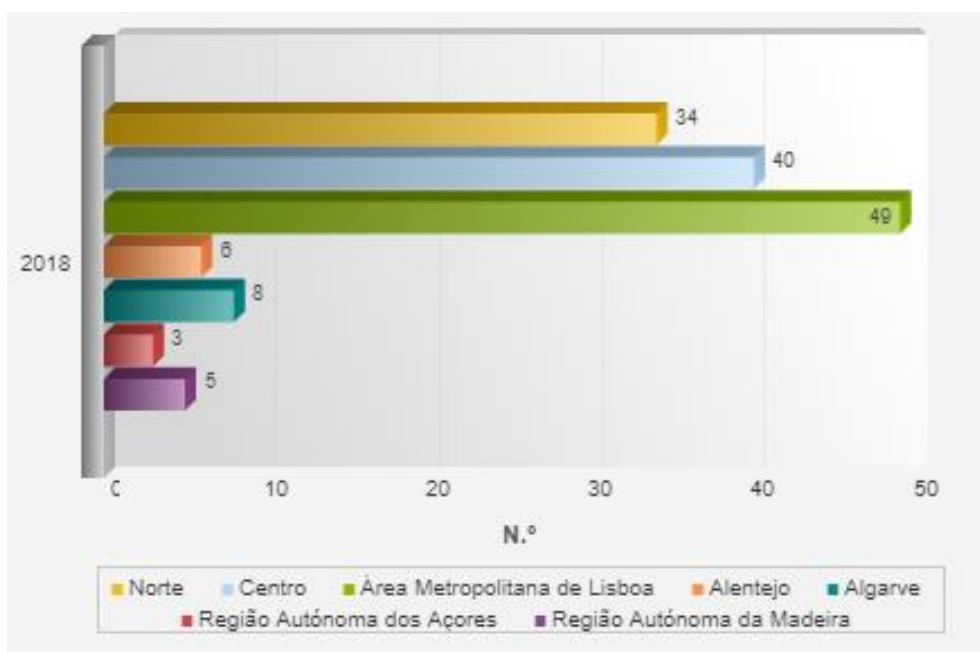
Figure 4 Portuguese Employment Trends (2006-2014)



Source: P-BIO (2016)

As we've seen before, at European level, 79% of employment and 56% of the number of companies were concentrated in five countries: U.K.; Germany; France; Switzerland; and the Netherlands. From a total sum of 23 countries, Portugal is ranked 14th in terms of employment volume (0.9% of the total) and 10th in terms of the number of companies (2.9% of the total) (OECD, 2019). If we consider the information retrieved from INE.pt, the website of Instituto Nacional de Estatística (INE), in 2018 there were 145 active biotechnology firms, divided nationwide as we can see in figure 5.

Figure 5 Biotechnology firms in Portugal per region (2018)

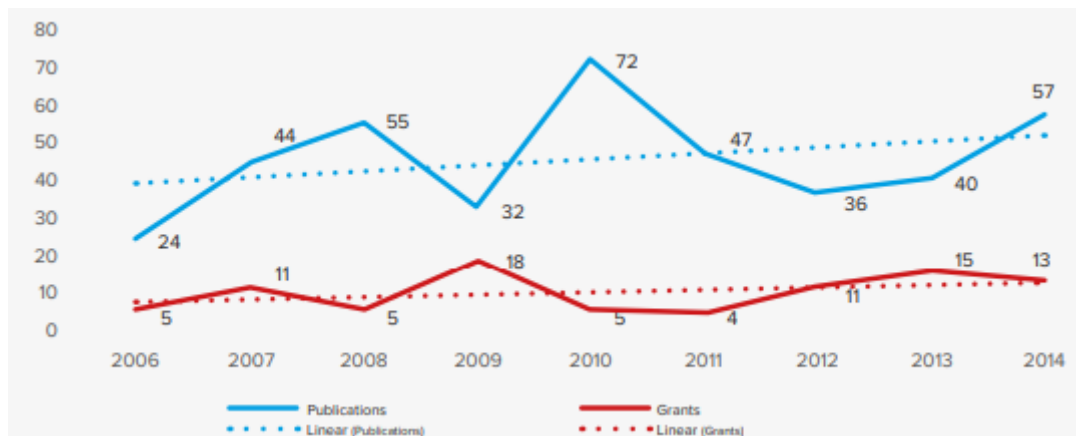


Source: INE (2019)

As we can see in Figure 5, the “Área Metropolitana de Lisboa” region is the one with the most firms related to biotechnology in Portugal, followed by the “Centro” region with 40.

If we take into consideration the patent publications in the biotechnology area, the ones filled by Portuguese applicants have come to a greater significance in the last few years. According to P-Bio (2016), from 2006 to 2014 these publications more than doubled, but also the patent grants also show this increasing trend within the reference period, although in 2014 the number was lower than the previous year (figure 6).

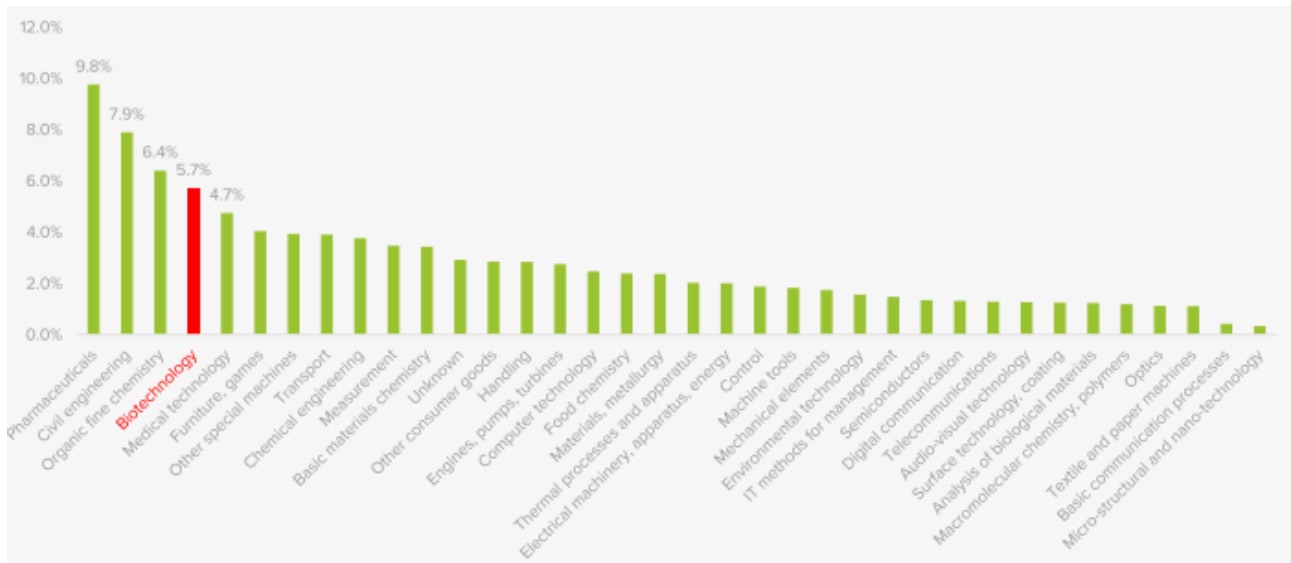
Figure 6 Portuguese biotechnology patent publications and grants (2006-2014)



Source: P-BIO (2016)

In Portugal, the total number of patent publications pertaining to the 35 existing technology domains, within the reference period of 2006 - 2014, was of 7,125. The biotechnology accounts for 407, representing 5.7% of the total publications. This value puts biotechnology in the fourth place among 35 technology classifications (Figure 7). In 2014 the share of biotechnology patents in the total Portuguese patents publications was higher than the average of the period (6.5%) and higher than the three previous years. This was the third highest value in an eight-year timespan.

Figure 7 Relative distribution of the total Portuguese patent publications in the period 2006-2014 by technology



Source: P-BIO (2016)

According to P-Bio (2020), in 2017 the Portuguese health cluster was responsible for 10% of the GDP with a total expenditure of EUR 19 billion. This is, therefore, one of the sectors with the greatest weight in the Portuguese economy. Moreover, in 2019 the Portuguese government has established some new guidelines in order to foster competitiveness and internationalization in the BIOHEALTH sector. These guidelines were supported by the following indicators according to P-Bio (2020):

- The GVA of the Health cluster was responsible (in 2015) for EUR 8.7 billion. That is approximately 5% of the Portuguese GDP of that year;
- The exports of medicines and medical devices in 2019 stood at EUR 1.48 billion;
- In 2016, the Health cluster's average pay was 20% higher than the Portuguese national average;
- In 2019, the clinical investigation represented a revenue of EUR 87 million for the SNS (Portuguese National Health System), and it is estimated that in 2021 it could rise to EUR 141 million;
- Also, in 2019, life and Biomedical Sciences are the most competitive sector in Portugal. In this sector, the country compares internationally well, the rankings place Portugal ranked 11th in the OECD for scientific productivity, which is also supported by the success rate in attracting competitive EU funding;
- Between 1994 and 2015, doctoral grants awarded by FCT (Fundação para a Ciência e Tecnologia) in Medical Sciences (12%), Health and Natural Sciences (16%) and Engineering Sciences and Technologies (24% of which are bioengineering, engineering biomedical, biological engineering) accounted for more than 50% of the grants awarded representing a huge investment in the creation of highly qualified human capital for this area and which is not yet translated into an impact on the economy.

2.5 Characterization of the biohealth sector in Spain

The biotechnology sector in Spain continues to grow year after year. This is largely due to the transversal nature of the biotechnology, as more and more companies from different sectors incorporate biotechnological activities to its products and services. It is important to point out that there has been an increasing weight of the turnover of companies in the biotechnology sector in the Spanish GDP. A positive evolution has been observed, even in the crisis years. As evidence we have the values of 2014, the year in which that figure stands at 10.35%, and 2008, when the Biotechnology barely accounted for 2.98% of GDP. This value of 10.35% (2014) has equalled even tourism figures in the country, one of the pillars of the Spanish economy (ICEX, 2016). The number of biotechnology firms is growing in Spain since 2013. As we can understand from Figure 8, there was a decrease in 2012-2013 but then there was an upward trend. It was also a trend if we intend to understand the percentage of biotechnology firms of all firms in Spain.

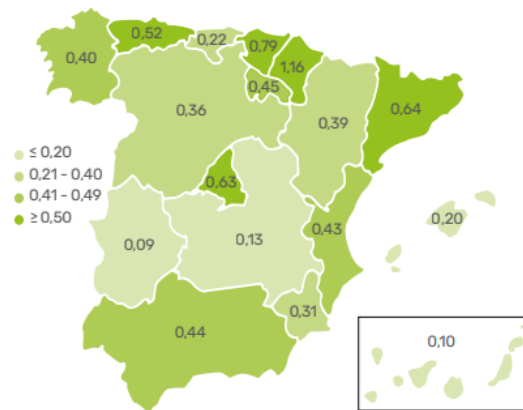
Figure 8 Biotechnology firms' evolution in Spain (2010-2017)



Source: ASEBIO (2019)

Regarding the territorial distribution of these Biotech companies, Figure 9 includes the territorial distribution obtained both in terms of business demographics, such as specific invoicing originated in each of the Autonomous Communities. As can be seen in the mentioned Image, the business demography is concentrated around three communities (Catalonia, Madrid and Andalusia), while average turnovers reach the highest values in Cantabria, Madrid and Catalonia. Combining this business demography with levels of average turnover, we can understand that between Catalonia and Madrid, they absorb near 73% of total turnover of these Biotech companies.

Figure 9 Biotech business intensity (Biotech per 1000 companies), Spain 2017



Source: ASEBIO (2019)

According to ICEX (2016), the Biotechnology sector accounted for 4% of Spain's GDP in 2016. There are nearly 3000 companies involved in biotech activities and 620 strictly biotech. Of all strictly biotech companies 59% of them only focus on healthcare. If we analyse only industrial companies related to biotechnology, 9% of them are related to healthcare.

2.6 Characterization of cooperation processes between universities, industry, entrepreneurship and innovation in the biohealth sector

Achieving effective technology transfer and commercialization of new discoveries from universities, research institutions, and national laboratories to the private sector has been a challenge for several countries, developed and developing alike. The interactions between universities and industry must be recognised as an important pillar to economic development, because it increases a country's competitive advantage, creates jobs and contributes to social inclusion.

Not only the countries can benefit from it, but also University students, businesses and communities can benefit from deepening this collaboration. First, countries can benefit because it increases the import-export ratio, creates new firms and new jobs. Then, firms in competitive environments will need highly qualified employees with well-developed absorptive capacities so that they can be able to adopt new technologies, new products and innovations. As for that, Universities face the challenge to develop entrepreneurial and innovation skills in students in order to be prepared for the labour market in the future.

When stimulating that entrepreneurial and innovative feeling on students, universities can target onto new ideas, new products and new firms, in order to put onto the market all the research that is carried indoors. Research conducted by universities must boost new start-ups and technology production.

For both universities and businesses, University-Business Cooperation (UBC) is being comprehended as an optional activity that is not necessarily natural for both. As such, appropriate mechanisms need to be put in place to stimulate and support cooperation. These supporting mechanisms should aim to help reduce or eliminate the largest barriers, offer facilitators and provide incentives that reward universities and businesses to undertake the activity. This can include

creating new, or building on old policies, strategies, structures and activities (European Commission, 2017).

But why is this cooperation important? First, because UBC can address organisational problems for Universities, such as decreased funding, low levels of innovation and the needs for skilled human capital. And then, it can also address social and economic issues such as unemployment rates, lack of competitiveness, and be the engine towards knowledge-based societies and economies.

The European Commission (2017) aligned 14 activities between Higher Education Institutions (HEIs) and Business, in order to increase the levels of the relationship, which can be seen in Table 2.9. presented below.

Table 2.9: UBC areas and activities

| UBC AREAS | UBC ACTIVITIES |
|--------------|--|
| Education | 1. curriculum co-design (e.g. employers involved in curricula design with HEIs) 2. curriculum co-delivery (e.g. guest lectures) 3. mobility of students (e.g. student internships/placements) 4. dual education programmes (e.g. part academic, part practical) 5. lifelong learning for people from business (e.g. executive education, industry training and professional courses) |
| Research | 6. joint R&D (incl. joint funded research) 7. consulting to business (e.g. contract research) 8. mobility of staff (i.e. temporary mobility of academics to business and of business people to HEIs) |
| Valorisation | 9. commercialisation of R&D results (e.g. licencing/patenting) 10. academic entrepreneurship (e.g. spin offs) 11. student entrepreneurship (e.g. start-ups) |
| Management | 12. governance (e.g. participation of academics on business boards and business people participation in HEI board) 13. shared resources (e.g. infrastructure, personnel, equipment) 14. industry support (e.g. endowments, sponsorship and scholarships) |

Source: European Commission (2017)

There is also a need to create the appropriate culture for UBC to flourish, stating that the behaviour of faculty, students and administrators is supported by the values, norms and reward systems of the University. It is known that the individual and the surrounding culture, including individual rewards, are important and that most policy efforts to facilitate collaboration are directed at institutions, aiming to formalise such interaction through creating the right institutional culture and environment for it.

Whether it is the University or the Business, the institution has a key role in either leading the development of a cooperation and engagement culture in a top-down strategy, or nurturing and supporting individual academic or research groups to cooperate, through a bottom-up approach to strategy. Given growing external engagement obligations, academics have additional responsibilities of interacting with public institutions and business, which implies that universities'

management need to establish mechanisms that incorporate the change of roles on both levels and to implement structures that acknowledge the interrelationship of the levels.

Concerning the cooperation between Universities and Business, it is important to stimulate the knowledge exchange, as well as creating long-term partnerships and opportunities for both, driving creativity, innovation and entrepreneurship. As for that, UBC needs to focus on drivers rather than barriers, the mechanisms of UBC need to be developed and aligned and relationships need to be placed at the core of UBC. In short, UBC needs to be approached as an ecosystem that requires careful management. For UBC to institutionalise and increase its impact, there should be a coordinated joint effort between governments at national and regional level, Universities and faculty boards, and business managers. UBC in education offers potential for better aligning curricula and the skills of graduates with the labour market, improving employment pathways for students, and recruitment for employers, as well as lifelong learning programmes for business. For research, HEIs offer the greatest benefit to business as a partner for innovation with a longer-term horizon as well as shorter term problem solving. Conversely, business offers HEIs insights, opportunities, data for high quality research and the ability to bring research into practice and create impact. Through valorisation, HEIs become part of a regional innovation system acting as a source of next generation innovations, new high-tech companies and entrepreneurial talent for the value chains of industry. Cooperation in management, provides possibilities for improved regional and institutional governance, the sharing of facilities, equipment and other resources to better leverage strategic assets. The potential exists for HEIs to act as an “anchor tenant” on which their cities and regions can build competitiveness upon. In this scenario, the campus acts as a platform or hub, a modern collaborative precinct, which brings together excellence in HEIs and business. UBC has the potential to increase the ability of the higher education system to keep pace with the rate of change in our societies in the areas of education and research, to create and develop talent, as well as to rise Europe’s competitiveness in a globalised and rapidly changing world (European Commission, 2018).

Next, we will try and analyse the perspectives on the three countries that are represented on the BIO-ALL project, according to the 2017 UBC studies conducted by the European Commission. They analysed both the university view and the business view, where they conducted several inquiries to major stakeholders of both parts regarding their acknowledgement of the UBC.

2.7 The Italian Perspective

From the University perspective, and according to the European Commission (2017A), the involvement of Italian academics in UBC is low, with over 80% of academics not undertaking any business-related activities at all. The most common activities that are practiced by academics to high or medium extent are mobility of students (12.7%), consulting (12.7%) and R&D collaboration (11.3%). Very few academics engage in UBC related to management and valorisation, along with mobility of staff and lifelong learning.

Italian academics see themselves as proactive initiators of collaborative activities with businesses. The majority state their high frequency of initiation of UBC. The students and internal intermediaries within the universities, as well as external intermediaries are the most passive initiators of UBC in the Italian context. The cooperation of Italian universities tends to take place with larger companies and SMEs, mostly located within the country or region.

Regardless of their cooperation experience, Italian academics see insufficient funding and bureaucratic procedures as the major factors that hinder UBC. Specifically, the lack of funding by SMEs, which themselves have a limited capacity to invest in long-term larger projects, emerges as a significant barrier. Lack of university and government funding similarly puts the UBC into question for Italian academics, as well as the complicated bureaucratic nature of the collaborative activities. Italian HEI managers share a nearly similar perspective on the barriers to the cooperation between businesses and universities. Interestingly, the issues related to human resources, such as frequent staff turnover within any of the partners, are not seen as factors that can seriously hinder the cooperation.

The well-established relationship between the partners is key to the successful collaboration, as both Italian academics and HEI managers agree upon that. Mutual trust and commitment, and a shared goal considerably facilitate UBC. However, the relationship should be supported by the structures and, more importantly, through a sustainable financial basis. Thus, the existence of funding to undertake the cooperation is one of the more frequently mentioned facilitators of UBC by all the Italian academics.

HEI stakeholders in Italy are driven by different motivations to engage in UBC. Academics who already cooperate with businesses are motivated by the opportunities to obtain financial resources and put their research in practice, while those who do not undertake the collaboration see the possibility to improve graduate employability and contribute to the mission of the university more motivating. Interestingly, HEI managers hold a similar view to non-cooperating academics. They are more motivated to undertake UBC for the benefit of other stakeholders, such as improving graduate employability, impacting the society, contributing to the mission of the university and addressing societal challenges. Overall, the policy, strategic and structural mechanisms to support UBC are developed from low to medium extent in Italian HEIs, which is slightly lower than the European average. Regional innovation policies and those that positively support research collaboration between universities and businesses are more developed on the governmental level, while documented mission, vision and strategy embracing UBC and university top-level commitment to collaboration are the internal strategic HEIs mechanisms developed to a greater extent in Italy. The more developed structural and operations mechanisms, that support UBC in Italy are connected with employability and networking activities (such as career offices, alumni networks and UBC activities facilitating student interaction with businesses), and bridging structures (such as board member or vice rector positions for UBC, agencies and industry liaison offices).

Italian academics identify their capabilities for UBC as moderate. They believe it is their and the university's role to collaborate with businesses in research. They also state that they have a lot to offer in R&D collaboration to companies. Italian

academics, however, admit they do not know enough about what businesses need and want and they do not have enough support to undertake UBC, despite having a positive attitude towards UBC in general. Italian academics seem to be satisfied with the joint activities with businesses in research, however the education related UBC has significantly lower satisfaction rates, which corresponds to the European average. Nonetheless, 99,6% of Italian academics show a very strong commitment to maintain or increase their collaborative activities in the future. This shows a positive momentum for UBC in Italy that still, however, has a large room for improvement.

According to the European Commission (2017B), but from the Italian businesses' perspective, they tend to demonstrate a higher inclination to engage in joint R&D, mobility of students and consulting. There is a noticeable lack of development of other UBC activities. Over 50% of Italian businesses do not undertake any collaboration in valorisation and management. Particularly underdeveloped are curriculum co-design and student entrepreneurship. Notably, Italian businesses see themselves as the most proactive actors in the initiation of the UBC activities, with 70% reporting to have been the major initiators. On the contrary, Italian business representatives perceive external and internal intermediaries significantly more passive in the UBC initiation.

Italian businesses see their cultural differences with universities, such as varying time horizons, as the major obstacle to collaboration. Italian business representatives also note that the lack of government funding and bureaucracy related to UBC in universities hinder the intensity and/or quality of joint activities. Different professional staff profiles in the business world and academia, and thus the lack of university staff with business knowledge are reported to serve as an important barrier for businesses to collaborate with universities.

While funding to undertake cooperation emerges as the top factor that enables UBC in the eyes of Italian business representatives, the factors that are related to the relationships between the partners are not less prominent. Italian businesses highlight the importance of a shared goal, mutual trust, mutual commitment and prior relationship with the university partner. These results indicate that any effort towards enabling business cooperation with universities should focus on the development of relationships and building trust.

They see UBC less beneficial for themselves than for the students and society. Then, what is the major motivation for businesses to undertake UBC? Italian businesses are primarily driven to a collaboration with universities in order to improve their own innovation capacities, obtaining additional financial resources and getting access to cutting-edge technologies. Attracting student talents from the universities and enhance their own reputation drive Italian businesses to engage in UBC as well. This aligns with the most practiced UBC activities reported by the Italian businesses, being joint R&D and mobility of students.

While universities emphasise the development of specific mechanisms for UBC, a much less structured approach is normally taken by the business world in this respect. It's common for business owners to report that their companies dedicate resources to collaborate with universities and have a developed

strategy for doing so. Interestingly, in the Italian case, it is common for the companies to have a flat structure, without a well-defined internal organisation. It is aligned with the finding that the top-level management is less committed to UBC than the average European perspective shows, and the official role of UBC facilitator is not well developed in the Italian business realm.

Italian businesses follow an overall European trend in being rather supportive of collaboration with universities. Italian businesses are certain of their own capability to absorb knowledge and technology from universities. They report that universities play an important role in the development of an innovative ecosystem. Italian businesses also note they have enough university contacts, skills and knowledge of UBC and what universities want from collaboration. Importantly, the Italian business representatives are more satisfied with their UBC in research than the European average portrays. However, with more focus on research and innovative development, Italian businesses do not see their own responsibility and capability to collaborate with universities in education-related activities, and therefore show much less satisfaction with UBC in education.

2.8 The Portuguese Perspective

Analysing the UBC in Portugal from the University perspective, according to the European Commission (2017C), the academics tend to be involved in a variety of different cooperation types, with international mobility of students, joint R&D and curriculum co-delivery emerging as the most developed ones. However, over 60% of academics do not engage in these activities at all. Management and valorisation related activities are the least developed in Portugal, ranking below the European average. Academics see themselves as proactive initiators of UBC, with over half of them stating that they usually or always initiate such cooperation. On the contrary, they perceive that external intermediaries and students are those stakeholders that less often initiate UBC. The cooperation of Portuguese HEIs tends to be with micro and small-sized companies located in their region.

Academics as well as HEI representatives, state that they are considerably hindered by the lack of business, university and government funding along with the limited resources of SMEs. However, the main barrier identified by academics is the insufficient work time allocated by the university for their UBC activities, which is also considered an obstacle for HEI representatives but in a lesser extent.

While funding to undertake cooperation emerges as one of the top five facilitators, the relational factors and the interest of business in accessing scientific knowledge play an even more important role. The existence of mutual trust, mutual commitment, a shared goal facilitates and thus drive cooperation. They believe that any effort dedicated to increase cooperation between businesses and universities should focus on relationship development as a basis for UBC.

While cooperating academics highlight research motivations, such as gaining new insights and using it in practice, academics not cooperating are motivated by the willingness to contribute to the mission of the university and address societal challenges. However, both coincide in improving teaching and graduate

employability as important motivators. HEI managers are motivated to undertake UBC mainly to positively impact society and to improve graduate employability. The possibility to obtain financial resources also emerges as a motivator. Overall, motivations involving benefits for other stakeholders hold great importance for all HEI respondents.

Universities in Portugal are seen to place a strong emphasis on developing support mechanisms for UBC. Also, high-level strategic developments such as top-level management commitment for UBC, a documented mission/vision embracing UBC and a strategy supporting UBC are perceived as well developed. The least developed mechanisms are related to the practice of recruiting business professionals in career offices and the reduction of teaching time for UBC cooperating academics. Generally, the "paper strategies" are substantially more developed than the implementation strategies in both Portugal and European HEIs.

Student-centred activities are the most developed operational mechanisms. Entrepreneurship courses offered to students and UBC activities facilitating student interaction with businesses are the most developed activities. On the contrary, student networks dedicated to UBC and the promotion of UBC by businesses on their websites are indicated as the most undeveloped UBC mechanisms.

Academics already cooperating with business have a positive perception of their abilities and roles in undertaking UBC. They believe it is their and their universities' role to collaborate with businesses, in both research and education activities. Overall, those cooperating have a positive attitude towards UBC. However, Portuguese academics consider their business contact base and general knowledge about UBC insufficient and they report that they lack support to undertake cooperation with businesses.

The Portuguese business perspective, according to the European Commission (2017D), shows a moderately high engagement in research related cooperation. Thus, most businesses intend to cooperate on a medium-high extent with universities in joint R&D, and half of them in consulting activities. Fewer businesses are involved in staff mobility. Education related cooperation also shows significant engagement, with more than two thirds of the businesses participating in international mobility of students. Valorisation and management activities are considerably less developed. Particularly low is also the educational activity of curriculum co-design. Portuguese businesses perceive themselves as the main actors reaching out for collaboration. They also see alumni and government as proactive UBC initiators. On the contrary, Portuguese representatives identify internal and external intermediaries as those stakeholders that less often initiate UBC.

The main barriers identified by businesses are related to cultural differences between them, such as the differing time horizons, a lack of people with business knowledge within universities and their focus on producing scientific outcomes. Portuguese businesses state that financial support mechanisms from the government are missing and universities lack awareness of opportunities arising from collaborating with them.

While funding to undertake cooperation is indicated as one of the top five facilitators for UBC in Portugal, factors related to the individual relationships emerge to be of even higher importance. It is the existence of trust, commitment and a shared goal along with prior relations with a partner that facilitate cooperation for Portuguese businesses. This indicates that any effort towards enabling cooperation between businesses and universities should focus on developing sustainable relationships, as a basis for successful collaboration.

Businesses in Portugal cooperate with universities principally to improve their own innovation capacity, to get access to new technologies and knowledge and to gather new talent. Further motivations to engage in UBC include positively impacting society, improving their reputation and getting access to new discoveries at an early stage. Generally, Portuguese businesses perceive students and themselves as the main UBC beneficiaries.

Strong emphasis has been placed on the development of UBC supporting mechanisms by universities, and yet little is known about such mechanisms in the business realm. This indicates that the strategies are those mechanisms that have the highest development, indicating the existence of a defined strategy for collaborating with universities along with the dedication of resources and presentations, lectures or mentoring within the university. Additionally, the practice of recruiting PhD students or scientists into the business, the existence a systematic R&D programmes and a committed top-level management. The most underdeveloped supporting UBC mechanisms in Portugal include academic-idea competitions and available positions for business people within the university.

Portuguese businesses perceive themselves to be supportive towards UBC. They recognise the importance of universities for their innovation efforts and report they have the capability to absorb knowledge and technology from universities. However, Portuguese businesses report as insufficient the support to undertake UBC within their business, as well as they perceive a lack of skills to do so.

2.9 The Spanish Perspective

Regarding the Spanish perspective and according to the European Commission (2017E), Spanish academics seem to be involved in a variety of different cooperation schemes, but their general involvement is low. Mobility of students, joint R&D and consulting to businesses emerge as the most prevalent activities. Most academics do not undertake UBC activities in the valorisation or management domains. The activities of mobility of staff and R&D commercialisation are particularly low. Academics see themselves as proactive initiators of UBC, with almost most of them stating that they usually or always initiate such cooperation. On the contrary, they perceive that external intermediaries and students are the stakeholders that less often initiate UBC. The cooperation of Spanish HEIs tends to be with medium-sized and large companies located in their region.

Independent of whether academics are currently cooperating with businesses or not, lack of resources, insufficient funding and bureaucratic procedures are perceived as the primary barriers to UBC. Cooperating academics stress funding problems to a greater extent, while non-cooperating academics emphasise

cultural factors such as differing motivations between businesses and universities and the businesses' lack of awareness of university research activities. Aligned with the academic perception, barriers most strongly perceived by Spanish HEI representatives also relate to lack of funding, differing motivations and the businesses' lack of awareness.

While funding to undertake cooperation emerges as one of the top five UBC facilitators, relationship related factors emerge as the most prominent ones. The existence of mutual commitment, mutual trust and a shared goal facilitate and thus drive cooperation. Cooperating academics also highlight the business interest in accessing scientific knowledge as a facilitator and HEI representatives recognise the importance of a prior relation with the business partner. This supports the vision that any effort dedicated to enable and increase cooperation between Spanish businesses and universities should focus on relationship development as a success factor.

Although cooperating academics highlight research motivations, such as gaining new insights and using it in practice, academics not cooperating are motivated by the willingness to contribute to the mission of the university and improve graduate employability. However, both coincide in addressing societal challenges and issues as an important motivator. HEI managers are motivated to undertake UBC mainly to positively impact society and to obtain financial resources. Improving the university's reputation also emerges as a motivator. In general, motivations involving benefits for other stakeholders hold great importance.

The level of development of UBC supporting mechanisms in Spanish HEIs is similar to the European one. High-level strategic developments such as top-level management commitment for UBC and a documented mission or vision embracing UBC are perceived as the most developed. On the contrary, specific incentive and recognition systems and the reduction of teaching time in exchange for extended cooperation emerge as the least developed. Career offices and agencies dedicated to UBC are also perceived as well-developed structures. Operational mechanisms are student-focused and IP legislation as well as regional innovation policies hold great importance within Spanish HEIs.

As so, Spanish academics who already collaborate with businesses have a positive view of their abilities and roles in undertaking UBC. They identified their strengths in the research area, and they believe it is the university's role to collaborate with businesses. However, they perceive they have insufficient support to undertake UBC. Spanish academics seem to be satisfied with the joint activities with businesses in research, however the education-related UBC has significantly lower satisfaction rates, which corresponds to the European average.

The Spanish business perspective, according to the European Commission (2017F), shows a relatively high engagement in research related cooperation. Thus, most businesses cooperate to a medium-high extent with universities in joint R&D, and several in consulting. Fewer businesses are involved in the mobility of staff. Education related cooperation also shows significant engagement, with two thirds of the businesses participating in the mobility of students. Valorisation and management activities are considerably less developed with less than half of businesses not undertaking these types of

cooperation at all. The educational activities of curriculum co-design, co-delivery and student entrepreneurship are particularly low. Spanish businesses perceive themselves as the main actors reaching out for collaboration. They also see current university students, alumni and government as proactive UBC initiators. On the contrary, Spanish representatives identify internal and external intermediaries as well as university management as those stakeholders that less often initiate UBC.

Primary barriers identified, relate to a lack of people with business knowledge within universities and missing financial support mechanisms from government. Moreover, business respondents point towards cultural differences between the two organizations (e.g. time horizons and motivations), as well as the high level of bureaucracy in HEIs.

That being said, and while funding to undertake cooperation is indicated as one of the top five facilitators for Spanish UBC, factors related to the individual relationships emerge to be of even higher importance. It is the existence of trust, a shared goal, and commitment alongside prior relations with a partner that facilitate cooperation for Spanish businesses. These results indicate that any effort towards enabling cooperation between businesses and universities should focus on relationship development as a basis for successful collaboration.

Also, Spanish businesses tend to cooperate with universities, principally to improve their own innovation capacity, to get access to new technologies and knowledge and to pursue future qualified talent. Further motivations to engage in UBC include positively impacting society, getting access to better qualified graduates and obtaining funding. Generally, Spanish businesses perceive themselves as UBC beneficiaries, but they see for themselves less benefits than for students and HEIs.

Strong emphasis has been placed on the development of UBC supporting mechanisms by universities, and yet little is known about such mechanisms in the business realm. This indicates that the strategies are those mechanisms that have the highest development, like the existence of resources to support cooperation, a committed top-level management and a defined strategy for collaborating with universities. Additionally, the majority reports the existence of student projects within their business and a systematic R&D programme. The most underdeveloped supporting UBC mechanisms in Spain include joint laboratories, academic-idea competitions and the funding of adjunct positions or chairs within a university.

As of that, Spanish businesses perceive themselves to be supportive towards UBC. They report having the capability to absorb knowledge and technology from universities and enough support to undertake UBC. Spanish businesses recognise the important role played by HEIs in their innovation efforts. They also state that they have a lot to offer to universities regarding research. However, Spanish businesses are less supportive towards UBC in education and find themselves least inclined towards taking the responsibility to collaborate with universities in this field. Generally, they are less satisfied with collaboration in education than in research.

2.10 Vision, Scenarios and Strategies for the biohealth sector

With the biohealth sector being the key of European development, it is more urgent than ever to meet the challenges of UBC that were revealed in the previous chapter to boost innovation and business acceleration. In all three countries the perspectives reveal areas of improvement that BIO-ALL takes into consideration and analyses it side by side with the EU perspective for a prosperous biohealth and biotech development.

Nowadays, biotechnology is a transversal activity, strongly based on R&D and high qualification of human resources, capable of bringing a strong potential for differentiation, innovation and valuing the economic sectors in which it is applied. Biotechnology is therefore recognized by developed economies as an essential and strategic investment. In fact, in the last 30 years, biotechnological innovation has brought concrete benefits to a large number of industrial sectors and has contributed significantly to an improvement in the social and human capital of societies in industrialized countries, as well as the well-being of the populations.

So, although often invisible, biotechnology is already present in people's daily lives. Biotechnological innovation is crucial for increasing industrial sustainability through the increasing substitution of derived raw materials of the oil industry by renewable raw materials and by reducing the environmental impact of many of the human activities of modern societies.

A biotechnology company, in the modern sense of the term is by definition, a company that will develop new products or services based on R&D. Soon, they will innovate products, which will be superior to existing solutions - when there are any - and therefore, they will also require, by definition, a technological development effort that is generally intensive in terms of capital consumption. The only reason to invest in the development of a new product is the existence of a need that this product will satisfy or fill. So, this is the starting point for any entrepreneur: thinking if the idea meets a need. In biotechnology, and precisely because of the type of investment associated with the development of a new product, this need must be large enough to offset the cost, and in particular the risk, arising from the R&D work to be carried out. That is why good projects in biotechnology are always ambitious.

This exponential growth in biotechnology in recent years is undoubtedly linked with the bet on training and qualification of human resources. The number of doctorates has been increasing at a steady pace as well as the number of postgraduate training programs. If on the one hand this movement created highly qualified and multidisciplinary resources (many of them with international experience), liable to be integrated into the emerging biotechnology business fabric, on the other hand this exponential growth of graduate students has led to an excess of resources which, without another professional outlet, or because of the entrepreneurial environment where they graduated, are the source of the boom of new companies observed in recent years. But are these qualified human resources able to implement new biotechnological companies with just that stiff knowledge of the technical sectors or do they need to have a formal entrepreneurial education?

There is a need of creating forms of compatibility between entrepreneurial activities and training, and general academic training, opening new perspectives

for entrepreneurship as a university culture. However, the Universities continue to massively form human resources in the various technical-scientific aspects, but we must actively bet on entrepreneurial training, instilling in these new human resources the culture of risk, innovation and implementation and even the commercial valorisation of knowledge generated. This is even more crucial in the life sciences sector, where the number of graduates is very high, and the typical professional exit based on scholarships most often involves staying in research duties without betting on placing the research on the market. The implementation of incentives and initiatives in biotechnological entrepreneurship within universities makes sense to be continued and reinforced. It is also important to reinforce it both at the teachers, encouraging their more frequent intervention and deep in the existing business fabric, but also training students in the themes essential to the success of a new biotechnology-based company as innovation, entrepreneurship, technology transfer as well as all the necessary and distinctive soft skills of the personal and professional success of each one. This will be the basis of tomorrow's success of nascent companies in biotechnology, which has had an extraordinary impact on health care during the past thirty years. This will continue in the future, as the understanding of the currently untreatable diseases grows, governments and firms around the world will continue to advance in biotechnological innovation. Business practices will evolve in order to manage the expensive, time-consuming, and risky process of product development. This will lead to a continuing stream of new types of medicines, leading to breakthroughs in healthcare.

According to the OECD (2014), there are 7 types of health biotech related innovations that will have a high probability of reaching the markets by 2030:

- Many new pharmaceuticals and vaccines, based in part on biotechnological knowledge, receiving marketing approval each year;
- Greater use of pharmacogenetics in clinical trials and in prescribing practice, with a fall in the percentage of patients eligible for treatment with a given therapeutic;
- Improved safety and efficacy of therapeutic treatments due to linking pharmacogenetics data, prescribing data, and long-term health outcomes;
- Extensive screening for multiple genetic risk factors for common diseases such as arthritis where genetics is a contributing cause;
- Improved drug delivery systems from convergence between biotechnology and nanotechnology;
- New nutraceuticals, some of which will be produced by GM micro-organisms and others from plant or marine extracts;
- Low-cost genetic testing of risk factors for chronic diseases such as arthritis, Type II diabetes, heart disease, and some cancers;
- Regenerative medicine providing better management of diabetes and replacement or repair of some types of damaged tissue.

For this to be a reality by 2030, there is a real need to foster entrepreneurship and innovation both in Universities and in Businesses and through them (the UBC). Biotechnology will be a reality if it is fostered by governments, Universities and Business, and will be in our life in everything we do.

Also, according to the OECD (2014), in order to be aware of the challenges biotechnology will have in the future, we must look at these 7 guidelines:

- The need to prepare the foundation for the long-term development of the Bioeconomy: As for that there is a need to create and maintain markets for the environmentally sustainable products, investing in multi-purpose infrastructures and education. As for health measures, there is a need to develop regulation and research, because of the future health record systems that will link all prescribing histories, genetic and other information, in order to support long-term research into health outcomes.
- Reverse the neglect of agriculture and industrial biotechnologies: This need comes in order to boost research in agricultural and industrial biotechnologies, using and supporting international agreements to create and sustain markets for environmentally sustainable biotechnological products.
- Be prepared for a costly but beneficial revolution in healthcare: The high cost of many health biotechnologies will be difficult to justify without correspondent health improvements in terms of health outcomes. Furthermore, some emerging technologies such as regenerative medicine and personalised and preventive medicine, could require far-reaching changes in healthcare delivery.
- Turn the potentially disruptive power of biotechnology to economic advantage: Several biotechnologies that promise productivity improvements, better health, or environmental sustainability could disrupt current business models and economic structures. Many of these technologies will not reach their potential unless they can overcome economic and social barriers to their development.
- Reduce barriers to biotechnology innovation: High research costs, regulatory barriers, and market concentration can prevent new entrants, hindering biotechnological innovation, especially for small market applications.
- Promote the integration of biotechnology research across commercial applications: Knowledge spill-overs across research disciplines and commercial applications can maximize the economic and social aspects of the Bioeconomy. Support for integration requires coordinated actions that draw on the expertise of numerous government ministries, including those responsible for agriculture, education, environment, health, industry, natural resources, and research.
- Create an ongoing dialogue among governments, citizens and firms: Many of the policies to support the Bioeconomy will require the active participation of citizens and firms. Governments need to address some of the misconceptions around biotechnology and describe the different alternatives for managing sustainability.

Summing up, biotechnology offers technological solutions for many of the health and resource-based challenges facing the world. It can increase the supply and environmental sustainability of food, feed and fibre production, improve water quality, provide renewable energy, improve the health of animals and people, and help maintain biodiversity by detecting invasive species. Yet biotechnology is unlikely to fulfil its potential without appropriate regional, national and, in some cases, global policies to support its development and application. Policies to support entrepreneurship and innovation are important, as is start-ups financing, as well as synergies between companies and academia. In this sense, it is important that we all move in the same direction so that the strategies implemented lead to the idealized visions and scenarios, allowing everyone to have a better quality of life and greater environmental sustainability.

Hereupon, and regarding the spread of the Covid-19 pandemic, there is a broad shared consideration between scholars and business, that there will be changes and innovations in the health sector. It is expected that public policies (especially in the health sector, where the process of privatizing the provision of services is being established over the past thirty years across Europe) will undergo a sudden and symmetrical change of direction. Therefore, public health will have to become mostly centralized again, being the defence system and the driving force for the well-being of citizens, distributed across territories. Hence, there will be a need to develop and foster new ideas and new approaches. As for that, funding will need to shift in order to respond to the new public needs. But not only go again toward public health provision of services but also improve public-private partnerships to make the system more flexible without incurring in large public investments.

In terms of public health, it is important to point out that this pandemic does not only affects those who have the disease, but everyone else who has chronic and serious diseases, and who will suffer from not having the treatments they need, because health systems are completely overloaded. This will contribute to higher mortality in general. Research resources and funding will need to change as of right now. We will need to move from scarce resources and limited funding to a scenario of huge access to financing. Funding will also need to involve the development of new financial instruments in the international and European scope.

It's important to note that policies are already starting to appear (in fact there have already been subsidies) to boost European production of health products (IPE – Individual Protective Equipment hospital equipment ...), and improve storage and strategic reserves.

This will for sure attract the creation of new biohealth related firms, but also the attention of other companies that will change their R&D into biohealth measures. Right now, we are already seeing companies deriving their production for situations related to public health and biohealth (e.g. masks, gowns, fans, etc.) in order to respond to the immediate needs of the populations.

The incoming financial support will also be a driving force for Universities to boost investigation, but also a mean to rethink investigation wise on biohealth, fostering entrepreneurship and innovation among the student community, and through direct relations with firms, just as previously mentioned.

A common orientation for the challenges ahead will be increasingly needed, and it is in this sense that a guideline should be structured so that we do not have to wait for a forced and lagged answer in the event of a future pandemic, such as Covid-19.

Then, it's also essential to highlight that although regulation could be an entry barrier, in the current Covid-19 pandemic, the EU wants safe products on the market (drugs, respirators and vaccines) so a strict regulation is necessary to avoid tragedies. All medicines must be authorized before they can be used by the general population. For this to happen, they must pass tests that guarantee

their safety, immunogenicity in the case of a vaccine (that is, the ability of an antigen to activate the immune system and produce an immune response), and protective efficacy.

The regulations used are very strict and were born, according to Roger Solanas, mainly as a result of three dramatic events. Such as the Thalidomide crisis, Nuremberg trials and Tuskegee experiment.

Finally, and summarising, the pharmaceutical trade has become an international exchange network. This global interconnection needs to be addressed through regulatory structures that allow national authorities to exchange information and skills quickly and efficiently. For this reason, the medicines that have an acceptable quality need a strong regulatory framework.

3 Objectives

The core objective of the present Deliverable is to provide a shared comprehensive overview on the state-of-play and needs of key actors in the BIOHEALTH sector and benchmark good practices to stimulate engagement of such key actors and capitalisation of lessons learnt. The Co-deliver of this blueprint will support, leverage and accelerate systemic changes envisaged by the BIOHEALTH Gear Box. Moreover, this roadmap for enhanced cooperation between and within key actors at national and European level (Academia, Business and Incubators/ Accelerators) supports, leverages an accelerates entrepreneurship and innovation dynamics inside the BIOHEALTH sector.

This Blueprint constitutes a roadmap based on an exhaustive mapping of the current landscapes, trends and lessons learned (state-of-play and good practices). It presents possible evolution scenarios, related strategies and actions and provides recommendations for a brighter future of UBC and entrepreneurial and innovative processes within the sector.

4 Methodology

About this deliverable, there were some changes regarding the initially idealized. As of that, regarding the health rules applied due to the Covid-19 pandemic, face-to-face interviews and focus groups could not be carried out. As such, the questionnaires were made online and meetings were made via "web calls".

As a result, the responses and opinions to the questionnaires may have shifted, since the countries where the information was collected were dealing directly with the pandemic. In addition to that, the respondents were people directly linked to the BIOHEALTH area. Their opinions reflected the expectations, and the activities that are being developed in the area of research and development of new products (e.g. reagents and personal protection for doctors and health personnel), new drugs, new antivirals, new machinery (e.g. respirators and machines for new tests, etc.), or even the development of new vaccines.

For the development of the blueprint, a survey was developed and interviews were made to relevant stakeholders of the BIOHEALTH sector. A set of responses were collected, being 14 from Academia, 9 from incubators/accelerators, 29 from Business, and 13 from others (chambers of commerce, national associations, among others)

Moreover, this Blueprint for the development of a roadmap for the future of innovation and entrepreneurship in the BIOHEALTH sector involves:

- i) the identification of possible visions, scenarios and strategies throughout key players input;
- ii) validation with experts;
- iii) development of guidelines and recommendations;
- iv) validation with key players and opinion/policy makers.

In fact, this document exemplify a set of visions, scenarios and strategies fine-tuned with the support of a group of experts involved in the gathering of information through a series of semi-structured interviews.

The Blueprint will be revised and updated, under the leadership of the Business partners considering the evolving pace, technological advances and dynamics within the BIOHEALTH ecosystem. This work will be done maintaining the international pillars of cooperation between Academia, Business and Incubators/Accelerators. Also, lessons learned from the project will be incorporated and the success achieved will constitute a best practice that will inspire further cooperation actions between key-players. An updated vision and related strategies will be designed, and new actions will be planned and give new content and direction to the BIOHEALTH Gear Box Blueprint ("Driving Innovation and Entrepreneurship in the BIOHEALTH Sector").

5 Results

5.1 Overall Results

The overall results of the survey can be observed in the Table 5.1 displayed below. A total of 65 questionnaires have been carried out.

Table 5.1: Overall Interviewees profile

| Profile of the interviewees | | | | |
|-----------------------------|-------|----------|-------|-------|
| Organization | Italy | Portugal | Spain | Total |
| Academia | 7 | 5 | 2 | 14 |
| Incubator/Accelerator | 5 | 3 | 1 | 9 |
| Business | 7 | 8 | 14 | 29 |

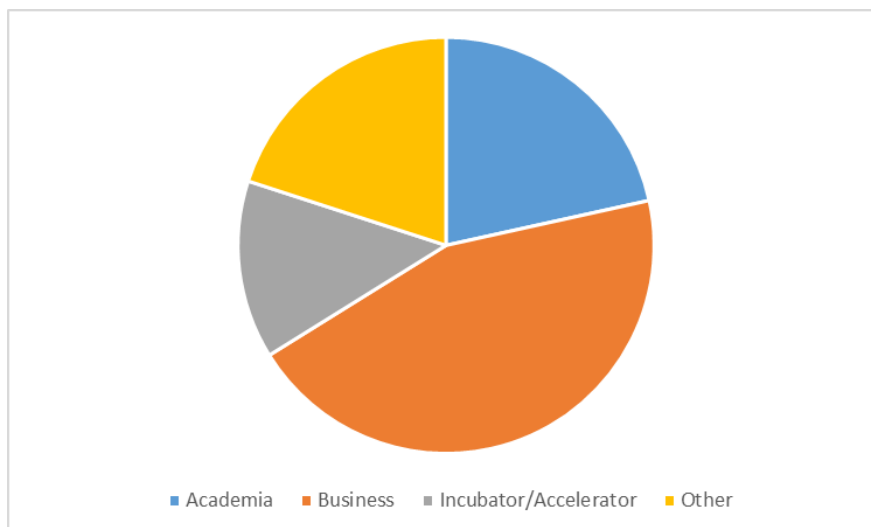
| | | | | |
|-------|----|----|----|----|
| Other | 6 | 2 | 5 | 13 |
| TOTAL | 25 | 18 | 22 | 65 |

Source: BIO-ALL, 2020

When discussing the content of the questionnaires', it is important to take in consideration that most of the questions were open-ended questions, which leads to answers with more depth and length. Consequently, there are substantial differences between the answers received which, although predictable, is interesting in helping to have a broader perspective on the problem.

Profile of the interviewees

Graph 5.1: Profile of the interviewees



Source: BIO-ALL, 2020

Among the 65 questionnaires received overall, 14 responses came from Academia, 29 from Business, 9 from Incubator/accelerator, and 13 from Other relevant stakeholders.

Visions of the BIOHEALTH sector, considering entrepreneurial and innovative processes

Regarding the vision of the BIOHEALTH sector, considering entrepreneurial and innovative processes, the common denominator among all countries was "development". All people interviewed thought about the presence of big opportunities in this area. Moreover, many interviewees pointed out lack of investments or equipment in this sector. Turning the attention to the answers at a "National Level", Italian incubators and accelerators focused on the growth of

the BIOHEALTH sector from a holistic point of view, also by **shifting from “long life” goal to a “healthy life” goal**. Businesses interviewed by Spain pointed out instead the **need for the presence of strong private player in the BIOHEALTH landscape**. In general, Portugal interviewees view the sector as one to watch in the next years, with great possibilities to invest, explore innovation and entrepreneurship, if the **path is clear in terms of regulatory affairs** both from national and international point of view.

- **shifting from “long life” goal to a “healthy life” goal**
- **need for the presence of strong private player in the BIOHEALTH landscape**
- **establish a clear path in terms of regulatory affairs**

Scenarios for the BIOHEALTH sector, considering entrepreneurial and innovative processes

Regarding the scenarios for the BIOHEALTH sector, the respondents outlined their answers in a general way and then pointing out their assumption for short, medium and long term situations. Predictably, the **COVID-19 pandemic** was one of the protagonists in such answers, since this event is and will continue to influence the whole world and especially the BIOHEALTH sector. At a national level, Italian stated how **regulations and tax advantages** could be present in the upcoming scenarios. Moreover, of course, **new technologies** will be progressively appearing, as the years go by and the business world evolves. Spain respondents focus on the **disconnection between public and private entities** and the difficulties to start projects from 0 in the region, due to lack of strategic and economic support. Inefficiently managed public structures, directly impacting the generation of **new local innovations** that can impact globally and try to get an ideal situation like this, correctly managed public platforms. Portugal respondents stating a different but as much important convergence, by creating Hubs to **combine academic and research know-how** with that of management, finance and entrepreneurship in order to develop ideas and innovation. And here too, as the Italians expert pointed out, for these scenarios to come true some respondents point out the need of a guideline and a need to **diminish the bureaucracy** that can be responsible in ending some innovative business that are starting.

Drivers and trends in future scenarios for the BIOHEALTH sector

Turning the focus on the drivers and trends in future scenarios for the BIOHEALTH sector, many interviewees across the three countries pointed out how National and EU strategies will be protagonist for the development of this sector. Moreover, **stronger investment in research and innovation** will keep companies and universities going side by side with these trends. Italians respondents pointed out the **rise in demand coming from the public sector**:

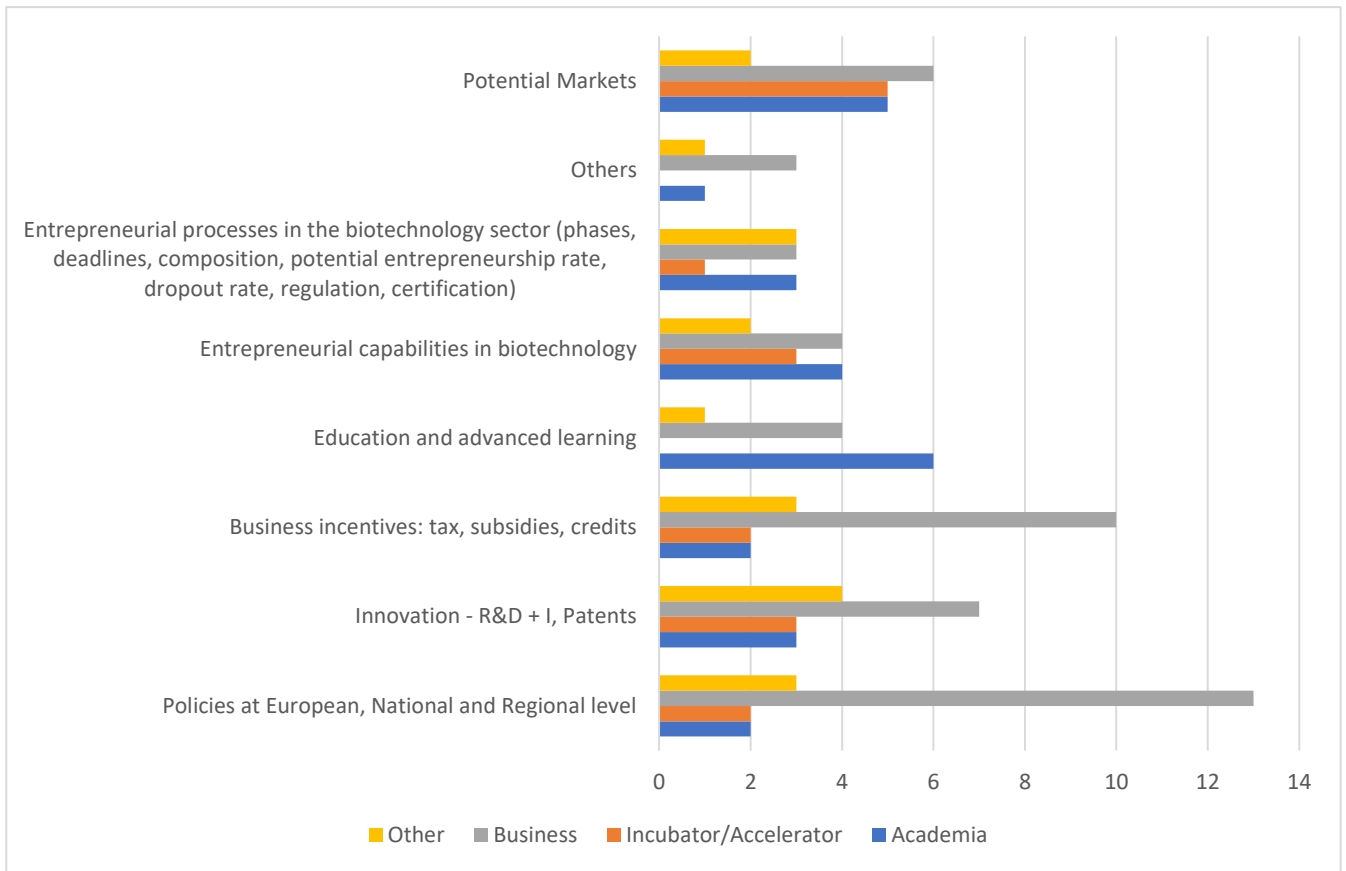
vaccines; drugs; new medical products; new technologies; and new organizational models and structures for the provision of these goods and services. The answers obtained in Portugal, seem to be in line with these considerations, since they stated the **need to gather experienced entrepreneurs** in order to keep up with such evolution in this sector. This could be the role of the Universities, by inviting them as experienced partners and mentors in hubs. Looking to Spain, the interviewees stated that private initiatives, entrepreneurs and businessmen will be the drivers of these trends. Also, there will have to be a greater connection between companies and research groups to advance together.

Strategies and actions to achieve scenarios in the sector, considering the entrepreneurial and innovative processes

As for the most practical strategies and actions to achieve the scenarios in the sector, cooperation, investments and public interventions will be among the most critical factors. And again, **networking between academia and business** seems to be the road to follow, in order to ensure the success of the sector. Italian respondents suggested to connect private savings and investment, and also support **start-ups growth through specialized investment funds** and the creation of markets for financing start-ups. Spanish respondents expanded the range of useful synergies, stating that cooperation among all actors in play will be key to achieve success: in particular, long-term wise, the strategy to be followed is **shift from a competitive environment to a cooperation system** where projects and entrepreneurs can take advantage of and benefit from the infrastructure and means that exist. Portuguese interviewees, in order to create synergy between Universities and Businesses, suggested to promote scientific production and at the same time **develop adequate tools to protect intellectual property**. On the short term this would translate in defining a tangible plan in developing competences, on a medium term by betting on training and sharing the good practices, and on a long term by materializing all the above in new companies, better employees and a bigger know-how in the biotechnology areas.

Strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector

Graph 5.2: Strategies and actions to promote innovation and entrepreneurship, answers statistics



Source: BIO-ALL, 2020

On an overall level, and looking at graph 5.2 displayed above, business respondents focus on policies at European, National and Regional Level; Business incentives: tax; subsidies; credits; and innovation – R&D+I and patents. Considering the incubator/accelerator respondents, these are divided amongst almost all the possible answers, having prevalence: potential markets; and entrepreneurial capabilities in biotechnology. In this scope, it is worth note that none of the interviewees from the incubator/accelerator category choose the option of education and advanced learning. On the other hand, academia respondents selected with more prevalence the option of education and advanced learning followed by the potential markets. We can also observe that other stakeholders are more divided in their responses and encompass all of them.

Regarding the Strategies and Actions to promote innovation and entrepreneurship, the answers differed among the respondents from the three countries. Italian interviewees focused on the “Potential Markets” as strategy: 15 people out of 26, in fact choose this option. Spanish respondents opted mostly for the option: “Policies at European, National and Regional level”, which remains one of strategies most discussed in this report. Portuguese respondents, instead, mostly indicated “Business incentives: tax, subsidies, credits” as the most important strategy: this one too is, in fact, a crucial factor that rose up within the report.

Overall, as can be seen for the bar graphs, the preferred answer was “Policies at European, National and Regional level”, with 13 preferences.

Recommendations for policy makers to achieve the scenarios and strategies

Finally, regarding the recommendations for policy makers to achieve the scenarios and strategies, the interviewees, in various ways, pointed out how **“knowledge” is the key** to start any new result. Spanish, for example, stated that there certainly must be an **adequate regulatory framework** but, without knowledge, it is impossible to start a business in the BIOHEALTH sector. Italian respondents turned their attention to the consequences generated by COVID-19, which will have lasting affect over time: **Bureaucratic simplification** for access to finance will be crucial, so that any kind of future development will be properly efficient. Another interesting point of view is given by the Portuguese respondents, which stated that **Intellectual Property is the cornerstone for the BIOHEALTH sector** as it is the connection between Universities and Businesses, which for its turn should be far more efficient.

5.2 Results from Italy

5.2.1 Interviewees characterization

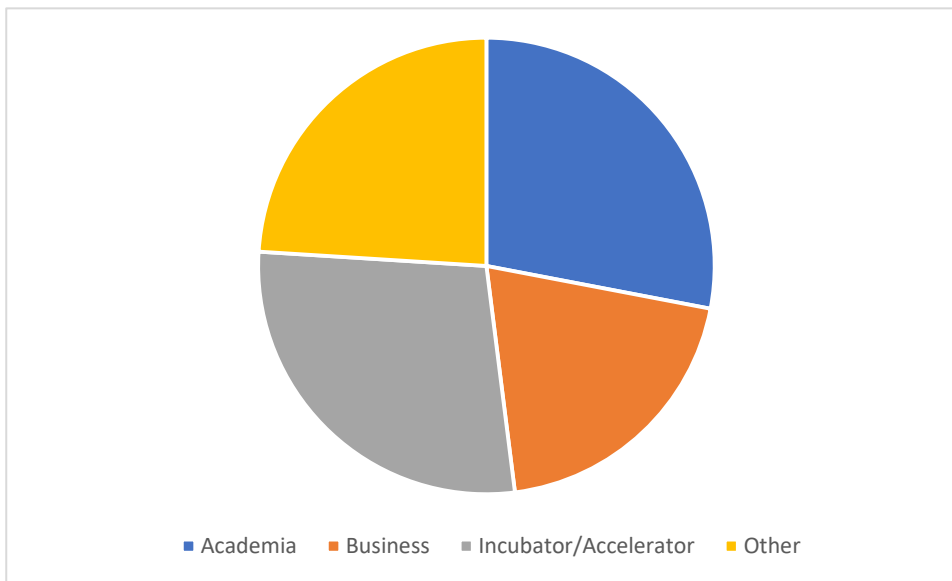
This questionnaire was designed to gather information on what the main thoughts of the actors of the BIOHEALTH sector are on the future of the sector relating it to innovation and entrepreneurship. The set of actors is composed by people related to the BIOHEALTH sector from the Academia, Incubator/Accelerator, Business or other relevant stakeholders.

The questionnaire was designed, tested and applied in order to collect information from the above sources cited and was anonymous and confidential, serving only for the purposes of data collection and subsequent analysis and action design.

The results presented in this chapter of the report reflect the perceptions of the interviewees in Italy. Data was collected by means of an online survey sent out via email to a database of actors from the BIOHEALTH sector, leading to a total of 25 Italian responses. The study measured the perceptions of respondents with respect to their BIOHEALTH sector perception and predictions.

Among the 25 questionnaires received from Italy, 7 responses came from Academia, 5 from Business, 7 from Incubator/accelerator, and 6 from Other relevant stakeholders.

Graph 5.3: Profile of the interviewees (IT)



Source: BIO-ALL, 2020

5.2.2 Visions of the BIOHEALTH sector, considering entrepreneurial and innovative processes

When asking a question about their vision on the BIOHEALTH sector, we aimed to understand the similarities and differences among stakeholders. Nanus (1992) defines “vision” as realistic, credible, attractive future for an organization. A realistic vision therefore must be relevant to an organization or a sector to be credible. A vision must inspire and motivate those who are in the sector to implement it. It must be seen by all as realistic, honest and achievable. It must be attractive. A vision is meant to inspire the leaders and the organizations to look into the future prospects of the sector. A vision is not in the present or where we are now, a vision is where the BIOHEALTH sector will be in the future.

As for that, we wanted to know what do the stakeholders understand in terms of the future of the BIOHEALTH sector. Sharing a future image of the BIOHEALTH sector will be a guideline to strive and find the best solutions to make it happen. The following table has the answers that the interviewees gave.

Table 5.2: BIOHEALTH Sector Vision (IT)

| A) Describe your vision of the BIOHEALTH sector, considering entrepreneurial and innovative processes. (Definition of "Vision": Stakeholders' idea of the sector and represents what the sector intends to become) | |
|--|---|
| Organization | Answer |
| Academia | “The BIOHEALTH sector should become a large medical and scientific centre capable of attracting skills and abilities from all other scientific sectors to provide products, services, technologies and tools for public and private health care.” |

| | |
|-----------------------|---|
| Academia | "The BIOHEALTH sector will attract the greatest attention from the world of research and technological development." |
| Academia | "The BIOHEALTH sector completely renewed in products, services, technologies and organizational models." |
| Academia | "The BIOHEALTH sector will need new organization models and technological developments." |
| Academia | |
| Academia | |
| Academia | "The BIOHEALTH sector will be the centre of new studies." |
| Incubator/Accelerator | "The BIOHEALTH sector will be an economic growth engine." |
| Incubator/Accelerator | "The BIOHEALTH sector will continue to grow." |
| Incubator/Accelerator | |
| Incubator/Accelerator | "The BIOHEALTH sector will contribute to shift the goal from "long life" to "healthy life"." |
| Incubator/Accelerator | |
| Business | "Creation and diffusion of new companies and innovations in the BIOHEALTH sector." |
| Business | "The BIOHEALTH sector will act as a driving force and engine of development for a new public health economy." |
| Business | "Growth and consolidation of the pharmaceutical sector at European and international level." |
| Business | "BIOHEALTH sector will direct towards better coordination and make future healthcare people-centred." |
| Business | "BIOHEALTH sector will lead benefits and incentives for a healthy and productive society." |
| Business | |
| Business | "BIOHEALTH sector will promote balance and active lifestyle to all levels of society." |
| Other | "The BIOHEALTH sector will integrate the skills of the biomedical world, biosensors and Artificial Intelligence to support and treat each person in an individualized way." |
| Other | "The BIOHEALTH sector will combine technologies from different areas." |
| Other | "The BIOHEALTH sector will merge know-hows and methodologies from different areas." |
| Other | |
| Other | "BIOHEALTH system with top-level integration among different scientific areas." |
| Other | "BIOHEALTH sector to be the leader to embrace innovation." |

Source: BIO-ALL, 2020

In the table 5.15 presented above, we can see the interviewees' visions for the BIOHEALTH sector. The answers from the academia indicated the need to attract skills, abilities and, more in general, attention from all the scientific and research sectors. Moreover, the answers indicated also a direction in renewing "products, services, technologies and organizational models". This indicated both the need and the intention of expanding the BIOHEALTH in different direction in a holistic way.

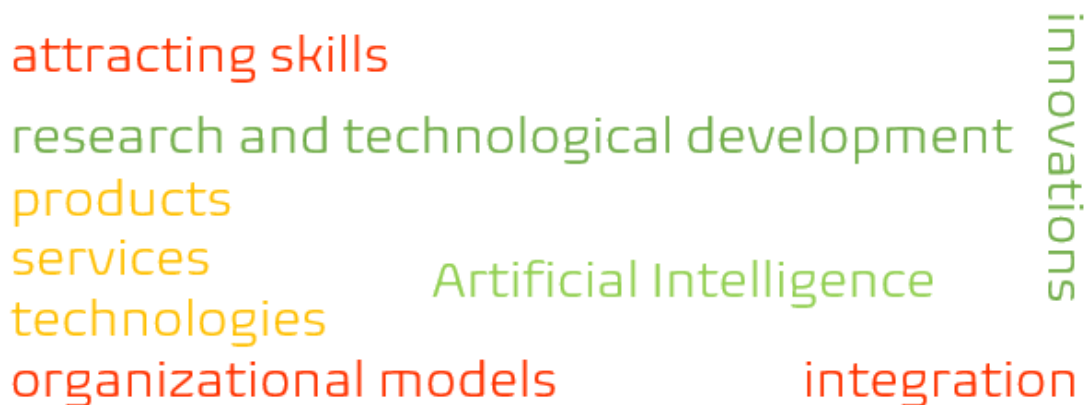
Incubators and accelerators focused on the growth of the BIOHEALTH sector, both from an economic and holistic point-of-view. Moreover, one interviewee pointed out the critical contribution of the BIOHEALTH sector in the shift from “long life” goal to a “healthy life” goal.

The answers from the business world pointed to the “development” of the BIOHEALTH sector in the industrial world: creation and diffusion of new companies could act, in fact, as “driving force” and “engine of development” for a new public health economy.

More in general, stakeholders pointed out the need of integrate skills among the biomedical world in order to foster progress in this sector.

In the figure below we can see the different visions of the BIOHEALTH sector, considering entrepreneurial and innovative processes by the interviewees in Italy.

Figure 5.1: Representation of the visions of the Italian interviewees for the BIOHEALTH sector



5.2.3 Scenarios for the BIOHEALTH sector, considering entrepreneurial and innovative processes

We asked the interviewees about the scenarios that they see for the future of the BIOHEALTH sector. It is important to understand what are the available options and the possibilities that could happen in the future. As for that we also wanted them to point out and clarify them in short (1-3 years), middle (3-7 years) and long term (10-15 years).

Korte and Chermack (2007) say that scenario planning is a means for making explicit the mental models supporting organizational reasoning and action. Once made explicit, these models can be challenged, and alternatives developed. As such it is important to hear the opinion of the different stakeholders, in order to line the different scenarios considering the entrepreneurial and innovative processes, and then define strategies for those possible scenarios. The following tables have all the scenarios received.

Table 5.3: BIOHEALTH Sector Scenarios (IT)

| B) Describe the possible scenarios of the BIOHEALTH sector that you have in mind, considering the entrepreneurial and innovative processes. (Definition of "Scenario": one of several possible situations that could happen in the future) | |
|--|--|
| Organization | Answer |
| Academia | "The most likely scenario, also in light of the present Covid-19 pandemic, is that the BIOHEALTH sector assumes a central role in the redefinition of new lifestyles, study and work." |
| Academia | "Covid-19 pandemic is going to influence the sector." |
| Academia | "A scenario where the BIOHEALTH sector will be central for the public administration and private companies." |
| Academia | "COVID-19 pandemic is a factor that will change the society we live in as a whole." |
| Academia | "The BIOHEALTH sector will be at the centre and protagonist of a massive and intense innovative process in the public health sector." |
| Academia | "Over the next decade, healthcare services available will increase." |
| Academia | "BIOHEALTH sector will fulfil the need for accurate diagnosis and effective management of diseases." |
| Incubator/Accelerator | "BIOHEALTH sector will provide mechanisms to facilitate the access to distributed data sets." |
| Incubator/Accelerator | "BIOHEALTH sector will be influenced by ethical regulatory." |
| Incubator/Accelerator | "The BIOHEALTH sector will develop rapidly and primarily in countries where venture capital instruments are widespread." |
| Incubator/Accelerator | "The BIOHEALTH sector is facing a period of intense growth." |
| Incubator/Accelerator | "The BIOHEALTH sector will act as a driving force for many economic sectors." |
| Business | "BIOHEALTH sector will foster collaboration and knowledge sharing." |
| Business | |
| Business | "BIOHEALTH stakeholders will be more involved in the strategic decision-making process in healthcare." |
| Business | "Financial resources will be planned for epidemiologically relevant and cost intensive diseases." |
| Business | "New methodologies and know-hows will become an additional tool in activities and research." |
| Business | |
| Business | |
| Other | "I expect a progressive convergence of nanotechnologies, sensors and artificial intelligence." |
| Other | "Use of new technologies." |
| Other | |
| Other | "IOT – Internet of Things." |
| Other | |
| Other | |

Source: BIO-ALL, 2020

The table above has all the answers the interviewees gave as for possible scenarios in the BIOHEALTH sector. The first answer from Academia reflects the current trend influenced by the presence of the Covid-19 pandemic: with the post-pandemic developments, is likely that the BIOHEALTH sector will assume a central role in the redefinition of new lifestyles, study and work. Moreover, it is

clear how the BIOHEALTH sector “will be at the centre and protagonist of a massive and intense innovative process in the public health sector”, thus becoming essential for public administration and private companies.

Incubators and accelerators stated that the BIOHEALTH sector will fulfil the need for more accurate diagnosis and better management of diseases, in general. Moreover, they pointed out that ethics regulatory will influence the trend in the BIOHEALTH sector.

Business focuses again on the macroeconomic trends that will result in the following time period. According to the answers given, the BIOHEALTH sector will face a period of intense growth and will develop mainly in countries where venture capital instruments are widespread. This trend will result as a driving force for many economic sectors.

The stakeholder engaged with this interview pointed out a progressive convergence in new technologies, such as nanotechnologies, sensors and artificial intelligence.

The next three subchapters will analyze the interviewees’ answers about possible strategies for the BIOHEALTH sector in the short, medium and long term, in order to achieve the strategies.

5.2.3.1 Short term

Table 5.4: BIOHEALTH Sector Scenarios, short term (IT)

| H) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the short term (1-3 years) | |
|--|--|
| Organization | Answer |
| Academia | “Research for a vaccine for COVID-19 will influence all the health-related sector.” |
| Academia | “Focus and strengthen relationship between academia and businesses.” |
| Academia | “Vaccine for COVID-19.” |
| Academia | “Academia and business should focus on trying to find a solution for the pandemic problem together.” |
| Academia | “Funding for universities.” |
| Academia | “Tax advantages for universities.” |
| Academia | “COVID-19” |
| Incubator/Accelerator | “Start-ups should be more involved in the BIO-ALL sector.” |
| Incubator/Accelerator | “Technology to prevent and detect the coronavirus.” |
| Incubator/Accelerator | “Innovation to face unprecedented situation.” |
| Incubator/Accelerator | “Develop a technology/methodology to locate positive cases of Coronavirus faster.” |
| Incubator/Accelerator | “Bounce back from the current COVID situation.” |
| Business | “Incentives for research and jobs healthcare related.” |
| Business | “Incentives and tax advantages due to the current situation.” |
| Business | “Profound transformation in all the BIOHEALTH related supply chain.” |
| Business | “COVID situation.” |
| Business | |
| Other | “Start to reshape the financial sub-sector of BIOHEALTH areas.” |
| Other | “Digital innovation.” |
| Other | “COVID vaccines and medicines.” |

| | |
|-------|--|
| Other | |
| Other | |
| Other | |

Source: BIO-ALL, 2020

On a short term, the Academia focuses on the COVID-19 influence on the BIOHEALTH related scenarios. The research for a vaccine will be in fact the protagonist within all scientific areas.

Incubator and accelerators too cited COVID-19 as a protagonist in the coming period: they also pointed out the need to develop new technologies and methodologies to tackle this situation.

Business focused on the economic and social consequences of the COVID-19 pandemic and how institution should help society to get back on his feet (incentives, tax advantages, etc.).

Interesting response by the other stakeholders involved: they thought that the financial sub-sector of BIOHEALTH areas should be reshape, in order to respond to the changes brought by this new unexpected global event.

5.2.3.2 Medium term

Table 5.5: : BIOHEALTH Sector Scenarios, medium term (IT)

| I) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector in the medium term (3-7 years) | |
|--|---|
| Organization | Answer |
| Academia | "Fill the connection gap between Universities and companies." |
| Academia | "Ensure resources required to transform technology from a discovery into a product." |
| Academia | "Identifying and recruiting experienced entrepreneurs who have gone through the start-up process." |
| Academia | "Develop indicator to measure impact of product and services on human health." |
| Academia | "A consortium of programs aimed at building a community of entrepreneurs, scientists, investors and professionals that can Building such an ecosystem." |
| Academia | "Build communities of entrepreneurs, scientists, investors and professionals." |
| Academia | |
| Incubator/Accelerator | "Build a network of advisors to better understand all aspects of BIOHEALTH value chain." |
| Incubator/Accelerator | "Recruiting experienced entrepreneurs who come from the start-up environment." |
| Incubator/Accelerator | "Support and mentor start-ups and entrepreneurs." |
| Incubator/Accelerator | "Provide support to companies that decides to commercialize product or services." |
| Incubator/Accelerator | |
| Business | "Recover from COVID-19 pandemic aftermath." |
| Business | |
| Business | "Build and strengthen relationships with stakeholders across Industry and Investors." |
| Business | "Sustain the development and growth of future entrepreneurs." |
| Business | "Match technology with entrepreneur skills." |

| | |
|----------|--|
| Business | |
| Business | |
| Other | "Recover from pandemic." |
| Other | "Accelerate growth in cybersecurity and health technology industries." |
| Other | |
| Other | "Recover from COVID-19." |
| Other | "Support start-ups and early stage technology companies." |
| Other | |

Source: BIO-ALL, 2020

Respondents to the medium-term questionnaire, again mentioned COVID-19 situation and how its aftermath will affect society.

In particular, Academia underlined the importance of developing indicators to measure the impact of new product and services introduced in the market. Moreover, consortium and communities of stakeholders should be fostered in order to monitor and analyze the evolution of the market.

Incubators and accelerators mentioned too the creation of a network of advisors to better understand BIOHEALTH sector and the provision of support to companies that decide to commercialize product or services.

For businesses, the recover from the COVID-19 aftermath it's still imperative, along with the need to build and strengthen relationships with stakeholders across Industry and Investors.

The other stakeholders involved in the interviewees mainly focus on the COVID-19 aftermath and how it will change the BIOHEALTH landscape. Moreover, they pointed out the need to accelerate growth in cybersecurity and health technology industries, as a preparation to the evolution boost in technology that we will see across all industry sectors.

5.2.3.3 Long term

Table 5.6: : BIOHEALTH Sector Scenarios, long term (IT)

| J) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the long term (10-15 years) | |
|---|--|
| Organization | Answer |
| Academia | "Start following the goal of Universal Healthcare." |
| Academia | |
| Academia | "Developing local supply chain sources." |
| Academia | |
| Academia | "Digital health options will accelerate." |
| Academia | "Expect innovations with drones and robotics and other advanced technologies." |
| Academia | "Regenerative medicine." |
| Incubator/Accelerator | "Monitor laws and regulations related to health care." |
| Incubator/Accelerator | |

| | |
|-----------------------|--|
| Incubator/Accelerator | "Analyze legal concepts and principles related to health care." |
| Incubator/Accelerator | "Monitor privacy and confidentiality policies related to healthcare information data." |
| Incubator/Accelerator | |
| Business | "Keep designing, implementing continuous risk assessment and contingency planning." |
| Business | "Develop mobile health-care technologies." |
| Business | "Utilization of advanced computational systems." |
| Business | "EU and International policies." |
| Business | "National policies." |
| Business | |
| Business | |
| Other | "Networking." |
| Other | "Remote diagnosis." |
| Other | "We should expect another pandemic or another "black swan" in general that could influence the whole world." |
| Other | |
| Other | "New technologies." |
| Other | "Support from institution and government to keep the pace with the innovation." |

Source: BIO-ALL, 2020

Regarding the long-term scenario, the academia cited Universal Healthcare as a long-term goal to reach, along with the innovation in many fields, such use digital health, regenerative medicine, drones and robotics in general.

Incubators and accelerators cited the need to monitor laws and regulations and to analyze legal concept that could rise along with the evolution of the sector. Privacy and confidentiality policies related to healthcare information data were cited as important, too.

New technologies have also been cited by business and other stakeholders involved.

Figure 5.2: Representation of the Italian respondents BIOHEALTH Sector Scenarios



5.2.4 Drivers and trends in future scenarios for the BIOHEALTH sector

What follows is a brief appraisal of the drivers and trends that the interviewees feel is going to be included in the BIOHEALTH sector's future scenarios. Although it is important to point out scenarios, the prediction of future trends and drivers for the BIOHEALTH sector is a somewhat a hazardous exercise. As of that this will only be a glimpse of what can happen in the future, even though we can find similar paths and ways of convergence amongst the answers. Below is the table with the interviewees' answers.

Table 5.7: BIOHEALTH's Main Drivers and Trend Scenarios (IT)

| F) What will be the main drivers and trends in future scenarios of the BIOHEALTH sector? | |
|--|--|
| Organization | Answer |
| Academia | "UE Strategy. National priorities. Sensitivity and intensive and wide demand from the public sector." |
| Academia | "Vaccines, drugs, new medical products, new technologies, new organizational models for services provision." |
| Academia | "Supply of new drugs and vaccines as well as new organizational structures for public health." |
| Academia | "International priorities will drive the BIOHEALTH sector." |
| Academia | |
| Academia | "PPP will drive the evolution of the actors in the sector." |
| Academia | |
| Incubator/Accelerator | "Aging of the world population." |
| Incubator/Accelerator | "The creation of an BIOHEALTH ecosystem that covers all cycle of the product/service (research, approval, production, release)." |
| Incubator/Accelerator | "The need for targeted therapy for many diseases." |
| Incubator/Accelerator | |
| Incubator/Accelerator | |

| | |
|-----------------------|--|
| Incubator/Accelerator | "The need for the use of electronic devices, such as IT enabled medical devices." |
| Business | "New vaccines, new drugs, new technologies, new organizational models." |
| Business | |
| Business | |
| Business | "Telemedicine, artificial intelligence, big data, new drugs release and new diagnostics." |
| Business | "The main driver for BIOHEALTH will be the possibility to gain financial resources." |
| Business | "Healthcare spending per person will grow." |
| Business | |
| Other | "The emergence of new genetic skills will allow us to better understand the pathologies at an individual level. Targeted treatments and preventive interventions can be carried out, through localized use of gene therapies, immuno-modulators, neutralizing antibodies, brought to the site by organic, inorganic and hybrid vectors." |
| Other | "There will be a "multi-stakeholder" approach that will address health-care related challenges." |
| Other | |
| Other | |
| Other | "New policies will be holistically bases and cover both economic growth and sustainable development." |
| Other | "BIOHEALTH sector should be a key into education and innovation in general." |

Source: BIO-ALL, 2020

The Table 5.20 displayed above has the answers the interviewees gave for what will be the main drivers and trends in future scenarios of the BIOHEALTH sector. Academia responses underlined that European Union strategies intertwined with national priorities will lead the overall BIOHEALTH scenario. Moreover, there will be a rise in demand coming from the public sector: vaccines, drugs, new medical products, new technologies, and of course new organizational models and structures for the provision of these good and services.

Incubators and accelerators underlined that the average age of the world population will rise: this will be a key driver for all health-related sector in the future. Moreover, the need for targeted therapy will rise, along with the use of IT in this sector.

Businesses responses were in line with the academia considerations. New vaccines, drugs, technologies (such as artificial intelligence and big data) and organizational models are too considered to be the main direction the BIOHEALTH sector will go on. Moreover, one of the main drivers for the BIOHEALTH sector will be the possibility to gain financial resources.

The stakeholder contributions are interesting too: "the emergence of new genetic skills will allow us to better understand the pathologies at an individual level. Targeted treatments and preventive interventions can be carried out, through localized use of gene therapies, immuno-modulators, neutralizing antibodies, brought to the site by organic, inorganic and hybrid vectors." This

answer reflects the tendency of maximizing the customization of the treatments to each patient.

Figure 5.3: Representation of the BIOHEALTH's Main Drivers and Trend Scenarios, according to Italian respondents



5.2.5 Strategies and actions to achieve scenarios in the sector, considering the entrepreneurial and innovative processes

It is always tempting to take desires for reality. Although visions of the future or scenarios appear desirable, the choices and strategic direction of an organization or a sector do not necessarily match a single proactive vision. One must also be prone and prepared for expected changes to a sector's future environment (Godet, 2000). That is why it is important to define strategies and strategic actions in order to achieve the scenarios envisioned.

We asked the interviewees about the practical strategies and actions that will be necessary to achieve the scenarios. In the tables presented below we can see the answers they gave.

Table 5.8: BIOHEALTH's Most Practical Strategies and Actions (IT)

| G) Describe the most practical strategies and actions to achieve these scenarios in the sector, considering the entrepreneurial and innovative processes. (Definition of "Strategy": a detailed plan for achieving success ") | |
|---|--|
| Organization | Answer |
| Academia | "To recover the damage induced by COVID-19 it will be necessary the reorganization of the public health system. Production reorganization to ensure self-sufficiency for strategic products. Incentives for innovations, patents in the sector." |
| Academia | "Strong injection of public resources into the R&D system." |
| Academia | "To reach the success in BIOHEALTH it is required to increase funding to Academia." |

| | |
|-----------------------|--|
| Academia | "Facilitate cost-effective intervention in the BIOHEALTH sector." |
| Academia | "Improve the evidence-base, so that policy and decision makers can better understand the BIOHEALTH science." |
| Academia | |
| Academia | |
| Incubator/Accelerator | "Best practice model for healthy diets and lifestyle." |
| Incubator/Accelerator | "Develop best practices on healthcare." |
| Incubator/Accelerator | "Develop communication and technology initiative to help the final consumer to obtain and interpret information." |
| Incubator/Accelerator | |
| Incubator/Accelerator | |
| Business | "Develop all the means that can connect private savings to investment in start-ups through specialized investment funds and the creation of markets for listing start-up." |
| Business | |
| Business | "Support investment in start-ups through specialized investment funds and the creation of markets for the listing of start-up." |
| Business | |
| Business | "The most important factor to reach the success for a BIOHEALTH SME is to increase medium-long term financial resources." |
| Business | |
| Business | |
| Other | "Each strategy goes through the integration of skills. Public intervention will be essential for the results to be of universalistic and non-census use." |
| Other | "Government and public-private partnerships." |
| Other | "Develop best-practice models." |
| Other | |
| Other | "Evaluate the impact of investment of science in order to develop cost-efficient incentives." |
| Other | |

Source: BIO-ALL, 2020

In the previous Table 5.21, we can observe how the COVID-19 pandemic is influencing the opinion of the people active in the BIOHEALTH sector.

According to academia, in order to recover from the damage induced by COVID-19 it will be necessary the reorganization of the public health system: production reorganization will be a priority, as much as incentives for innovations. Strong injection of financial public resources into the R&D system and universities are, in fact, critical to foster the development in this pathway.

For accelerators and incubators is imperative to develop a list of best practices in this sector: this, in fact, could be the basis for a comprehensive blueprint for all the actors involved in this area.

Businesses focus instead in the role of financial resources and investment in the sector: connecting private savings and investment, and supporting start-ups' growth through specialized investment funds and the creation of markets for

financing start-ups. And, of course, the most important factor to reach the success for a BIOHEALTH SME is to increase medium-long term financial resources.

According to the other stakeholder involved in the interview, each strategy that is going to be implemented goes through the integration of skills. Public intervention will be essential for the results to be of universalistic and non-census use.

5.2.5.1 Short term

Table 5.9: BIOHEALTH's Most Practical Strategies and Actions, short term (IT)

| H) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the short term (1-3 years) | |
|--|---|
| Organization | Answer |
| Academia | "The BIOHEALTH sector will have a strong short-term boost due to the Covid-19 pandemic." |
| Academia | "Proliferate of ideas, products, drugs, innovative technologies, not all actually of primary necessity and effective." |
| Academia | "Proliferation of innovative ideas and products." |
| Academia | "R&D." |
| Academia | "All activities related to recover the economic and organizational disaster, after COVID-19. Economic support for poor people." |
| Academia | "Enhance and facilitate access to AIM, with the creation of sectors for middle and small Start-up. Tax advantages for start-up in the biomedical sector." |
| Academia | "Funding for discovering innovative biomarkers." |
| Incubator/Accelerator | "Active innovators will seek to develop a portfolio of partners with a diverse mix of scientific and operational capabilities to support non-asset –based partnerships to promote innovation and bring new medicines to patients in need more quickly and safely." |
| Incubator/Accelerator | "Integration of skills, tools and know-how in (alphabetical order): Bioinformatics; Biological codes; Bio-sequences; Data analysis; Data mining; Databases; Image analysis; Informatics; Literature mining; Networking; New biological hypotheses; Protocol mining; Robotics; Systems biology; etc.." |
| Incubator/Accelerator | |
| Incubator/Accelerator | "Development of on-demand biohealth products thanks to a broader application of new production processes such as additive manufacturing, in a sound widely approved body of definitions and norms." |
| Incubator/Accelerator | |
| Business | "Strengthen and facilitate access to the start-up share price. Tax advantages for start-up in the biomedical sector." |
| Business | "Proliferation of a significant number of innovative ideas." |
| Business | "Innovative biomarkers." |

| | |
|----------|--|
| Business | "Development of new technological platforms for the production of drugs and vaccines. Robotics development in drug management and surgery." |
| Business | "Strengthen and facilitate access to the start-up share price, with the creation of sectors for small and medium sized start-ups. Tax advantages for start-up in the biomedical sector." |
| Business | "Increasing medium-long term financial resources." |
| Business | |
| Other | "Following the Covid-19, European states will launch a substantial public investment plan for research into vaccines, products, biomedical technologies and health biology." |
| Other | |
| Other | "R&D investments." |
| Other | |
| Other | "Vaccine production and development of targeted projects." |
| Other | |

Source: BIO-ALL, 2020

Specifically, in the short term, the "Academia" focused on the impact of the COVID-19 pandemic, which according to the people interviewed, will strongly influence the short-term evolution of the BIOHEALTH sector. Funding and R&D are also two critical factors in the short-term scenario: this way, the proliferation of innovative ideas, products and service could be facilitated.

Incubators/accelerators show more interest on the development of innovation and integration of ideas, product and services. "Active innovators will seek to develop a portfolio of partners with a diverse mix of scientific and operational capabilities". This integration of skills could be on skills like Bioinformatics, Data analysis and Networking.

Businesses answers underlined too the proliferation of innovative ideas within the short-term context, but they also pointed out the need to strengthen and facilitate access to the start-ups by, for example, increasing tax advantages.

The other stakeholders involved in the interviews again underlined the importance of the COVID-19 pandemic in the current situation and of course the development of the vaccine, along with the value in R&D investments.

5.2.5.2 Medium term

Table 5.10: BIOHEALTH's Most Practical Strategies and Actions, medium term (IT)

| I) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector in the medium term (3-7 years) | |
|--|--|
| Organization | Answer |
| Academia | "BIOHEALTH sector will enjoy a strong "dragging" effect of the effort made in the short term." |

| | |
|-----------------------|---|
| Academia | "Rationalization of the innovative process, skimming and selection." |
| Academia | "Selection of new businesses." |
| Academia | "Preclinical phase results." |
| Academia | "Support to Universities and Research centres for innovation. Ask for an interface of University companies." |
| Academia | "Tax advantages for investment funds in the start-up sector." |
| Academia | "Funding innovative therapies using already known drugs or for obtaining chemical modification of already known drugs to increase their therapeutic effectiveness and/or to decrease their side-effects." |
| Incubator/Accelerator | "A continued expansion in disease area-focused consortia, including growing emphasis on more "open" arrangements with respect to structure, control, risk sharing, and other business arrangements. " |
| Incubator/Accelerator | "Integration of skills, tools and know-how centred on the following new biological / biotechnological topics in biomedicine (alphabetical order): Biodiversity analysis; Bioinformatics; Drug discovery; Evolution; Food health and healthy food; Genotype-phenotype relationships; in silica vs. wet biology; NGS, methods and protocols; Nutraceuticals; -omics tools (metabolomics, volatilomics, proteomics, transcriptomics, genomics, physiomics; food omics; nutrigenomics; etc.); Search for biodiversity; Structure-function relationships at every level of biological organization; Theoretical biology and medical modelling; etc." |
| Incubator/Accelerator | "Artificial intelligence applications in health systems management and treatment of patients. Deeper learning and data gathering from patients in an approach oriented more on preventing disease, rather than treating it." |
| Incubator/Accelerator | |
| Incubator/Accelerator | |
| Business | |
| Business | "Tax advantages for investment funds in the start-up sector." |
| Business | "Rationalization of the expansion process of BIOHEALTH companies." |
| Business | "Innovative therapies using already known drugs or chemical modification of already known drugs to increase their therapeutic effectiveness and/or to decrease their side-effects." |
| Business | "Expansion of artificial intelligence applications in the management of health systems (programming of health plans, management of hospitals, management of clinical data and clinical research, prevention." |
| Business | "Incentives in the start-up sector." |
| Business | "Looking for new products from Academia bringing them to the market or to Big Pharma." |
| Other | "The European Commission will direct investments towards active aging, disease prevention and widespread diagnostics." |
| Other | "Whereas hospitals' triple function -healthcare, research, and training- is widely recognized internationally, their "4th Mission" of innovation and knowledge transfer turning |

| | |
|-------|--|
| | them into agents of strategic development for economic development is new challenge in a complex scenario. Coordinated efforts at several levels from multiple European stakeholders are necessary.” |
| Other | |
| Other | “Tax advantages for investment funds in the start-up sector.” |
| Other | |
| Other | |

Source: BIO-ALL, 2020

Regarding the medium term, the academia underlined again the need for tax advantages in investment funds devoted to start-ups. These incentives should persist in time, surpassing the short-term horizon, in order to contribute efficiently to the start-up’s growth. The academia also points out the need to fund innovative therapies using already known drugs or chemicals.

Incubators and accelerators prospected a continued expansion in “disease area-focused consortia” including growing emphasis with respect to structure, control, risk sharing, and other business arrangements. The integration of skills and know-how continues to be critical and it will be centred on many new BIOHEALTH sector related topics.

Businesses focuses again on the importance of incentives and tax advantages and incentives in the start-up sector and the importance of innovative therapies using already known drugs or chemicals.

The other stakeholders involved in the activities emphasised the importance of the direct investments by the European Commission towards active aging, disease prevention and widespread diagnostics: moreover, coordinated efforts at several levels from multiple European stakeholders are necessary.

5.2.5.3 Long term

Table 5.11: BIOHEALTH’s Most Practical Strategies and Actions, long term (IT)

| J) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the long term (10-15 years) | |
|---|---|
| Organization | Answer |
| Academia | “Industrialization and standardization of products, services and technologies followed by incremental innovations.” |
| Academia | “Industrialization and standardization.” |
| Academia | “Industrialization and standardization of products and services.” |
| Academia | “Clinical phase.” |
| Academia | “Too far from now...” |
| Academia | “Tax advantages for mergers between small and medium-sized companies in the biomedical sector.” |
| Academia | |
| Incubator/Accelerator | “Funding for discovering innovative drugs.” |

| | |
|-----------------------|---|
| Incubator/Accelerator | "The eco-system is likely to expand its membership as regulators and the healthcare delivery system, particularly health plans, need an even larger evidence base (including patient-generated data, patient-reported outcomes, and "real-world evidence") to inform review and approval of drug applications. Additionally, evolving innovative coverage and payment models could fuel an even broader range of partnerships in the future." |
| Incubator/Accelerator | "Integration of skills, tools and know-how in (a) new professional figure(s) able to treat patients according to the new rules of the 'translational medicine' and 'personalized medicine' according to a holistic approach." |
| Incubator/Accelerator | |
| Incubator/Accelerator | |
| Business | "Acquisitions, incorporations and mergers between small and medium-sized companies in the biomedical sector." |
| Business | "Acquisition and incorporation processes by large companies and mergers between medium and small." |
| Business | "Innovative drugs." |
| Business | "Horizon too far." |
| Business | "Tax advantages of mergers between small and medium-sized companies in the biomedical sector." |
| Business | "Reinvesting earnings in research and development." |
| Business | |
| Other | "The private sector will engineer the solutions resulting from funded research." |
| Other | "For example, Italian Research Hospitals I.R.C.C.S. devoted to treating pathologies from bench to bedside in wide sectors of Italian Health Plan -i.e. oncology, orthopaedics, rehabilitation, cardiology, dermatology, neurology, pediatrics, infective and genetic diseases-, started from 2016 joint Knowledge Transfer activities promoted and guided by the Ministry of Health. Research Hospitals from other Member States supported by their Ministry and national Knowledge Transfer associations have the potential to become drivers for helping translate scientific/clinical excellence into new biomedical technologies of societal use." |
| Other | |
| Other | |
| Other | "Tax advantages of mergers between small and medium-sized companies in the biomedical sector." |
| Other | |

Source: BIO-ALL, 2020

Incubators and accelerators focus too on the integrations of skills and into the need for funding in order to discover innovative drugs. Moreover, eco-system is likely to expand its membership as regulator and the healthcare delivery system, particularly health plans, need an even larger evidence base to inform review and approval of drug applications.

Regarding the long-term scenario, the academia focuses on the importance of the industrialization and standardization of products, services and technologies

by incremental innovation. This is a fundamental step to develop the BIOHEALTH sector into a “day-to-day” industrial reality.

Businesses focus their attention about the role of innovative drugs and the strategy of re-investing earning in research and development in the sector.

Other stakeholders involved in this research foresee that the private sector will be protagonist, since it will engineer the solutions resulting from funded research. Also, tax advantages and incentives will be crucial to shape a more homogeneous market in the sector.

Figure 5.4: Representation of the BIOHEALTH’s Most Practical Strategies and Actions, according to Italian respondents



5.2.6 Strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector

It is important to consider the key role of innovation and entrepreneurship in the BIOHEALTH sector. The incorporation of innovation requires strategies aiming to increase the BIOHEALTH’s sector market share, the quality of the offered goods and services, production capacity, business visibility and health and safety guarantees. Schumpeter (1934) stated that entrepreneurship and innovation are independently connected and interlinked. Hence, without innovation, entrepreneurship has unclear significance to individuals, organizations, the economy and vice-versa. Hammel (2000) states that innovation must often be the foundation of creations, and for that it is critical for any company, industry or sector that wants to compete effectively in the Twenty-first century’s landscape.

With this question we wanted to know what the interviewees see as the upmost important strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector, choosing only a maximum of two answers from a list: “Policies at European, National and Regional level”; “Innovation - R&D + I, Patents”; “Business incentives: tax, subsidies, credits”; “Education and advanced learning”; “Entrepreneurial capabilities in biotechnology”; “Entrepreneurial processes in the biotechnology sector (phases, deadlines,

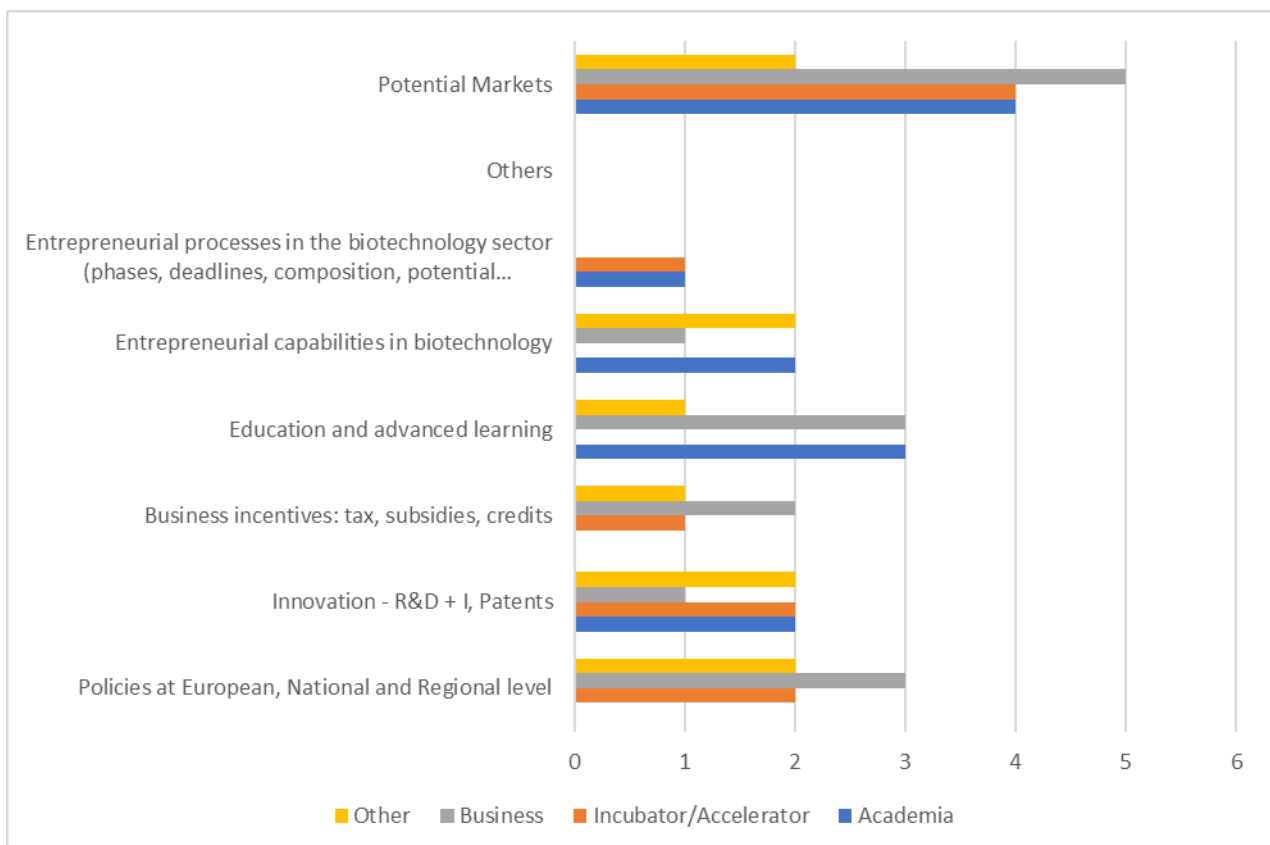
composition, potential entrepreneurship rate, dropout rate, regulation, certification)”; “Potential markets”; and “Others”.

Table 5.12: Strategies and actions to promote innovation and entrepreneurship (IT)

| K) In your opinion, what are the strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector? Please provide a maximum of two responses | |
|--|---|
| Organization | Answer |
| Academia | Entrepreneurial capabilities in biotechnology, Entrepreneurial processes in the biotechnology sector. |
| Academia | Innovation - R&D + I, Patents, Potential Markets. |
| Academia | Education and advanced learning, Entrepreneurial capabilities in biotechnology. |
| Academia | Innovation - R&D + I, Patents, Education and advanced learning. |
| Academia | Entrepreneurial processes in the biotechnology sector, Potential Markets. |
| Academia | Education and advanced learning, Potential Markets. |
| Academia | Entrepreneurial processes in the biotechnology sector, Potential Markets. |
| Incubator/Accelerator | Policies at European, National and Regional level, Potential Markets. |
| Incubator/Accelerator | Policies at European, National and Regional level, Potential Markets. |
| Incubator/Accelerator | Innovation - R&D + I, Patents, Business incentives: tax, subsidies, credits. |
| Incubator/Accelerator | Innovation - R&D + I, Patents, Potential Markets. |
| Incubator/Accelerator | Entrepreneurial processes in the biotechnology sector, Potential Markets. |
| Business | Business incentives: tax, subsidies, credits, Entrepreneurial processes in the biotechnology sector. |
| Business | Entrepreneurial capabilities in biotechnology, Potential Markets. |
| Business | Education and advanced learning, Potential Markets. |
| Business | Education and advanced learning, Potential Markets. |
| Business | Policies at European, National and Regional level, Business incentives: tax, subsidies, credits. |
| Business | Policies at European, National and Regional level, Potential Markets. |
| Business | Policies at European, National and Regional level, Innovation - R&D + I, Patents. |
| Other | Education and advanced learning, Entrepreneurial processes in the biotechnology sector. |
| Other | Innovation - R&D + I, Patents, Entrepreneurial processes in the biotechnology sector. |
| Other | Policies at European, National and Regional level, Potential Markets. |
| Other | Policies at European, National and Regional level, Business incentives: tax, subsidies, credits. |
| Other | Innovation - R&D + I, Patents, Entrepreneurial capabilities in biotechnology. |
| Other | Entrepreneurial capabilities in biotechnology, Potential Markets. |

Source: BIO-ALL, 2020

Graph 5.4: Graphical representation of the Strategies and actions to promote innovation and entrepreneurship (IT)



Source: BIO-ALL, 2020

As we can see on the previous figure, most of the interviewed focused on the “Potential Markets” at center of the strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector. Business especially found this the right way to promote innovation and entrepreneurship, since 5 out of the 7 interviewed choose this option.

Many interviewees also focused their attention on “Policies at European, National and Regional level”. This result is in fact in line with the previous consideration found in the questionnaire responses.

Also, Innovation – R&D+I and Patents, with Education and advanced learning appear to be among the top choice for most of the respondents.

Table 5.13: Strategies and actions to promote innovation and entrepreneurship, answer justification (IT)

| L) Regarding the question K), please justify your answer | |
|--|--|
| Organization | Answer |
| Academia | “Entrepreneurs have the ability to see opportunities and possibilities that others do not see.” |
| Academia | “R&D is the key to keep a company updated in this fast-evolving area.” |
| Academia | “Knowledge is essential to build a good business.” |
| Academia | “R&D is fundamental in the BIOHEALTH sector.” |
| Academia | “Biotechnology, especially in the healthcare sector, have considerable social impact but there is also high potential from a financial point of view.” |

| | |
|-----------------------|--|
| Academia | "Successful biotechnology players must acquire and demonstrate a combination of technical, commercial and operational skills." |
| Academia | |
| Incubator/Accelerator | |
| Incubator/Accelerator | "BIOHEALTH sector should be put among the first priorities at European Level, in the next project period." |
| Incubator/Accelerator | "Innovation is the key in the BIOHEALTH sector. Incentives are important to aid start-ups to break into the market." |
| Incubator/Accelerator | |
| Incubator/Accelerator | "Entrepreneurial processes are the opportunity to create innovative and unique products and technologies potentially revolutionary." |
| Business | |
| Business | "The BIOHEALTH sector still has some "green field" opportunities. Businesses should embrace this path." |
| Business | |
| Business | "Product and process innovation are to be put as driver of sustainability." |
| Business | "BIOHEALTH as a priority in Horizon Europe (2021-2027)." |
| Business | "It should also be aimed at developing nations, where the BIOHEALTH sector is still in its early developments." |
| Business | "At European level, it should be fostered the acquisition of skills to enable the development of BIOHEALTH projects." |
| Other | "Know-how and skills in this sector." |
| Other | "Start-ups will develop the BIOHEALTH sector." |
| Other | |
| Other | "Knowledge management." |
| Other | |
| Other | "The BIOHEALTH sector needs people capable of dealing with the unexpected in his field, with a sense of business, with a great capacity for negotiation, the ability to learn quickly new things even if not strictly related to the research it deals with, and with an high sense of responsibility because its products can reach a lot of people." |

Source: BIO-ALL, 2020

The justification given from the Academia put a pin on R&D and knowledge management. These two are considered as fundamental factors to ensure the development of the sector in the economic area. Furthermore, an interviewee cited both the social and financial impact: these points of view are to be taken both under consideration in order to control and gain advantage from the development of the BIOHEALTH sector. Incubators and accelerators pointed out as motivation innovation, incentives, EU funding, and the entrepreneurial processes as key for such innovative and unique products/technologies. Businesses highlighted the importance of "development" in this topic. This field, in fact, has still some "green field" opportunities that should be caught. Other stakeholder involved in the questionnaire underlined instead knowledge as the key driver to promote strategies and development: Know-how and skills in this sector, knowledge management are key factors to form people capable of dealing with unexpected events in his field, with a sense of business, with a

Figure 5.5: Representation of the Strategies and actions in order to promote innovation and entrepreneurship in the BIOHEALTH sector, according to Italian respondents

great negotiation capacity, the ability to learn quickly new things even if not strictly related to the research it deals with.

Start-ups

incentives

EU projects

knowledge

Green field

innovation

Entrepreneurial

5.2.7 Recommendations for policy makers to achieve the scenarios and strategies

In times of fast change, growing complexity, and critical uncertainty, it is required to be prone to cope with the unexpected. The purpose of this question is to provide a brief guide to strengthening the foresight capacity through a better use of strategic foresight in policymaking onto achieving the scenarios and strategies previously aligned. The answers collected are presented below.

Table 5.14: Recommendations for Policy Makers (IT)

| M) Recommendations for policy makers (what are the objectives and next steps) to achieve the scenarios and strategies you have identified? | |
|--|--|
| Organization | Answer |
| Academia | "Assumption of awareness that the crisis generated by Covid-19 will have lasting effects over time. It is urgent and necessary to remodel public health policies, lifestyles and study methods." |
| Academia | "Bureaucratic simplification for access to finance." |
| Academia | "Policy makers will need to take a new long-term perspective to reform the health sector and BIOHEALTH by placing new public health." |
| Academia | "Foster digitalization of health-care related data." |
| Academia | |
| Academia | "Develop convergence of technologies among biology, engineering, IT, etc." |
| Academia | |
| Incubator/Accelerator | "Shift towards knowledge-driven and evidence-based innovation." |
| Incubator/Accelerator | "Developing platform for technologies and standards, in order to keep up with the globalization trend." |
| Incubator/Accelerator | "Monitor the advances in research and development in the BIO-HEALT sector." |
| Incubator/Accelerator | "Ensure rapid acceptance of new technologies in this sector." |
| Incubator/Accelerator | |
| Business | "Bureaucratic simplification for access to public funding." |
| Business | "To encourage public and private funding in the BIOHEATH sector." |

| | |
|----------|---|
| Business | "Guarantee public funds for R&D in the long term." |
| Business | "Validate assets and enterprises." |
| Business | "No constraints in public health expenditures." |
| Business | "Assure that there are no "funding gaps" in the broad picture." |
| Business | |
| Other | "Lobbying at European and national level to push in the direction outlined above." |
| Other | |
| Other | "Regulatory risks in this sector should be at the minimum." |
| Other | |
| Other | "Keep considering provision of health as a public good and a rights: this way the government will maintain a central role in all the health-related issues and developments." |
| Other | |

Source: BIO-ALL, 2020

In this last question, the Academia pointed out that the consequences generated by COVID-19 will have lasting affect over time, impacting at all levels of society. Bureaucratic simplification for access to finance is also considered as crucial, since any kind of development needs these mechanisms to become truly efficient.

Incubators and accelerators cited the developing of convergence of technologies among different areas and to ensure a rapid and smooth acceptance of new methodologies, products and services in the market.

Business and stakeholders both focused on the bigger picture: it is important to put R&D at the very centre of the development. Moreover, regional, national and EU policies should also focus on the BIOHEALTH sector. In fact, keeping the provision of health as a public good: this way the government will maintain a central role in all the health-related issues and developments.

Figure 5.6: Representation of the Recommendations for policy makers, according to Italian respondents



5.3 Results from Spain

5.3.1 Interviewees characterization

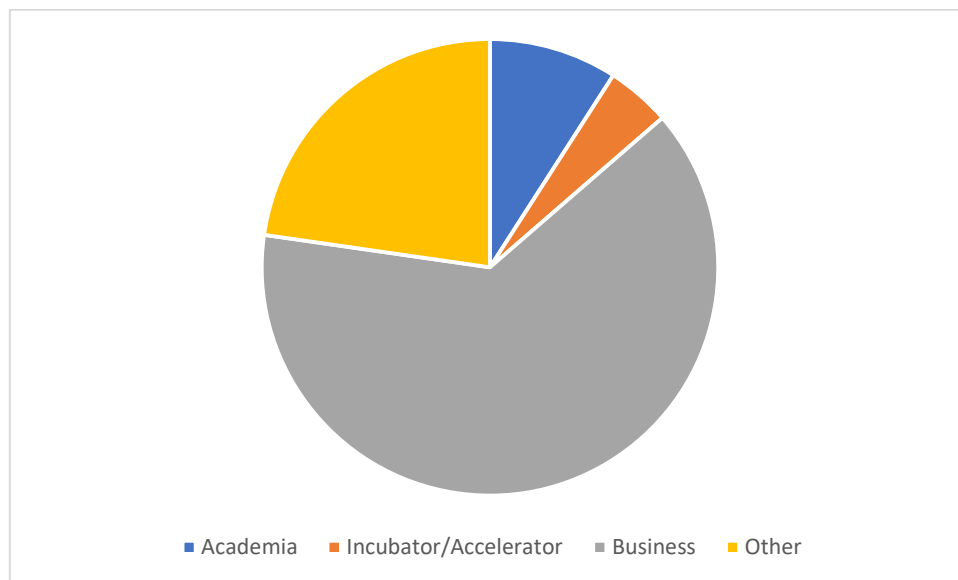
This questionnaire was designed to gather information on what the main thoughts of the actors of the BIOHEALTH sector are on the future of the sector relating it to innovation and entrepreneurship. The set of actors is composed by people related to the BIOHEALTH sector from the Academia, Incubator/Accelerator, Business or Other relevant stakeholders.

The questionnaire was designed, tested and applied in order to collect information from the above sources cited and was anonymous and confidential, serving only for the purposes of data collection and subsequent analysis and action design.

The results presented in this report reflect the perceptions of the interviewees in Spain. Data was collected by means of an online survey sent out via email to a database of actors from the BIOHEALTH sector, leading to a total of 22 Spanish responses. The study measured the perceptions of respondents with respect to their BIOHEALTH sector perception and predictions.

Among the 22 questionnaires received from Spain, most of the respondents came from "Business" with 14, followed by "Others-Stakeholders" with 5 respondents. In the following graphic we can see the distribution.

Graph 5.5: Profile of the interviewees (ES)



Source: BIO-ALL, 2020

5.3.2 Visions of the BIOHEALTH sector, considering entrepreneurial and innovative processes

When asking a question about their vision on the BIOHEALTH sector, we wanted to understand the similarities and differences the different stakeholders have. Nanus (1992) defines "vision" as realistic, credible, attractive future for an organization. A realistic vision therefore must be relevant to an organization or a sector to be credible. A vision must inspire and motivate those who are in the

sector to implement it. It must be seen by all as realistic, honest and achievable. It must be attractive. A vision is meant to inspire the leaders and the organizations to look into the future prospects of the sector. A vision is not in the present or where we are now, a vision corresponds to where the BIOHEALTH sector will be in the future.

As for that, we wanted to know what do the stakeholders understand in terms of the future of the BIOHEALTH sector. Sharing a future image of the BIOHEALTH sector will be a guideline to strive and find the best solutions to make it happen. The following table has the answers that the interviewees gave.

Table 5.15: BIOHEALTH Sector Vision (ES)

| A) Describe your vision of the BIOHEALTH sector, considering entrepreneurial and innovative processes. (Definition of "Vision": Stakeholders' idea of the sector and represents what the sector intends to become) | |
|--|---|
| Organization | Answer |
| Academia | "Integrated system of companies, research centres and universities. Avoid dispersal (single window)." |
| Academia | "The BIOHEALTH sector will transfer to society through the most disruptive innovations that come from knowledge agents. The returns generated by these innovations, through capital, knowledge and social benefit through tool development for disease prevention and treatment, will have a positive impact on all agents who participate in the value creation, resulting in a virtuous circle that will feed itself. Due to this, an ecosystem will be created where public-private collaboration will allow the execution of this transfer that will have a mutual flow. The BIOHEALTH sector should include investors, managers and business developers, members of the clinical community and scientists of pure and applied sciences. All this within a highly digital environment." |
| Incubator/Accelerator | "Since the BIOHEALTH sector is the pillar of the welfare state, as has become visible in this health crisis, and is a powerful employment sector, all political and scientific efforts must be combined to strengthen it." |
| Business | "WITHOUT FINANCIAL ASSISTANCE OR SUBSIDY there is no project and without a project there is no future." |
| Business | "A tool for generating synergies." |
| Business | "It is a sector with a lot of potential, we should learn from our Anglo-Saxon colleagues and cover the whole spectrum of a product's life. With good basic research in universities (which we already have) and good applied research and transfer to the market by private or mixed public-private capital (in which we are far behind). Without a strong private sector we have a handicap with respect to other companies." |
| Business | "From the agriculture BIO sector, I see that the BIOHEALTH sector is one of the most competitive in terms of capital needs and expertise required to develop technologies to |

| | |
|----------|--|
| | launch into the market. There is also a high demand for intellectual protection.” |
| Business | “In my opinion, it is the sector that develops health-related products and services based on biotechnology, therefore I believe that innovation is a fundamental pillar.” |
| Business | “This sector is continually growing but it lacks investment, equipment, and staff.” |
| Business | “Integrated system including companies, research centres and universities. Prevent dispersion: single contact point.” |
| Business | “It is broken by the base, since the transition from research/technology to company lacks the adequate financing instruments to do so without assuming excessive personal risk.” |
| Business | “Quite dynamic, in which public institutions themselves work together with private entities to promote the emergence of new technologies that have a global impact in the Healthcare Marketplace space. In this vision, there is a close relationship between public capacities (health networks), investment actors, Corporates & Start-ups, working on joint objectives, but with their own indicators for each of them.” |
| Business | “Given the high quality innovation that is coming out of the universities and investigation centres, and the high quality infrastructure that is available, my vision is that a concomitant level of support for moving these technologies into commercial entities and guiding and supporting, both financial support and advisory support, them in the process towards the market while creating high paying jobs and wealth in the community.” |
| Business | “DATA-DRIVE-HEALTH is a concept-VISION within the realm of Precision Medicine. Individuals make use of innovative personal testing products (not to be confused with disease diagnostics). Innovative testing generates personal data that informs on an individual's physiology on a daily basis, employing available tools such as telephones and wearable electronic devices. As they continuously evaluate their own personal data, individuals make decisions and informed interventions in their lifestyle, nutrition, and interactions with health providers.” |
| Business | “The innovative and entrepreneurial processes in the BIOHEALTH sector should identify the origin of the innovative process as well as the objective of innovation. This is not the same as starting an innovation process in a university technology centre or company private, due to the size of the company or entrepreneurial initiative. The agents of the sector and their interests are very different; the scientific or economic point of view prevail depending on where the initiative is born. For some agents, "making money" is the objective, while for others it is scientific advancement and positioning.” |
| Business | “It is a very broad sector (Biotech, medical devices, health digitization, agriculture, etc.), in which there is still a lot of knowledge to discover, so there is scope for growth. |

| | |
|----------|---|
| | However, in certain subsectors the entry barriers are very high (due to the duration of processes, for example, in pharma) and are usually projects that require a great deal of investment. It is a sector where it is relatively easy to obtain financing for research projects (on loan if a private entity does so), but it is difficult to obtain financing to take the step to commercialize these products.” |
| Business | “The current situation will remove many administrative barriers and will allow growth within a few months, which would have taken several years in another situation. The barriers will be relaxed and the financing will be facilitated of this sector, which will grow like no other in the coming years.” |
| Other | “Technology-based sector closely related to the agents generated of knowledge that develops high value-added services that becomes a business niche especially suitable for mature societies such as the European one with characteristics of low birth rate, aging population, chronification, loneliness, etc.” |
| Other | “What matters is the breadth, depth, and continuity of interactions across a broad front between industry and academic researchers from multiple disciplines. It is sustained exchange across a wide interface that translates into economic impact.” |
| Other | “It is my opinion that the BIOHEALTH sector must become a key sector in the strategic lines of government and have more relevance at an international level with success stories so we can be considered global potential.” |
| Other | “Boost new entrepreneurial processes to position the BIOHEALTH sector as one of the strongest and most collaborative ecosystems and raise the weight of the BIOHEALTH sector to at least 2-3% of the national GDP.” |
| Other | “The current global pandemic has directly impacted the BIOHEALTH sector, which will undergo a substantial change. Entrepreneurial initiatives will be imperative in the complete value chain, including manufacturing.” |

Source: BIO-ALL, 2020

In the table above, we can see the interviewees’ visions for the BIOHEALTH sector. From their answers we can understand that the respondents see the BIOHEALTH sector as one of the most competitive in terms of capital needs and expertise required to develop technologies to launch into the market. There is also a high demand for intellectual property rights’ protection.

There is also a feeling of big opportunities in this area, in which there is still a lot of knowledge to discover, so there is scope for growth. However, in certain subsectors the entry barriers are very high (due to the duration of processes, for example, in pharma) and are usually projects that require a great deal of investment. It is a sector where it is relatively easy to obtain financing for research projects (on loan if a private entity does so), but it is difficult to obtain financing to take the step to commercialize these products.

Although there are main concerns about the development of the BIOHEALTH sector, the interviewees' view points out that the BIOHEALTH sector should include investors, managers and business developers, members of the clinical community and scientists of pure and applied sciences. All this within a highly digital environment.

If we analyse the responses of different types of organizations, we can understand that for the respondents from "Academia", the envision that the BIOHEALTH sector will transfer to society through the most disruptive innovations that come from knowledge agents. The returns generated by these innovations, through capital, knowledge and social benefit will have a positive impact on all agents who participate in the value creation, resulting in a virtuous circle that will feed itself. Due to this, an ecosystem will be created where public-private collaboration will allow the execution of this transfer that will have a mutual flow.

A special mention is given to the single window concept, that is, the integrated system of companies, research centres and universities.

The interviewees from the "Incubator/Accelerator" state that they see the BIOHEALTH sector as a powerful employment sector, then all political and scientific efforts must be combined to strengthen it.

The interviewees from "Business" state that BIOHEALTH sector is continuously growing but it lacks investment, equipment, and staff. They consider the sector as one with a lot of potential, although several lessons could be learned from Anglo-Saxon benchmarks and cover the whole spectrum of a product life cycle. With good basic research in universities (which, Spain already has) and good applied research and transfer to the market by private or mixed public-private capital (in which Spain is far behind). Without a strong private sector Spain has a handicap with respect to other companies.

Lastly, "Other" entities state that BIOHEALTH sector must become a key sector in the strategic lines of government and have more relevance at an international level with success stories, in order to be able to explore its global potential.

In the figure below we can see the different visions of the BIOHEALTH sector, considering entrepreneurial and innovative processes by the interviewees in Spain.

Figure 5.16: Representation of the visions of the Spanish interviewees for the BIOHEALTH sector



5.3.3 Scenarios for the BIOHEALTH sector, considering entrepreneurial and innovative processes

We asked the interviewees about the scenarios that they see for the future of the BIOHEALTH sector. It is important to understand what the options are, what are the possibilities that could happen in the future. As for that we also wanted them to point out and clarify them in short (1-3 years), middle (3-7 years) and long term (10-15 years).

Korte and Chermack (2007) say that scenario planning is a means for making explicit the mental models supporting organizational reasoning and action. Once made explicit, these models can be challenged, and alternatives developed. As such it is important to hear the opinion of the different stakeholders, in order to line the different scenarios considering the entrepreneurial and innovative processes, and then define strategies for those possible scenarios. The subsequent tables have all the scenarios received.

Table 5.17: BIOHEALTH Sector Scenarios (ES)

| B) Describe the possible scenarios of the BIOHEALTH sector that you have in mind, considering the entrepreneurial and innovative processes. (Definition of "Scenario": one of several possible situations that could happen in the future) | |
|--|--|
| Organization | Answer |
| Academia | "Investment cut. Increased competitiveness and regulatory aspects." |
| Academia | "Current scenario: the lack of coordination between entrepreneurs and innovators creates an ineffective system regarding the transfer of knowledge. This means there is an undercapitalized BIO-SALUD entrepreneurship system that hinders its competitiveness in international markets. This in turn avoids obtaining returns that can be reinvested in the system, so that many of the innovations created both at the private and public levels are not transferred. Furthermore, |

| | |
|-----------------------|--|
| | <p>when competing in a global market with other BIOHEALTH sectors whose scenarios are different from this one, the loss of competitiveness will increase.</p> <p>Future scenario: Increase in the capitalization of the BIOHEALTH sector will attract highly specialized personnel for developing businesses in highly competitive international markets. This would increase the capacity to generate new innovations that could be transferred to the market, creating great added value and social benefit."</p> |
| Incubator/Accelerator | <p>"With the current world situation of the Covid-19 and in view of the deficiencies of the health system and the problems that biotechnology companies have, both technical and economic, to get their products ahead (regulations, validations, financial, etc.), so that we are not again in this situation before possible new pandemics, the budgets dedicated to R&D+I will be increased and greater incentives will be provided to the companies of this sector (fiscal, subsidies, credits, etc.). Likewise, the regulatory deadlines and costs will have to be reduced, since we have a rigid and excessively bureaucratic system. Also digitize the health system, will be equipped with ICT, BigData, sensorization, drones, etc. ... to make it more effective and flexible and here will have to intervene companies with the implementation of their solutions."</p> |
| Business | |
| Business | <p>"A platform for connecting companies and research groups to move forward together."</p> |
| Business | <p>"1. We should complement the very good basic research we have, solving our deficiencies in translational science and creation of production and marketing companies, promoting the creation of private companies.</p> <p>2. Basic health research is promoted and public awareness is enhanced.</p> <p>3. The public and private sectors complement each other in order to develop products from basic science to commercial application."</p> |
| Business | <p>"I do not believe there will be significant changes in relation to how this sector has traditionally been developed in terms of purchases and sales as companies reach specific milestones prior to accessing the market."</p> |
| Business | <p>"I believe that a significant development in the upcoming years is very likely. This will lead to interesting economic opportunities, especially for innovative and disruptive entrepreneurs who are able to identify business opportunities."</p> |
| Business | |
| Business | <p>"Cutbacks in investment. Increase of competitiveness and regulatory aspects."</p> |
| Business | <p>1) "Remains as it is, and only large companies capitalize on innovations based on a healthcare system anchored in the past, generating little value for all parties.</p> |

| | |
|----------|---|
| | <p>2) The healthcare system is digitized, rethinking processes and optimizing the whole in collaboration with SMEs that take on innovation and large companies that ensure processes, generating much value for all parties.</p> <p>3) There is an intermediate situation, where large companies copy or absorb outstanding SMEs, and then slowly transfer innovation to the health sector. Value stays fundamentally in large companies.”</p> |
| Business | <p>➤ “Scenario 1: Current situation. Disconnection between public and private entities. Difficulties to start projects from 0 in the region, due to lack of strategic and economic support. Inefficiently managed public structures, directly impacting the generation of new local innovations that can impact globally.</p> <p>➤ Scenario 2: Ideal situation. Correctly managed public platforms. Public financing for the initial stages, and for the generation of ideas in a continuous flow. Professionals with extensive experience in the pharmaceutical / medical devices industry managing the platforms. Local private investment instruments. Support to the entrepreneur: not only economic, but also of knowledge.”</p> |
| Business | <p>“That the PTS would be a single entity incorporating all the public facilities and entities on the campus, or at least having them structures in a way that they communicate well, and that they are structured in a way that facilitates fulfilling the needs of the private BIOHEALTH sector. This would also include insuring that resources, particularly business and regulatory, with a global perspective are available to provide support. In this sense, Agencia IDEA is the exact opposite of what is needed bio start-ups and companies in the BIOHEALTH sector.”</p> |
| Business | <p>“The scenarios for acceleration of Data-Driven Health innovations revolve around two key catalysts: a) University Entrepreneurial Innovation Incubators; b) Biohealth technology parks such as the PTS in Granada. Industry leaders must work in concert with Universities and Parks to create internship opportunities for young students and budding entrepreneurs. All players need to become more proficient at intellectual Property protection.”</p> |
| Business | <p>“My point of view about possible future scenarios involves uniting three fundamental pillars in any entrepreneurial and innovative initiative. The first step focuses on real innovation and the real situation of each organization or company, secondly, looking for the innovation's balance and profitability in different scenarios, in the short, medium and long term; finally, and no less important for me, the impact and benefit to society, both as a public body and in private companies. The first priorities should be the advantages to society.”</p> |

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| Business | "Increased life expectancy will lead to more and more solutions to aging-related diseases. Public health systems are currently hardly economically sustainable, and telemedicine and virtual healthcare will be developed." |
| Business | "It will grow exponentially. Innovation will be promoted and the size of the sector will expand." |
| Other | <p>"Pessimistic scenario: the difficulty of startups to survive is combined with the entry barriers of this sector (costs and time frames derived from certification). Intra-enterprise only works in large companies that already operate in the sector and can address the certification process and the market entry process.</p> <p>Neutral scenario: The sector's startups are as successful as the current one, with many projects that do not even reach the certification process.</p> <p>Optimistic scenario: External support (market study, entrepreneurship study, relations with the sector, improvements in the certification process...) achieve the success of the startups with a survival rate higher than the rest."</p> |
| Other | "An interesting scenario: In the German industrial ecosystem firms find local and regional bankers with deep industry knowledge, a vocational education system that produces highly-qualified workers, trade associations, technical universities, industrial collective research consortia, industrial research centers, technical advisory committees." |
| Other | <ul style="list-style-type: none"> ➤ "Situation 1: everything remains as it was. ➤ Situation 2: with the looming crisis, cuts in R&D + I will be made again and the opportunity will be lost. ➤ Situation 3: just as other countries did in the previous crisis (2009), they prioritize BIOHEALTH and problem innovation (COVID-19) to become an opportunity. In this sense, all public and private agents must make aligned strategic plans." |
| Other | "In the future, the BIOHEALTH sector must be prepared to deal with one of the most relevant problems in our society, which is overpopulation and how to deal with aging people. Likewise, other problems to be addressed in the future are: control and surveillance of pandemics, development of organic tissues and prevention of diseases." |
| Other | "Commitment from all influential actors, including financial actors, in the BIOHEALTH sector to foster entrepreneurship. Greater development and stability in R&D." |

Source: BIO-ALL, 2020

The table above has all the answers the interviewees gave as for possible scenarios in the BIOHEALTH sector.

They believe that a significant development in the upcoming years is very likely. This will lead to interesting economic opportunities, especially for innovative and disruptive entrepreneurs who are able to identify business opportunities.

In this way they want to change the current situation, which is characterized by a disconnection between public and private entities. Difficulties to start projects from 0 in the region, due to lack of strategic and economic support. Inefficiently managed public structures, directly impacting the generation of new local innovations that can impact globally and try to get an ideal situation like this, correctly managed public platforms. Public financing for the initial stages, and for the generation of ideas in a continuous flow. Professionals with extensive experience in the pharmaceutical/medical devices industry managing the platforms. Local private investment instruments. Support to the entrepreneur: not only economic, but also of knowledge.

Analyzing the views from different stakeholder types, "Academia" talks about two scenarios, current scenario where the lack of coordination between entrepreneurs and innovators creates an ineffective system regarding the transfer of knowledge and future scenario where the increase in the capitalization of the BIOHEALTH sector will attract highly specialized personnel for developing businesses in highly competitive international markets. This would increase the capacity to generate new innovations that could be transferred to the market, creating great added value and social benefit.

"Incubator/Accelerator" respondents assume that the budgets dedicated to R&D+I will be increased, and greater incentives will be provided to the companies of this sector (fiscal, subsidies, credits, etc.). Likewise, the regulatory deadlines and costs will have to be reduced, since we have a rigid and excessively bureaucratic system. Also digitize the health system, will be equipped with ICT, BigData, sensorization, drones, etc. ... to make it more effective and flexible.

"Business" respondents stated that Spain should complement the very good basic research we have, solving our deficiencies in translational science and creation of production and marketing companies, promoting the creation of private companies. Also, public and private sectors should complement each other in order to develop products from basic science to commercial application. Some "Business" respondents believe that the healthcare system will be digitalized, rethinking processes and optimizing the whole in collaboration with SMEs that take on innovation and large companies that ensure processes, generating much value for all parties.

"Others" stated that is necessary that exists a commitment from all influential actors, including financial actors, in the BIOHEALTH sector to foster entrepreneurship. Greater development and stability in R&D.

Lastly, they outline an interesting scenario: In the German industrial ecosystem firms find local and regional bankers with deep industry knowledge, a vocational education system that produces highly-qualified workers, trade associations, technical universities, industrial collective research consortia, industrial research centers, technical advisory committees, and they want Spain follows this line.

In the next questions, the interviewees were asked to give possible scenarios for a short, middle and long term.

5.3.3.1 Short term

Table 5.18: BIOHEALTH Sector Scenarios, short term (ES)

| C) Regarding the question B), please give your answers about possible scenarios for the BIOHEALTH sector, in the short term (1-3 years) | |
|---|---|
| Organization | Answer |
| Academia | |
| Academia | “In the short term, access barriers to the intellectual properties from knowledge agents that will remain untranslated could be eliminated. The restrictions imposed on Spanish researchers putting them at a disadvantage with other territories could also be removed. All of this together with tax policies encouraging investment in BIOHEALTH projects would allow the creation of new entrepreneurial projects. In this case, the problem of undercapitalization would have to be solved.” |
| Incubator/Accelerator | “So, I think that the next few years will bring very good economic opportunities, especially for those entrepreneurs more innovative and disruptive, who know how to see the business opportunity. This scenario will happen in the short term out of necessity and will be established and perfected in the medium to long term.” |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | ““Brain drain”: researchers migrate to countries that provide greater support to R&D.” |
| Business | |
| Business | |
| Business | “>Attraction of consulting companies in the pharmaceutical/medical devices sector. Partially working with public entities and private enterprises. >Modification of health research management structures. Reduction in the number of organizations, but creation of a skilled, dynamic and results-oriented organization. These organizations work with a focus on quantifiable results objectives, budgets linked to these objectives, and revision of objectives by personnel.” |
| Business | “Everything stated should be doable within 3 years if politics can be removed from the picture and all the entities in the PTS are agreeable.” |
| Business | “Short term: Create effective and well-coordinated operational links between Universities and Technology Parks, with particular emphasis on common vision, common |

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| | goals, and state-of-the-art curricula that will attract bright students." |
| Business | "In the short term, the "REAL" "innovation must be promoted, the short-term innovation must be undertaken in settings where the documentary and bibliographic part of the project coexists with the experimental and normative part of the innovation process. On short term, the technology and worked materials should be optimized in order to work on them." |
| Business | "Virtual assistants and health management systems must be implemented to make health more sustainable and to be able to face crises like the current one. Solutions, platforms, already in place in other sectors will have to be implemented." |
| Business | "The first and most necessary thing is research on medications, technology application in eHealth, avoiding direct contact of medical personnel with patients due to the risk of infections. A lot of public money is going to be put in to defeat the current pandemic, and this sector is key." |
| Other | "Organization of an entrepreneurial ecosystem in bio." |
| Other | "Involvement of Master Bio students in projects of innovative companies" |
| Other | "In the short term, I think a multitude of initiatives will be promoted by the public sector and executed by the BIOHEALTH scientific community which generate innovative solutions and support the private sector. I predict that new enriched BIO startups will appear with private capital and expect to be financed by the private sector." |
| Other | "In the short term, the BIOHEALTH sector must improve the processes of primary health care and disease prevention. This way, look for a short-term scenario that enhances prevention before treatment processes. Systems allow remote assistance will also be of vital importance." |
| Other | |

Source: BIO-ALL, 2020

In the short term, the interviewees stated that virtual assistants and health management systems must be implemented to make health more sustainable and to be able to face crises like the current one. Solutions, platforms, already in place in other sectors will have to be implemented.

The first and most necessary thing is research on medications, technology application in eHealth, avoiding direct contact of medical personnel with patients due to the risk of infections. A lot of public money is going to be put in to defeat the current Covid-19 pandemic, and this sector is key.

The "Academia" interviewees think that, in the short term, access barriers to the intellectual properties from knowledge agents that will remain untranslated could be eliminated. The restrictions imposed on Spanish researchers putting them at a disadvantage with other territories could also be removed. All of this together with tax policies stimulating investment in BIOHEALTH projects would allow the creation of new entrepreneurial projects. In this case, the problem of undercapitalization would have to be solved.

On the other hand, “Incubator/Accelerator” interviewees, state that the next few years will bring very good economic opportunities, especially for those entrepreneurs more innovative and disruptive, who know how to see the business opportunity.

Some of “Business” interviewees, speak about “Brain drain”: researchers migrate to countries that provide greater support to R&D but most of them think that a multitude of initiatives will be promoted by the public sector and executed by the BIOHEALTH scientific community which generate innovative solutions and support the private sector. They predict that new enriched BIO startups will appear with private capital and expect to be financed by the private sector.

Last, “Other” interviewees state that to have an organization of an entrepreneurial ecosystem in bio is quite important. Also, they think that is quite important to create effective and well-coordinated operational links between Universities and Science and Technology Parks, with emphasis on common vision, common goals, and state-of-the-art curricula that will attract bright students which will be future qualified entrepreneurs.

5.3.3.2 Medium term

Table 5.19: BIOHEALTH Sector Scenarios, medium term (ES)

| D) Regarding the question B), please give your answers about possible scenarios for the BIOHEALTH sector in the medium term (3-7 years) | |
|---|---|
| Organization | Answer |
| Academia | |
| Academia | “Identification of strategic areas in the BIOHEALTH sector and creation of specific funds responding to specific needs. This would lead to identifying regions with higher current capacities responding to specific needs with the idea of implementing SMART Specialization policies.” |
| Incubator/Accelerator | “So, I think that the next few years will bring very good economic opportunities, especially for those entrepreneurs more innovative and disruptive, who know how to see the business opportunity. This scenario will happen in the short term out of necessity and will be established and perfected in the medium to long term.” |
| Business | |
| Business | |
| Business | |
| Business | |
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| Business | |

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| Business | "Develop industry partnerships to stimulate innovation in personal testing. A pertinent and timely example is low-cost microbiome testing. When personal microbiome testing is available at a cost of 100 euros, the key missing innovation needed for product adoption will revolve around marketing campaigns capable of teaching the utility and health improvement value of this testing modality." |
| Business | "The medium term in BIOHEALTH sector is a dangerous point, and medium term planning should not be an extension of the short term. Medium-term innovation must incorporate new technologies and new materials that are appearing in the design process and include, refine and adapt them as in the innovation process." |
| Business | "Process automation, the development of tissue engineering, are things that can be easily implanted in the medium term. Also the use of artificial intelligence and robotics for numerous processes." |
| Business | "Once telecare is integrated and widespread in the health sector, we will go the 360° path of health, providing pocket solutions for monitoring chronic patients and metabolic diseases: cholesterolemia, diabetes, hypertension." |
| Other | "Stronger institutional support." |
| Other | "Strengthening the entrepreneurial ecosystem." |
| Other | "In the medium term, I think only BIO projects which have been able to demonstrate success indicators will be acquired by large private groups in the pharmaceutical sector, generating a new concentration. Once a turning point has been reached, the public sector will subsidize innovation again." |
| Other | "In the medium term, the BIOHEALTH sector will have advanced a lot regarding innovative processes for improving telecare. Also, the advanced development of new organic tissues to improve human treatments." |
| Other | |

Source: BIO-ALL, 2020

The medium term in BIOHEALTH sector is a dangerous point, and medium term planning should not be an extension of the short term. Medium-term innovation must incorporate new technologies and new materials that are appearing in the design process and include, refine and adapt them as in the innovation process. Regarding the "Academia" interviewees, they state that on a medium term will be necessary the identification of strategic areas in the BIOHEALTH sector and creation of specific funds responding to specific needs. This would lead to identifying regions with higher current capacities responding to specific needs with the idea of implementing SMART Specialization policies.

The "Incubator/Accelerator" interviewees said that the good economic opportunities, will happen in the short term out of necessity and will be established and perfected in the medium to long term.

The “Business” interviewees see the process automation and the development of tissue engineering, are things that can be easily implanted in the medium term. Also, the use of artificial intelligence and robotics for numerous processes. Moreover, once telecare is integrated and widespread in the health sector, we will go the 360° path of health, providing pocket solutions for monitoring chronic patients and metabolic diseases: cholesterolemia; diabetes; and hypertension. Finally, the “Other” interviewees think that on a medium term there will be Stronger institutional support and the entrepreneurial ecosystem will be stronger.

5.3.3.3 Long term

Table 5.20: BIOHEALTH Sector Scenarios, long term (ES)

| E) Regarding the question B), please give your answers about possible scenarios for the BIOHEALTH sector in the long term (10-15 years) | |
|---|--|
| Organization | Answer |
| Academia | |
| Academia | “The specialized poles will create activities which will generate both public and private returns allowing the development of new disruptive innovations. Vehicles created in the intermediate phase will increase in value and will stabilize in the region creating a high number of highly qualified jobs. The region-wide increase in value will act as a magnet for other investors to participate in the successful environment. This way, the funds created in the intermediate phase will be self-sufficient and will grow.” |
| Incubator/Accelerator | “So, I think that the next few years will bring very good economic opportunities, especially for those entrepreneurs more innovative and disruptive, who know how to see the business opportunity. This scenario will happen in the short term out of necessity and will be established and perfected in the medium to long term.” |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | “Long term opportunities exist in product integration with major industries, such as the food industry. Andalusia is a major food producer, and yet nutrigenomics remains a boutique research activity. Nutrigenomics will not achieve industrial growth until entrepreneurial startups with |

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| | innovative products are able to form commercial partnerships with large industrial players in the food industry such as Danone, Nestle, Puleva, etc., as well as large players in health such as Microsoft Healthcare NExT." |
| Business | "To speak of long-term innovation is to speak of economic capacity to withstand such a long recession period. The regulations and deadlines in Biohealth mean that many projects also have to endure many bureaucratic obstacles and legal barriers. Long-term innovation projects must be highly supported and analyzed from the start, as well as the importance of the team that takes over its management, since it must be aware and motivated to progress in compliance as well as identify and guide the project before possible problems arise. On long-term projects, the search for funding often takes great time for the main researchers, which is an error to solve if we want the projects not to be orphaned with knowledge. " |
| Business | "In the long term we will see how medicine will be enhanced with the use of sensors, the increase in pathology markers preventing the appearance of diseases and therefore save the system money." |
| Business | "Bio-mechanical solutions will appear in such a way that solutions for the regeneration of tissues, artificial organs with biological material will be used. Hospitals will cease to exist the way they are today. Multidisciplinary units will be created for complex diseases such as cancer and most pathologies will be treated in the patient's environment. Chronics will be treated for their problems remotely and in real time, only when there are acute health problems." |
| Other | "Results." |
| Other | "Investment and entrepreneurial ecosystem." |
| Other | "We will see its fruits in this period of 10-15 years for everything we do today in the sector. If we do nothing now, we will re-mortgage the sector and future generations of researchers and innovators." |
| Other | "In the long term, the BIOHEALTH sector should focus on how to address the possibility of overpopulation with a percentage of elderly people. Aging population and social changes in relation to the main caregivers of dependent patients make it necessary to deal with dependency and chronic care with high social and health policy." |
| Other | |

Source: BIO-ALL, 2020

To speak of long-term innovation is to speak of economic capacity to withstand such a long recession period. The regulations and deadlines in Biohealth mean that many projects also must endure many bureaucratic obstacles and legal barriers. Long-term innovation projects must be highly supported and analyzed from the start, as well as the importance of the team that takes over its management, since it must be aware and motivated to progress in compliance as well as identify and guide the project before possible problems arise. On long-

term projects, the search for funding often takes great time for the main researchers, which is an error to solve if we want the projects not to be orphaned with knowledge.

If we analyze the responses from the different organizations, we can see that the “Academia” interviewees affirmed that on a long term it is expected that the specialized poles will create activities which will generate both public and private returns allowing the development of new disruptive innovations. Vehicles created in the intermediate phase will increase in value and will stabilize in the region creating a high number of highly qualified jobs. The region-wide increase in value will act as a magnet for other investors to participate in the successful environment. This way, the funds created in the intermediate phase will be self-sufficient and will grow.

The “Incubator/Accelerator” interviewees said that the good economic opportunities, will happen in the short term out of necessity and will be established and perfected in the medium to long term.

The “Business” respondents said that there will be a more favorable situation on the long term. In the long term we will see how medicine will be enhanced with the use of sensors, the increase in pathology markers preventing the appearance of diseases and therefore save the system money. Bio-mechanical solutions will appear in such a way that solutions for the regeneration of tissues, artificial organs with biological material will be used. Hospitals will cease to exist the way they are today. Multidisciplinary units will be created for complex diseases such as cancer and most pathologies will be treated in the patient's environment. Chronics will be treated for their problems remotely and in real time, only when there are acute health problems.

Lastly, the “Other” interviewees stated that, in the long term, the BIOHEALTH sector should focus on how to address the possibility of overpopulation with a percentage of elderly people. Aging population and social changes in relation to the main caregivers of dependent patients make it necessary to deal with dependency and chronic care with high social and health policy.

But if these are the scenarios envisioned by the interviewees, what are the main trends and drivers for which the sector could respond to on a short, medium and long term? The following points will give us those answers.

In the figure below, we can see the different possible scenarios of the BIOHEALTH sector, considering entrepreneurial and innovative processes by the interviewees in Spain.

Figure 5.7: Representation of the Spanish respondents BIOHEALTH Sector Scenarios



5.3.4 Drivers and trends in future scenarios for the BIOHEALTH sector

What follows is a brief appraisal of the drivers and trends the interviewees feel are going to be in the BIOHEALTH sector's future scenarios. Although it is important to point out scenarios, the prediction of future trends and drivers for the BIOHEALTH sector is a somewhat a hazardous exercise. As of that this will only be a glimpse of what can happen in the future, even though we can find similar paths and ways of convergence amongst the answers. Below is the table with the interviewees' responses.

Table 5.21: BIOHEALTH's Main Drivers and Trend Scenarios (ES)

| F) What will be the main drivers and trends in future scenarios of the BIOHEALTH sector? | |
|--|---|
| Organization | Answer |
| Academia | "Investments." |
| Academia | "Public-private collaboration allows a flow of knowledge in both directions financed by public-private capital. This will make public administrations identify strategic needs within the sector to promote projects with public-private financing responding to those needs. This would be to use the current project financing emergency model for COVID19 but, not based on an emergency but on long-term strategic planning." |
| Incubator/Accelerator | "The main drivers will be universities, research centres and private companies. And the tendency will be, in short, that there is a greater connection between companies and research groups to advance together." |
| Business | |

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| Business | "As promoters of both companies and research groups, with the intention of advancing towards solutions for personalized and precision medicine." |
| Business | "Personalized and biological therapies will grow and become more democratic by reducing their price due to the increased demand. Once again, the main driver must be the result of a close collaboration between the public and the private." |
| Business | "Tests and molecular markers." |
| Business | "Perhaps the need of innovation in terms of less aggressive methods for early detection of diseases or the development of treatments by means of bioindicators, and vaccines. I think it is very interesting, especially in the case of the elderly sector." |
| Business | "Public administration and private entities." |
| Business | "Investment." |
| Business | "The boost will come from the smart city sector, which will lead the transformation into preventive medicine and digitization within 2 years, given the inability of companies in the sector to collaborate with public health systems and the difficulty of doing so with private ones. The tendency is to work in prevention, self-management supported by expert systems that especially monitor chronics and help the general population." |
| Business | "Artificial Intelligence and data science, Aging, Medical devices, Diagnostic Device, Infectious Diseases." |
| Business | "Aging populations, obesity which is the driver of incidence of most chronic diseases, AI and climate change." |
| Business | "BIOHEALTH will be drive by the need for innovations that deliver: a) measurably improved health outcomes for all users of products/technologies; b) reduced costs for government health delivery; c) Optimal utilization of digital technologies in health; d) measurable reduction in the incidence of chronic diseases though the utilization of innovative products and technologies. e) improvements in the quality of life of the aging population." |
| Business | "The future of the BIOHEALTH sector depends on defending the society's interests and not of the large multinationals which monopolize decisions both at the government level and in the health systems. The lobby represented by the large biotech companies in front of the medicine agencies and notified organisms is an absolute control. The interests of these multinationals collide head-on with the emerging innovation in the entrepreneurship process. A serious fact is the financing found by the universities is small in comparison with the objective of the large companies to appropriate research lines financed with public resources. If we want innovative entrepreneurship in the BIOHEALTH sector, we must contribute to protect our resources from external interference highly oriented to short-term economic benefits. We must innovate in scenarios to position innovation in entrepreneurship in order to |

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|----------|---|
| | promote new formulas and models of entrepreneurship in the educational society that are different from the current ones, in the same way that we innovate in processes and products for the future of innovative entrepreneurship at BIOHEALTH.” |
| Business | “Private initiatives, entrepreneurs and businessmen will be the drivers of these trends. And they will encounter legal and funding barriers, not only at the national but also at the European level.” |
| Business | “Advances in immunology will be the first steps. The advance for the personalization of medicine will be consolidated as a health solution. Health will be treated from a health perspective and not from disease. It will prevent citizens from getting sick.” |
| Other | “We are seeing a very special interest in big data and AI techniques.” |
| Other | “The essential exchanges are those between human beings: students excited about entrepreneurship graduating from universities and going to work in startups and companies, engineering students sent on internships to a company for several months, researchers from industry standing around a coffee machine in a lab talking with their university counterparts, scientists from research centers spending a few years in government policymaking positions, a university patent expert counseling the chemist with a great new idea on batteries, the chemist serving as a consultant to the startup that was initiated with a license from her discovery, the university industrial liaison officer walking a company’s R&D director on an introductory round to visit labs...” |
| Other | “Public sector always and pharma companies.” |
| Other | “The main drivers should be new entrepreneurs that emerge from IPOs that develop innovative processes. Other relevant actors will be companies will allow these entrepreneurs to advance in their developments thanks to financing and collaboration between the parties.” |
| Other | “Public administration. The focus will be put on the prevention of diseases.” |

Source: BIO-ALL, 2020

The above table has the answers the interviewees gave for what will be the main drivers and trends in future scenarios of the BIOHEALTH sector. They state that the boost will come from the smart city sector, which will lead the transformation into preventive medicine and digitization within 2 years, given the inability of companies in the sector to collaborate with public health systems and the difficulty of doing so with private ones.

The tendency will be work in prevention, self-management supported by expert systems that especially monitor chronics and help the general population. Artificial Intelligence and data science, aging populations, medical devices, diagnostic device, infectious diseases and obesity which is the driver of incidence of most chronic diseases. Advances in immunology will be the first steps. The

advance for the personalization of medicine will be consolidated as a health solution. Health will be treated from a health perspective and not from disease. It will prevent citizens from getting sick.

Private initiatives, entrepreneurs and businessmen will be the drivers of these trends. And they will encounter legal and funding barriers, not only at the national but also at the European level. Also, there will have to be a greater connection between companies and research groups to advance together.

Following the answers, and grouping them by organizations, we can see that "Academia" states as main drivers the investments and the public-private collaboration as allows a flow of knowledge in both directions financed by public-private capital. This will make public administrations identify strategic needs within the sector to promote projects with public-private financing responding to those needs. This would be to use the current project financing emergency model for COVID19 but, not based on an emergency but on long-term strategic planning.

Also, the "Incubator\Accelerator" interviewees affirmed that the main drivers will be universities, research centres and private companies.

If we analyse the "Business" interviewees' responses, we can understand that for them the main drivers will be the result of a close collaboration between the public and the private, this is, public administration and private entities besides the investment.

Finally, "Other" interviewees stated that the main drivers should be new entrepreneurs that emerge from IPOs that develop innovative processes. Other relevant actors will be companies will allow these entrepreneurs to advance in their developments thanks to financing and collaboration between the parties. Apart from public sector and pharma companies.

It is important not only to know the future trends but also to try and understand how to reach the speculated scenarios, which strategies to use. In the following points, we will analyze the respondents' answers about the strategies necessary to achieve these same scenarios.

It is important to note that ICTs have become present in the field of health. Clinical practice revolves around data, information and knowledge. The Internet is the largest source of health information not only for professionals but also for patients. In addition, a multitude of initiatives for medical and health applications have emerged and continue to emerge that, apart from information services, contemplate the possibility of consulting doctors: second opinion, support groups between patients, telemedicine services and a wide range of possibilities. The development of corporate-type digital communications network infrastructures and generalized access to the Internet are allowing the flow of information between all actors, using electronic medical records in a secure environment, improving the quality of services and facilitating more efficient and comfortable management for citizens.

The current trend in the technosanitary market involves combining the concepts of innovation, effectiveness and sustainability. A report on Healthcare Technology in Spain prepared by ICEX and Investin Spain, reflects a Healthcare

System immersed in a “process of evolution towards a more modern, efficient, flexible and effective system, which involves the application of ICT in the field of Health, the incorporation of biomaterials and the application of new biotechnological advances”.

In the figure below, we can see some of the main drivers and trends in future scenarios in the BIOHEALTH sector.

Figure 5.8: Representation of the BIOHEALTH's Main Drivers and Trend Scenarios, according to Spanish respondents



5.3.5 Strategies and actions to achieve scenarios in the sector, considering the entrepreneurial and innovative processes

It is always tempting to take desires for reality. Although visions of the future or scenarios appear desirable, the choices and strategic direction of an organization or a sector do not necessarily match a single proactive vision. One must also be prone and prepared for expected changes to a sector's future environment (Godet, 2000). That is why it is important to define strategies and actions in order to achieve the scenarios envisioned.

We asked the interviewees about the practical strategies and actions that will be necessary to achieve the scenarios. In the tables below we can see the answers they gave.

Table 5.22: BIOHEALTH's Most Practical Strategies and Actions (ES)

| G) Describe the most practical strategies and actions to achieve these scenarios in the sector, considering the entrepreneurial and innovative processes. (Definition of "Strategy": a detailed plan for achieving success ") | |
|---|--------|
| Organization | Answer |

| | |
|-----------------------|---|
| Academia | "Increase investment in R + D + i linked to objectives. These objectives should be set taking into account local situations. Large international programs are not suited to these situations." |
| Academia | "Initial actions must be accompanied by legislative changes at the national level." |
| Incubator/Accelerator | "The strategy to be followed in order to achieve the scenarios defined above will begin with greater collaboration between universities and private companies. University as a promoter of the entrepreneurial spirit and generator of knowledge in the sector and the company to materialize such research to commercial application. In addition, basic health research and public awareness must be promoted. All this must be accompanied by a more favorable tax situation for private research, development and production companies." |
| Business | |
| Business | |
| Business | <ol style="list-style-type: none"> 1. "To stop exporting professionals and basic science, private research must be facilitated and promoted with state aid and concessions in order to retain talent and science. The private sector can generate more attractive circumstances by being more competitive. 2. The generation of diverse public-private capital startups with a royalty-free emancipation plan." |
| Business | "Relying on successful entrepreneurs, especially if they have previously failed in this sector. This is what happens in successful innovation poles, which are always accompanied by advantages for the capital risked in this type of companies." |
| Business | "I couldn't tell but I understand that cooperation among all agents will be key to achieve success." |
| Business | |
| Business | "Increase investment in R&D related to objectives. Such objectives should be defined bearing in mind the local situations. Large international programmes are not appropriate for these situations." |
| Business | <ol style="list-style-type: none"> 1) "Creation of specific budgets for health innovation open to companies and especially SMEs, with a sufficient amount. No loans: grant. 2) Creation of a legal and / or administrative framework that allows SMEs to collaborate with the health system, and that connects health outside and within the hospital. Create protocols for interconnection with medical records, so that patients can consume and enrich them. 3) Create open, connected and secure data reservoirs so that companies can test solutions with real patient data, and with patients, in an agile, simple and cheap way. 4) Connect the external data to the health system with patient data, feeding their medical history. 5) Connect all the medical records of the different CCAA and European countries, through defined, distributed, safe and accessible protocols." |
| Business | <ul style="list-style-type: none"> ➤ "Modification of health research structures. Re-organization of resources, reviewing possible mergers / eliminations of agencies / foundations based on the objectives they cover (?) And the results obtained. ➤ Attraction of critical mass. Attraction of international consultants or profiles with real global experience in medical / diagnostic devices. ➤ Attraction of INTERNATIONAL CROs for clinical trial management." |
| Business | "Infrastructure, grants and advisors (with global experience) that really supports the sector instead of crushing it." |
| Business | "The most effective strategy to boost Entrepreneurship is to strengthen the Universities that are present within the Country/Region where the BIOHEALTH |

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| | economic development is to take place. The University must create the figure of a Vice-Rector for Technology and Economic Development. The Vice-Rector must be given resources to craft a curriculum suitable for fostering entrepreneurship, as well as a role in crafting interactions with Technology Parks and Industrial players in the region and in Europe." |
| Business | "The strategies to achieve success or vice versa for the implementation of new scenarios. The economic and social crises experienced in recent years have led to false expectations in the entrepreneurship model in the BIOHEALTH sector, the implementation of new initiatives or new projects in the area of BIOHEALTH and the support structure or strategy to carry them out are similar to innovation projects in ICTs or in software, each sector has its importance, but each one has its rhythms, its needs and time to market. Therefore, the strategies must be highly personalized by sector and I would dare to say for each project as a successful strategy." |
| Business | |
| Business | "Public initiative will be key for research and for changes in health plans. Primary medicine will be much more technological to achieve the following objectives: productivity (prevent health systems from becoming saturated), reliability (if patients are monitored, alert systems will avoid acute problems), personalization (medicine will be one and different for each patient), Extended Health will allow the use of nutrition and sport as a means of improving health." |
| Other | "Aggregation in regional networks of bio entrepreneurship, integration of existing networks Strong and forceful institutional support. Relationship with the existing sector that normally operates in the market. Relationship with Europe. Supporting international trade from the outset." |
| Other | "Building a dense set of connections along the interface between researchers and industry is what matters most." |
| Other | "There is no magic bullet, but it is key that the private sector enters the early stages of supporting research with validation, market analysis and investment." |
| Other | "Strategic lines: People-centered care, promoting multidisciplinary home care, performance evaluation and results-based incentives, management flexibility, legislative changes and good governance." |
| Other | |

Source: BIO-ALL, 2020

As for the most practical strategies and actions to achieve the scenarios in the sector, the interviewees state that cooperation among all agents is critical to achieve success. Relying on successful entrepreneurs, especially if they have previously failed in this sector. This is what happens in successful innovation poles, which are always accompanied by advantages for the capital risked in this type of companies.

Following the above answers, the "Academia" respondents stated that as a practical strategy there will be a need to increase investment in R + D + I linked to objectives. These objectives should be set considering local situations. Large international programs are not suited to these situations. Also, initial actions must be accompanied by legislative changes at the national level.

"Incubator/Accelerator" respondents state that the strategy to be followed in order to achieve the scenarios defined above will begin with greater collaboration between universities and private companies. University as a promoter of the entrepreneurial spirit and generator of knowledge in the sector and the company

to materialize such research to commercial application. In addition, basic health research and public awareness must be promoted. All this must be accompanied by a more favorable tax situation for private research, development and production companies.

If we analyze the “Business” responses, they all focus on increase investment in R&D related to objectives. Such objectives should be defined bearing in mind the local situations. Large international programmes are not appropriate for these situations. Also, creation of specific budgets for health innovation open to companies and especially SMEs, with a sufficient amount. No loans: grant and finally, creation of a legal and / or administrative framework that allows SMEs to collaborate with the health system, and that connects health outside and within the hospital.

“Others” consider that Building a dense set of connections along the interface between researchers and industry is what matters most.

The next three subchapters will analyze the interviewees’ answers about possible strategies for the BIOHEALTH sector in the short, medium and long term, in order to achieve the strategies.

5.3.5.1 Short term

Table 5.23: BIOHEALTH’s Most Practical Strategies and Actions, short term (ES)

| H) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the short term (1-3 years) | |
|--|--|
| Organization | Answer |
| Academia | |
| Academia | “Elimination of incompatibility clauses for investigators from the body of state officials. Tax deduction policies for investments in the BIOHEALTH area allow seed capital to enter high-risk projects. Creation of clinical investigator profile.” |
| Incubator/Accelerator | “This strategy will be given in the short term out of necessity and will be established and perfected in the medium to long term.” |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | “Measures to favor entrepreneurial projects (supporting entrepreneurs in both starting and continuation of businesses).” |
| Business | |
| Business | |
| Business | “The ones mentioned above.” |

| | |
|----------|--|
| Business | "The hard part is already done, the infrastructure and innovation, everything I am describing can be accomplished in less than three years if there is agreement to do so." |
| Business | "Create figure of Vice-Rector for Technology and Economic Development. Attract existing university faculty to participate in the program through special incentives that make sense within the context of University structure/politics." |
| Business | "Betting on identifying innovative projects with entrepreneurial capacity to promote real accompaniments away from the market of consultants, strategists, investors that come around the startups spinoffs etcetera, another model is needed with a more professional approach where help and Grants are managed in a personalized way by project, and away from political interests and cronyism." |
| Business | "It is necessary to increase support for companies that are already established and already sell, so they can expand the market. Develop an active export policy that allows companies to grow in size and feed the ecosystem." |
| Business | "The advancement of the IoT will allow the development of new bioanalyzers that will allow measuring metabolic problems in real time. A network of chronic connected patients will be developed as well as the doctor will be able to follow the amount of exercise and the patient's diet in near real time. The hyperconnectivity of patients will be advanced." |
| Other | "Creation and integration of networks, international support, relationship with the sector, relationship with Europe." |
| Other | |
| Other | |
| Other | |
| Other | "Larger government Budget allocations for the sector." |

Source: BIO-ALL, 2020

In the short term, the interviewees stated that the most practical strategies and actions to achieve the scenarios in the sector will be a mix between funding, university support and business support.

That being said, and considering the responses of the organizations, "Academia" respondents stated that there is a quick need of tax deduction policies for investments in the BIOHEALTH area allow seed capital to enter high-risk projects and creation of clinical investigator profile.

"Business" respondents remark that it is necessary to increase support for companies that are already established and already sell, so they can expand the market and develop an active export policy that allows companies to grow in size and feed the ecosystem.

"Other" respondents affirmed that it is necessary the creation and integration of networks, international support, relationship with the sector, relationship with Europe and a larger government budget allocations for the sector.

Next, we can see what the respondents consider as being the possible strategies for the sector on the medium term and on the long term.

5.3.5.2 Medium term

Table 5.24: BIOHEALTH's Most Practical Strategies and Actions, medium term (ES)

| I) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector in the medium term (3-7 years) | |
|--|--|
| Organization | Answer |
| Academia | |
| Academia | "Establishment of a transversal group that defines the medium-term strategic lines and creation of SMART Specialization policies. This group must include all agents participating in the sector (entrepreneurs, innovators and public administrations). Structuring investment funds to invest in strategic projects that have entrepreneurial and innovative agents. Establishment of the first entrepreneurial structures to emerge from this group." |
| Incubator/Accelerator | "This strategy will be given in the short term out of necessity and will be established and perfected in the medium to long term." |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | |
| Business | "Promoting collaboration projects between synergetic companies." |
| Business | |
| Business | |
| Business | "Removal of certain redundant public structures that undermine the financing and possible aid that companies/entrepreneurs really need." |
| Business | "None." |
| Business | "The Vice-Rector launches academic/industrial mentoring programs in Technology and Entrepreneurship, in coordination with Technology Parks. European grant funding is secured through the structuring of programs that are competitive within the context of Horizon Europe." |
| Business | "The medium-term strategy involves professionalizing the management of BIOHEALTH projects from a of social and economic profitability point of view, and where the project structure is not permanently conditioned by the search for subsidies or investors. Along this path, protect principal investigators to focus on their work." |
| Business | "It is necessary to provide and improve quality training in Business Management for graduates, especially in the BioTechnological sector. Legislative changes need to be made to favor start-ups, startups and micro-businesses. And to train industrial engineers that allow the development of products in the case of Granada." |
| Business | "Automatic management systems will be developed, and artificial intelligence will provide information to predict diseases and diagnose common diseases early. Artificial intelligence will intervene in the manufacture of diets, |

| | |
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| | treatments and sports for the patient. Hybrid food-drug applications will be developed in a personalized way." |
| Other | "Stronger institutional support." |
| Other | |
| Other | |
| Other | |
| Other | "Government policies focused on the preservation of health." |

Source: BIO-ALL, 2020

In the medium term, the interviewees stated that would be useful the establishment of a transversal group that defines the medium-term strategic lines and creation of SMART specialization policies. This group must include all agents participating in the sector (entrepreneurs, innovators and public administrations).

There are no great differences if we analyze through the different organizations' respondents.

As of that, "Academia" respondents affirmed a need of structuring investment funds to invest in strategic projects that have entrepreneurial and innovative agents.

If we take in consideration the "Business" respondents, they remark that the medium-term strategy involves professionalizing the management of BIOHEALTH projects from a of social and economic profitability point of view, and where the project structure is not permanently conditioned by the search for subsidies or investors. Along this path, protect principal investigators to focus on their work.

Finally, the "Other" respondents stated that there is a need for stronger institutional support and government policies focused on the preservation of health.

5.3.5.3 Long term

Table 5.25: BIOHEALTH's Most Practical Strategies and Actions, long term (ES)

| J) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the long term (10-15 years) | |
|---|---|
| Organization | Answer |
| Academia | |
| Academia | "In this temporary space some successful project will have been generated that will bring an important return. This increase in value will affect the entire ecosystem and the implementation of new projects will accelerate. Strategic lines will be reviewed, and investment funds will be increased, inviting new players." |
| Incubator/Accelerator | "This strategy will be given in the short term out of necessity and will be established and perfected in the medium to long term." |
| Business | |
| Business | |

| | |
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| Business | |
| Business | |
| Business | |
| Business | "Supporting research staff training and promoting measures to avoid "brain drain"." |
| Business | |
| Business | |
| Business | "Positioning of the region as an attractive environment for the execution of Biotech & Medical Devices' entrepreneurship / startup generation plans. Examples: Delft, Oxford, Berlin, Paris..." |
| Business | "None." |
| Business | "Work to achieve entrepreneurial maturation a small number of high impact "Success Examples of European startups in BIOHEALTH" and attract increased European funding in order to grow the BIOHEALTH Technology Park as an engine for innovation." |
| Business | "The long term in the strategy to be followed at BIO-SALUD is betting on generating an inter-institutional cooperation system where projects and entrepreneurs can take advantage of and benefit from the infrastructure and means that exist. We must flee from a competitive model where some projects fight against others and move to a collaborative model. " |
| Business | "If there is no sun to grow, it is not sown." There are many seeds, a lot of knowledge and entrepreneurs, but there are no incentives for investment. There are many obstacles to the arrival of capital. And the work of the University is fundamental, it is the great asset of Granada's economy and its development must be promoted at the level of training and applied research." |
| Business | "The use of bioengineering and AI will be generalized in all areas of health. New engineering professions related to health management will appear. The doctor will have large quantities of devices to manage the chronic patient." |
| Other | "Recurrent lines in industrial policies to promote and support the sector." |
| Other | |
| Other | |
| Other | |
| Other | |

Source: BIO-ALL, 2020

In the long term, the interviewees stated that some successful project will have been generated that will bring an important return. This increase in value will affect the entire ecosystem and the implementation of new projects will accelerate. Strategic lines will be reviewed, and investment funds will be increased, inviting the entry of new players.

The long term in the strategy to be followed at BIO-SALUD is betting on generating an inter-institutional cooperation system where projects and entrepreneurs can take advantage of and benefit from the infrastructure and means that exist. We must flee from a competitive model where some projects fight against others and move to a collaborative model.

If we take in consideration the “Academia” responses, we see the necessity of supporting research staff training and promoting measures to avoid “brain drain” and positioning of the country as an attractive environment for the execution of Biotech & Medical Devices' entrepreneurship / startup generation plans.

Finally, “Other” interviewees stated that we must establish recurrent lines in industrial policies to promote and support the sector.

In the figure below we can see some of the strategies and actions considered in order to achieve scenarios in the BIOHEALTH sector, considering the entrepreneurial and innovative processes.

Figure 5.9: Representation of the BIOHEALTH's Most Practical Strategies and Actions, according to Spanish respondents



5.3.6 Strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector

It is important to consider the key role of innovation and entrepreneurship in the BIOHEALTH sector. The incorporation of innovation requires strategies aiming to increase the BIOHEALTH's sector market share, the quality of the offered goods and services, production capacity, business visibility and health and safety guarantees. Schumpeter (1934), stated that entrepreneurship and innovation are independently connected and interlinked. Hence, without innovation, entrepreneurship has unclear significance to individuals, organizations economy and vice-versa. Hammel (2000) states that innovation must often be the

foundation of creations, and for that it is critical for any company, industry or sector that wants to compete effectively in the twenty-first century's landscape. With this question we wanted to know what the interviewees see as the upmost important strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector, choosing only a maximum of two answers from a list: "Policies at European, National and Regional level"; "Innovation - R&D + I, Patents"; "Business incentives: tax, subsidies, credits"; "Education and advanced learning"; "Entrepreneurial capabilities in biotechnology"; "Entrepreneurial processes in the biotechnology sector (phases, deadlines, composition, potential entrepreneurship rate, dropout rate, regulation, certification)"; "Potential markets"; "Others".

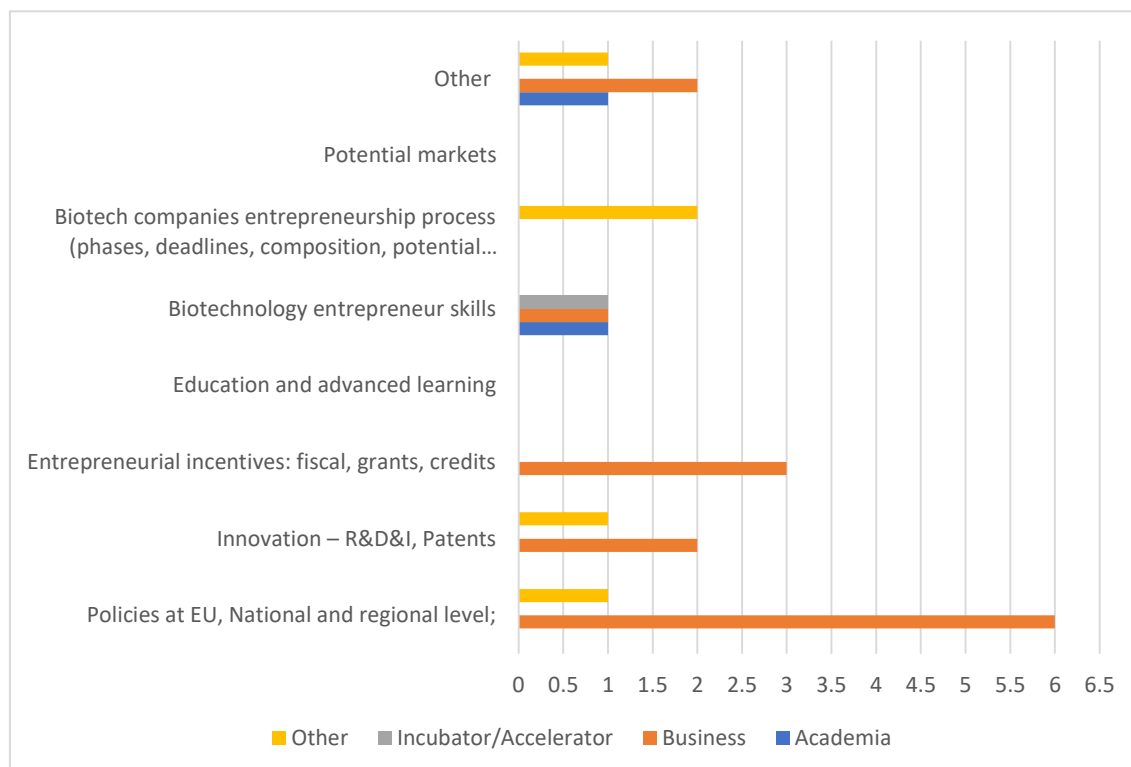
Table 5.26: Strategies and actions to promote innovation and entrepreneurship (ES)

| K) In your opinion, what are the strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector? Please provide a maximum of two responses | |
|--|--|
| Organization | Answer |
| Academia | All of the abovementioned. |
| Academia | Entrepreneurial skills in the BIOHEALTH sector. |
| Incubator/Accelerator | Entrepreneurial skills in the BIOHEALTH sector. |
| Business | |
| Business | Policies at EU, national and regional level. |
| Business | Business incentives: tax, grants, loans. |
| Business | Business incentives: taxes, subsidies and loans. |
| Business | Innovation, R&D, patents. |
| Business | EU, national, and regional policies. |
| Business | All of the abovementioned. |
| Business | EU, national, and regional policies. |
| Business | EU, national, and regional policies. |
| Business | Business incentives: tax, grants, loans. |
| Business | Other. |
| Business | Policies at EU, national and regional level. |
| Business | These would be EU Policies and Entrepreneurial Skills in the sector. |
| Business | Innovation, R&D, Patents. |
| Other | Entrepreneurship process of companies in the BIOHEALTH sector (phases, deadlines, composition, potential rate of entrepreneurship, rate of abandonment). |
| Other | Another one: All are important. |
| Other | Policies at EU, national and regional level. |
| Other | Entrepreneurship process of companies in the BIOHEALTH sector (phases, terms, composition, potential rate of entrepreneurship, abandonment rate). |
| Other | Innovation, R&D, patents. |

Source: BIO-ALL, 2020

In this question, the interviewees identified the strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector. So, they opted mostly for the options: “Policies at European, National and Regional level”, “Innovation - R&D + I”, “Business incentives: tax, subsidies, credits” and “Entrepreneurial skills in biotechnology”. To better analyze this question a graphical display of the answers is presented below.

Graph 5.6: Graphical representation of the strategies and actions to promote innovation and entrepreneurship (ES)



Source: BIO-ALL, 2020

Looking at the graphic, we can observe that nobody chosen “Educational and advanced learning” neither “Potential markers”.

We can also note that the respondents from the business sector were the ones who dispersed their answers, mainly chosen, “Innovation - R&D + I, Patents”, “Business incentives: tax, subsidies, credits”, Biotechnology entrepreneur skills and “Policies at European, National and Regional level” being it last the most chosen.

Both respondents from Academia and Incubator/Accelerator chosen the response Biotechnology entrepreneur skills.

Finally, the stakeholders dispersed their answers between “Policies at European, National and Regional level”, “Innovation - R&D + I, Patents”, “Biotech companies entrepreneurship process (phases, terms, composition, potential rate of entrepreneurship and exit rate) and others like all are important.

Table 5.27: Strategies and actions to promote innovation and entrepreneurship, answer justification (ES)

| L) Regarding the question K), please justify your answer | |
|--|---|
| Organization | Answer |
| Academia | |
| Academia | "Entrepreneurial skills that allow innovations to be commercialized in highly competitive and international markets is essential. Knowing how to protect intellectual property-based assets and how to create value with them by creating licenses and joint ventures with business and financial partners is key to the success of this strategy." |
| Incubator/Accelerator | "The staff required by biotechnology companies is highly qualified and there are problems in finding such staff because although they have the technical skills they lack the entrepreneurial skills so necessary for the business to function. The University would have to develop specific training programmes for entrepreneurial skills in the biotechnology sector." |
| Business | |
| Business | |
| Business | "The major powers in the sector have demonstrated the importance of the private sector and of private-public partnerships. In Spain the fiscal situation is not favorable for private research, development and production companies." |
| Business | "We can have the best ecosystem, the best training and will but without money/private investment, an entrepreneurial idea cannot be put into action. It is like a Ferrari not having petrol, it will not start." |
| Business | "There certainly has to be an adequate regulatory framework but, without knowledge, it is impossible to start a business. If innovation results in solutions demanded or potentially demanded by the market, it is easier to succeed." |
| Business | "It should be by means of incentives." |
| Business | |
| Business | "Without the support of the public authorities, it is not possible to innovate in a system that is mainly dominated by public health." |
| Business | "Doubtful public management of available resources." |
| Business | "Policies, there are many regulations that are against the venture. Very difficult to give stock options to employees or others, which notaries are required for many types of shares, declarations to the mercantile, subsidies that do not consider the needs and realities of start-ups. Incentives, the reality is that it is difficult to find seed capital for companies in BIOHEALTH. The structure of those offered was obviously desired by people who know nothing about the sector." |
| Business | "Build a joint program; University + Tech Park, for innovation and economic development with a highly focused vision." |

| | |
|----------|---|
| | Every node of Entrepreneurial innovation in the World has at its epicenter a University Center of industrial/entrepreneurial excellence." |
| Business | "In the initial phase of an innovation project in the biohealth sector, there is usually some type of aid, and, as the project proceeds, the economic needs in projects in which the economic return may be three or five years, the recession period is very large. and the search for financing becomes the most critical point to make entrepreneurship become a reality." |
| Business | "The European Union does not have legislation, let alone Spain, for the development of startups, nor for the generation of private investments. It needs to be treated differently than a startup, micro or large company. They do not have the same problems or the same structures. Instruments are necessary for companies to grow faster (public outlet, secondary market, crowdfunding, etc.). On the other hand, there is generally no entrepreneurial culture, and those who are entrepreneurs lack training in business management. More master's degrees and postgraduate training in business management must be offered. And biotechnological profiles are necessary." |
| Business | "The requirements are always in the training. But the models that work for entrepreneurship are related to the management of business models and financial culture. Public strategies must be oriented to create entrepreneurs who know business, because great ideas fail without the correct financing." |
| Other | |
| Other | "Sophisticated demand, people, innovation, patents, entrepreneurial and innovative capacity." |
| Other | "Based on the needs of society and the challenges of the private sector, the public sector should promote." |
| Other | "I believe that recently created companies or projects in this sector have a potential risk of failure. Therefore, it is necessary to promote the teaching and support for these entrepreneurs, which are the ideal entrepreneurial processes to achieve the objectives." |
| Other | |

Source: BIO-ALL, 2020

The justifications given by the various organizations are quite convergent. Considering, for example, "Academia" and "Incubator/Accelerator" both stated that there is a real need of improving Biotechnology entrepreneur skills as the staff required by these companies is highly qualified and there are problems in finding such staff because although they have the technical skills they lack the entrepreneurial skills so necessary for the business to function. The University would have to develop specific training programmes for entrepreneurial skills in the biotechnology sector.

"Business" respondents also stated that without the support of the public authorities, it is not possible to innovate in a system that is mainly dominated

by public health according with the answer most chosen “Policies at European, National and Regional level”. On the other hand, they stated that there certainly must be an adequate regulatory framework but, without knowledge, it is impossible to start a business. If innovation results in solutions demanded or potentially demanded by the market, it is easier to succeed. Finally, they also assess that in the initial phase of an innovation project in the biohealth sector, there is usually some type of aid, and, as the project proceeds, the economic needs, in projects in which the economic return may be three or five years, increase as the recession period is very large and the search for financing becomes the most critical point to make entrepreneurship become a reality, for this reason business incentives: tax, subsidies, credits are quite important too. Finally, “Other” interviewees stated that recently created companies or projects in this sector have a potential risk of failure. Therefore, it is necessary to promote the teaching and support for these entrepreneurs, which are the ideal entrepreneurial processes to achieve the objectives. Hence the great concern of the stakeholders about “Biotech companies entrepreneurship process (phases, terms, composition, potential rate of entrepreneurship, and exit rate).

Figure 5.10: Representation of the Strategies and actions in order to promote innovation and entrepreneurship in the BIOHEALTH sector, according to Spanish respondents



5.3.7 Recommendations for policy makers to achieve the scenarios and strategies

In times of rapid change, growing complexity, and critical uncertainty, it is required to be prepared for the unexpected. The purpose of this question is to provide a brief guide to strengthening the foresight capacity through a better use of strategic foresight in policymaking onto achieving the scenarios and strategies previously aligned. The answers collected are displayed below.

Table 5.28: Recommendations for Policy Makers (ES)

| M) Recommendations for policy makers (what are the objectives and next steps) to achieve the scenarios and strategies you have identified? | |
|--|--|
| Organization | Answer |
| Academia | "When in some countries they created very detailed strategic plans (which quickly became out of date), others increased the budgets dedicated to R&D & I twice (e.g. USA, South Korea and Japan)." |
| Academia | "Legislate to eliminate the incompatibilities of State researchers to undertake in the BIOHEALTH sector. Encourage the role of the clinical investigator to give resources to the attending physicians for developing the investigative part appropriately. Develop SMART Specialization policies and legislate to facilitate public-private investment." |
| Incubator/Accelerator | "Increase the budgets dedicated to R&D&I and provide greater incentives to companies in this sector (tax, subsidies and credits)." |
| Business | "I'm sorry not to be more explicit, but an entrepreneur cannot be allowed to go without a guarantee." |
| Business | |
| Business | "I've already passed it on." |
| Business | "Tax incentives for private investors. Public investments are slowly managed, imply a lot of bureaucracy and are not flexible when considering strategy changes." |
| Business | "Relying on entrepreneurs and their innovations at all levels, with innovative public procurement, and good entrepreneurship and innovation support programs. They should be facilitators in the process of knowledge acquisition." |
| Business | "Avoid brain drain and supporting innovative projects by implementing measures to support research." |
| Business | "When some countries drafted detailed strategic plans (which rapidly became obsolete) others doubled their R&D budgets (for instance USA, Korea, Japan)." |
| Business | "Talk to SMEs, not just representatives of large companies that defend their interests and do not innovate: they buy innovation." |
| Business | "Review public structures that exist in entrepreneurial environments. What does each one contribute? What objectives do they have to achieve? Do these objectives help the region advance? If so, what goals do they have set that can be measured? Have they been fulfilled? If they have been met The current situation indicates that the objectives set are wrong, and that the resources do not go where they are really needed. There is redundancy of public structures that also have a poor management (Foundations, Agencies ...)." |
| Business | "Just need to do one thing: accept what you don't know and look for people who do know. There are many regions in the world that are BIOHEALTH business development centers, because they ask for help!!!" |
| Business | "The COVID-19 pandemic debacle gives us a powerful political argument to argue in favor of increasingly promoting BIO_HEALTH and an engine for economic development. The vision for acceleration Personal Testing and Data-Driven Health innovations will create a powerful infrastructure for fighting future pandemics. Millions of euros are now available for COVID-19 research, and within a framework of creative industrial |

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| | innovation programs, these funds can be CREATIVELY CHanneled TO ACHIEVE BROADER objectives that transcend the COVID-19-centric activities. Example: University and Tech Park entrepreneurial innovation projects for pandemic preparedness though molecular testing product development can be extended to other testing modalities beyond COVID-19." |
| Business | "First of all, I would ask policy makers to leave decision-making about the innovation and entrepreneurship strategy to the technicians and professionals, and not to use entrepreneurship in the BIOHEALTH area as a political point. The next steps should pass through position entrepreneurs at a level of real importance and benefits and social commitment, not only with good intentions and newspaper headlines. Unite the entrepreneurial world of health under a collaborative umbrella and with management skills." |
| Business | "We must encourage the growth of existing companies and improve growth options. Innovation is not local, but global. Encourage exports (especially Latin America) and promote company growth through acquisitions, and these can be easily financed with investors. And regulatory changes are necessary." |
| Business | "Training is key. It is important that transversal programs are developed for biohealth, bioengineering, and financial and business training. Without these lines, failure is guaranteed. The areas of AI data analysis, chemical technologies with biosensors and bioanalyzers will be key to being at the forefront of the sector." |
| Other | "Strong support to the sector for knowledge-based issues, high added value, fully internationalized market, employment support, etc." |
| Other | "Connect innovation capacity with entrepreneurial capacity (e.g. to foster private investment (tax-free models) prizes, accelerators, hackathons, diaspora, etc.)." |
| Other | "What we do today will shape the future of our society and future generations. It is key to be clear about what we want to be as a country and what we can do with what we have. You must take the current scenario (COVID-19) to learn from mistakes and carry out an exercise in self-criticism that helps to initiate new long-term planning with the aim of positioning ourselves as a world power. We have excellent researchers, facilities and research centers, we just need to provide the conditions and implement the appropriate mechanisms so that everything is possible (aid to strategic research for the country, training in innovation, private sector intermediation with research centers, ...)." |
| Other | "Management must be determined by a technical profile, not by political or personal affinity. Management flexibility must involve financing with real budgets, developing public-private collaboration. In addition, innovative management tools will improve public procurement and human resource management. Thus, it will allow itself to attract and retain talent." |
| Other | "Prioritize the sector and focus on citizens' health." |

Source: BIO-ALL, 2020

In the previous table, there are some recommendations provided by the interviewees for future action of policy makers.

Analyzing by organization type, the “Academia” interviewees stated that is necessary to legislate for eliminating the incompatibilities of State researchers to undertake in the BIOHEALTH sector and facilitating public-private investment. “Incubator/Accelerator” interviewees also identified the needs for increasing the budgets dedicated to R&D&I and provide greater incentives to companies in this sector (tax, subsidies and credits).

“Business” respondents stated that is necessary provide tax incentives for private investors. Also is quite important to rely on entrepreneurs and their innovations at all levels, with innovative public procurement, and good entrepreneurship and innovation support programs. They should be facilitators in the process of knowledge acquisition.

“Other” interviewees also asked strong support to the sector for knowledge-based issues, high value added, fully internationalized market, employment support, etc. and connect innovation capacity with entrepreneurial capacity (e.g. to foster private investment (tax-free models) prizes, accelerators, hackathons, diaspora etc.).

Lastly, some of the interviewees provide an important reflection: “what we do today will shape the future of our society and future generations”. It is key to be clear about what we want to be as a country and what we can do with what we have. You must take the current scenario (COVID-19) to learn from mistakes and carry out an exercise in self-criticism that helps to initiate new long-term planning with the aim of positioning ourselves as a world power. We have excellent researchers, facilities and research centers, we just need to provide the conditions and implement the appropriate mechanisms so that everything is possible (aid to strategic research for the country, training in innovation, private sector intermediation with research centers, ...)”.

The following figure illustrates some of the recommendations for policy makers in order to achieve the scenarios and strategies proposed.

Figure 5.11: Representation of the recommendations for policy makers, according to Spanish respondents



5.4 Results from Portugal

5.4.1 Interviewees characterization

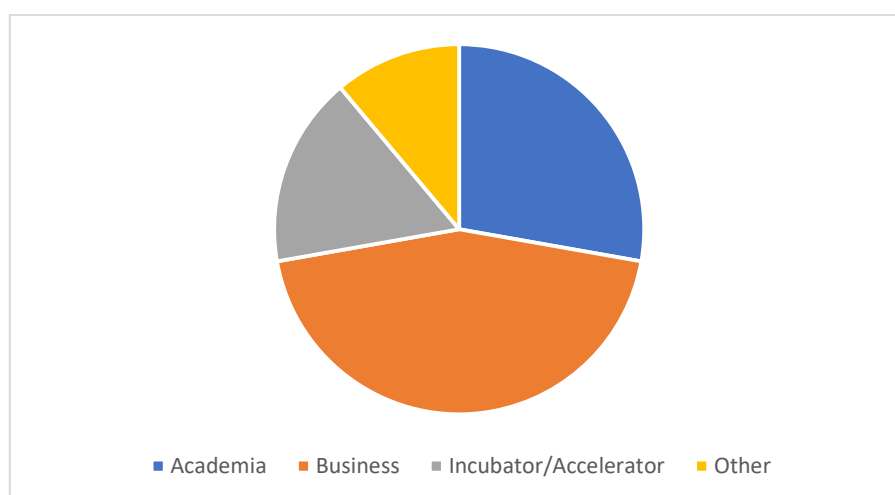
This questionnaire was designed for gathering information on what the main thoughts of the actors of the BIOHEALTH sector are on the future of the sector relating it to innovation and entrepreneurship. The set of actors is composed by people related to the BIOHEALTH sector from the Academia, Incubator/Accelerator, Business or Other relevant stakeholders.

The questionnaire was designed, tested and applied in order to collect information from the above sources cited and was anonymous and confidential, serving only for the purposes of data collection and subsequent analysis and action design.

The results presented in this report reflect the perceptions of the interviewees in Portugal. Data was collected by means of an online survey sent out via email to a database of actors from the BIOHEALTH sector, leading to a total of 18 Portuguese answers. The study measured the perceptions of respondents with respect to their BIOHEALTH sector perception and predictions.

Among the 18 questionnaires received from Portugal, most of the respondents came from "Business" with 8 respondents, followed by "Academia" with 5 respondents. In the following graphic we can see the distribution.

Graph 5.7: Profile of the interviewees (PT)



Source: BIO-ALL, 2020

5.4.2 Visions of the BIOHEALTH sector, considering entrepreneurial and innovative processes

When asking a question about their vision on the BIOHEALTH sector, we wanted to understand the similarities and differences the various stakeholders have. Nanus (1992) defines “vision” as realistic, credible, attractive future for an organization. A realistic vision therefore must be relevant to an organization or a sector to be credible. A vision must inspire and motivate those who are in the sector to implement it. It must be seen by all as realistic, honest and achievable. It must be attractive. A vision is meant to inspire the leaders and the organizations to investigate the prospects of the sector. A vision is not in the present or where we are now, a vision is where the BIOHEALTH sector will be in the future.

As for that, we wanted to know what do the stakeholders understand in terms of the future of the BIOHEALTH sector. Sharing a future image of the BIOHEALTH sector will be a guideline to strive and find the best solutions to make it happen. The following table has the answers that the interviewees gave.

Table 5.29: Table 2: BIOHEALTH Sector Vision (PT)

| A) Describe your vision of the BIOHEALTH sector, considering entrepreneurial and innovative processes. (Definition of "Vision": Stakeholders' idea of the sector and represents what the sector intends to become) | |
|--|---|
| Organization | Answer |
| Academia | "I think that there is not a very advanced view of the Biohealth sector, when compared to the IT sector. There is a gap regarding training related to entrepreneurship in the Biohealth sector, which ends up being treated as that of information technology/engineering." |
| Academia | "I believe that this sector has a lot of potential, even though there is a lot to do at this time. It has full potential but also is full of opportunities. Biohealth is the right and correct answer. However, in terms of creative processes we are far behind of what we can enhance. There are flaws in the |

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| | pedagogical and academic field (failure in technological entrepreneurship and in the interconnection of the various training themes), in the entry of start-up contests (restricted contests and afraid to bet on ideas), and institutional failure (government and municipalities)." |
| Academia | "Covid-19 pandemic will affect all kinds of funding and all markets. Therefore, most entrepreneurial and innovative processes will be Covid-19 pandemic related." |
| Academia | "I believe that investigators from academia, still have difficult to understand what the connection is and how they can make it. There must be an effort in order to shorten those difficulties. For instance, when you try and go to the business area or even on patenting. There is a need from business and academia to "speak the same language" and at this moment it is not happening." |
| Academia | "It is linked in its genetics to health technologies and biotechnology, but they are also integrated as in forms of bioengineering, pharmaceutical and agro-technological sciences (smarter, healthier foods, or specific foods for medicines). In addition to everything here, all that is related to the quality of life and well-being of the populations, not only in the environmental measure but also in the organizational component." |
| Business | "There are many opportunities in the Medtech ecosystem in Portugal, which should be enhanced soon. The quality of researchers and developers is excellent and only requires an experienced partner who guides the initial strategy, finding sources of funding and creating secure partnerships with market players who can validate the IP. Unfortunately, the investment ecosystem in Portugal is still immature and discovers major and serious problems in several situations. Thus, ensuring a point with proven international partners and an adequate culture for entrepreneurship is essential for the success of these studies." |
| Business | "A sector with a lot of potential for growth but highly limited in Portugal due to the investment and financing capacity, mainly in the initial phases. There is also a difficulty in quantifying the real value that innovations can bring." |
| Business | "Our vision for the sector in Portugal was first of all to achieve what is done in other places: Cambridge, Boston, etc." |
| Business | "I would like to see the Biohealth sector gain national relevance, in such a way that it is as desirable to undertake in Health as it is in ICT or tourism. In the future, I would like to see Portugal recognized as the ideal destination for Biohealth startups." |
| Business | "This sector is very connected to innovation and entrepreneurship but also connected to health, our most precious asset. We must be up to it, in order to achieve what people really need. Giving answers to their needs, challenging ourselves." |

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| Business | "My vision is that biohealth is the future. It will be so important that it can be able to manage our lives." |
| Business | "It is a growing sector, of what we have seen and the number of projects that we have observed. However, it seems to us that the sector is still a bit closed, with some resilience to the entry of non-specialized players in the area. In our case, because we are a little apart, we sometimes feel this distrust, even when approving the projects themselves. The fact that many of the people who are involved in the area come or are in the research area, only want the part of the publication and not the passage to production or placing on the market, and that causes many projects to be lost along the way and for companies in other areas to get away." |
| Business | "There is a huge potential for innovation, both in basic research but also in terms of prevention and improvement of the health sector. This is in the form of a response in terms of innovation of procedures and equipment, attitudes, behavioral preventive measures but also from a device perspective (medical and health promotion but also technologies that can be used in order to protect people and the environment)." |
| Incubator/Accelerator | "Considering that biohealth has a very broad scope and that has been producing significant innovation, the vision is to become a high-growth, more inclusive and fragmented market, where barriers to entry will decrease and capacity will increase; Europe has the opportunity to become the preferred region to develop and test innovative products and services, due to the sophistication and diversity of its healthcare systems." |
| Incubator/Accelerator | "My view about the BIOHEALTH sector is that it represents all kinds of innovations and improvements related to direct and indirect health. With this I include the whole application of methods of improvement not only of production processes, optimization of new products and services for health, but also of sustainable development in health practices. All this combined with this development, will create a need for greater and better entrepreneurship, with a need for a "guiding line". |
| Incubator/Accelerator | "I believe that there is a lot to improve. The sector's entities and companies are traditional and there is a lot of work to be done towards open innovation. Regarding regulation, it is difficult to find specialists, and it remains one of the biggest "pains" of startups." |
| Other | "It is a sector of great importance in society, but it is little explored; due to the lack of support, many of the ideas of potential entrepreneurs do not become business or entrepreneurial initiatives." |
| Other | "Promising future." |

Source: BIO-ALL, 2020

In the table above, we can see the interviewees' visions for the BIOHEALTH sector. From their answers we can retain that the respondents consider the BIOHEALTH sector as being one with a growing importance on a national or European scale. There is also a feeling of big opportunities in this area, being considered as a main area of investment in Portugal, which could be side by side with tourism, for instance. Besides that, there is a notorious concern from the interviewees in matters related to funding, regulations or barriers that could jeopardize future investments in this area.

Although there are main concerns about the development of the BIOHEALTH sector, the interviewees view the sector as one to watch in the next years, with great possibilities to invest, explore innovation and entrepreneurship, if the path is clear in terms of regulatory affairs. Moreover, they also indicate that there is still a great margin for improvement in the sector, both in research and in the connection made between research and the industry in order to place products on the market. Nevertheless, as one of the respondents explained, there is a "promising future" for the BIOHEALTH sector.

If we analyze the answers of different types of organizations, we can understand that for the respondents from "Academia", they envision the BIOHEALTH sector as one with a strong need of entrepreneurship fostering. They also envision the sector as being one to watch in the next years in terms of investigation. The interviewees from the "Incubator/Accelerator" state that they see the BIOHEALTH sector becoming a high-growth sector. As for that to become a reality there is a need to break some entry barriers and regulation. That associated to a "guiding line" will have the strength to shape the sector. The interviewees from "Business" state that there is a need to gain relevance in Portugal. For that we need to benchmark what is being done in other places, in order to be recognized as the ideal destination for Biohealth startups. Lastly, "Other" entities state that there is a promising future and a lot of potential in the BIOHEALTH sector if it is correctly supported. They claim that because the sector will be for sure of great importance to the society, government and authorities must be at the forefront to support it.

Summing up, the vision of the different respondent organizations state that the BIOHEALTH sector's vision will fundamentally involve a need for a strong government investment, but also the need to dictate rules and to foster entrepreneurship. Only then can the sector correspond to the identified potential.

In the figure below we can see the different visions of the BIOHEALTH sector, considering entrepreneurial and innovative processes by the interviewees in Portugal.

Figure 5.12: Representation of the visions of the Portuguese interviewees for the BIOHEALTH sector



5.4.3 Scenarios for the BIOHEALTH sector, considering entrepreneurial and innovative processes

We asked the interviewees about the scenarios that they see for the future of the BIOHEALTH sector. It is important to understand what the options are, what are the possibilities that could happen in the future. As for that we also wanted them to point out and clarify them in short (1-3 years), middle (3-7 years) and long term (10-15 years).

Korte and Chermack (2007) say that scenario planning is a means for making explicit the mental models supporting organizational reasoning and action. Once made explicit, these models can be challenged, and alternatives developed. As such it is important to hear the opinion of the different stakeholders, in order to line the different scenarios considering the entrepreneurial and innovative processes, and then define strategies for those possible scenarios. The following tables have all the scenarios received.

Table 5.30: BIOHEALTH Sector Scenarios (PT)

| B) Describe the possible scenarios of the BIOHEALTH sector that you have in mind, considering the entrepreneurial and innovative processes. (Definition of "Scenario": one of several possible situations that could happen in the future) | |
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| Organization | Answer |
| Academia | "Stakeholders must be made aware of the time associated with the development of a product in the Biohealth sector, in order to have more long-term financial support in this area." |
| Academia | "Seize the bet on competitiveness and entrepreneurship already made in high schools but also in middle school, prep school and primary school. As of that, there will be a higher and better utilization of all the innovation and creativity programs developed." |
| Academia | "The development of Covid-19 pandemic solutions will be the blueprint for all scenarios. The need to patent prototypes and its positioning in the market will shape the future." |

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| Academia | "At this moment conditions are created for there to be several changes at this level. This is because entrepreneurship disciplines are being introduced in the university course's training plans which will translate into a future change. Both in terms of new ideas but also in their potential." |
| Academia | "Only recently has this sector been defined by the European Union. There is a recent orientation to promote the so-called Bioeconomy in a broader sense. This sector is somewhat related to the EU's political guidelines, that is, a cross-fertilization between sectors and the use of KET's (key enabling technologies) that can be developed in some way to unleash new waves of innovation. That is why it is so important to develop this sector. Make a smart specialization at European level based on diversification but incorporating the component of innovation and entrepreneurship based on knowledge and technology." |
| Business | "I think that the creation of Hubs that combines academic and research know-how with that of management, finance and entrepreneurship will benefit the entire ecosystem by accelerating processes and creating future references." |
| Business | "I think that only disruptive ideas will be able to acquire the necessary funding to develop the project. In this area, it is especially necessary for promoters to be world leaders in their respective areas of innovation. It seems to me that in the short term, in Portugal, this sector will suffer a brutal impact with the limitation of available capital. high risk high reward is not, of course, an investor mindset in periods of economic retraction." |
| Business | "Creation of a dynamic pole of biotechnology based on the technologies we develop." |
| Business | "As in all sectors, the sector may experience a slowdown, stagnate or grow (in number of startups, size of companies, sales, etc.)." |
| Business | "There is a much better entrepreneurship education. Valuing self-employment more than it was used to be. There is also a bigger responsibility on entrepreneurship and innovation, but also of health and quality of life than it used to. Therefore, entrepreneurship is viewed as being associated as a vehicle of innovation, even by politics. As of that, there will be a snowball effect due to the prosperity of ideas and the realization of them. Ideas that are promoted and used as examples to be followed." |
| Business | "It will be for sure connected to biomedical devices. At this moment there are biomedical devices that can manage almost everything, and there have been major developments in terms of devices and patents in this area." |
| Business | "The sector still has its back to technology, contrary to what happens in other sectors. In my view, it will always be through this openness to technology that the scenarios will be created. There is a need to stop aversion to this |

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| | development and move from the paper plane to prototypes and products to be placed on the market.” |
| Business | “New perspectives on hygiene, environmental sustainability and preservation of ecosystems, but also for example in the agricultural and food sectors. There are two fundamental approaches: that of protected innovation (innovating and protecting that innovation as a business) and that of social contribution (including not only civil society but scientific and business). Those who have innovative ideas are not only focused on the part of the business, but also on putting that innovation at the service of the population, giving it away, as we saw now in the Covid-19 pandemic.” |
| Incubator/Accelerator | “Scenario 1: soft digitization, no significant change in processes and models; Scenario 2: integrated care as a mean to expand centralized capacity; Scenario 3: preventive healthcare and outcome-driven approach.” |
| Incubator/Accelerator | “The scenarios that I consider in the sector will always be linked to agricultural, environmental and economic improvement, but also to the level of safety (in food or medication, for example) and health, obviously. As for the agricultural part, the objective will always be to produce more for less, with a modification of plants and seeds that may result in a lesser possibility of diseases, or in the last case of not easily succumbing to climate change. On the environmental side, creating new, more sustainable processes and practices on the part of companies and populations. Certainly, the improvement of technique and new practices can lead to the creation of more jobs, more opportunities for new companies to emerge and stimulating the improvement of the technique of workers who may be interested in developing methods for new areas of work. In terms of health, there will be new scenarios, for example in the application of new types of drugs designated for each one (custom-made drugs).” |
| Incubator/Accelerator | “The pharmaceutical industry is the most profitable industry, so I assume that it will be the one that in the future will invest more in innovation to maintain the competitive advantage.” |
| Other | “Portugal has the potential to innovate more and better - it is crucial that there is convergence in support measures so that it is easier to find solutions that make entrepreneurial processes feasible and that information networks exist that allow access to knowledge and relevant entities (Universities, INPI , INFARMED ...).” |
| Other | “Biological medicines more accessible and more efficient to society.” |

Source: BIO-ALL, 2020

The table above has all the answers the interviewees gave as for possible scenarios in the BIOHEALTH sector. Thus, to develop and grow the sector the respondents refer there is a need of investment, in order to carve biohealth into society. They say that funding is vital to get those innovative ideas out of the paper and onto reality. The interviewees also state the Hub creation scenario, which will guide new entrepreneurs to develop innovations, but also will train the mindset for a future BIOHEALTH ecosystem. The creation of hubs will be the first scenario for the development of the sector. Only then will it be possible for everyone to work for the development of the same, to have organization and regulation. Those hubs will be dedicated mainly to biomedicine, agriculture and health, and will be coordinated between business and universities. That convergence will lead to a broad access to knowledge and shared solutions to the emerging problems. Also, the usage and development of technologies in order to help monitoring health issues, but also to develop agriculture or the preservation of ecosystems will be some of the future scenarios identified by the respondents.

Analyzing the views from different stakeholder types, “Academia” states that the financial support is always connected with the time spent on developing a product. As for that, stakeholders must be informed. They also state that the recent Covid-19 pandemic will carve the way for future issues in BIOHEALTH sector. “Incubator/Accelerator” respondents assume that the scenarios will circle around the pharmaceutical industry, but also agricultural. Also, sustainability and safety will be issues on possible scenarios such as preventive healthcare and outcome-driven approach. “Business” respondents stated that the scenarios will be in the creation of hubs in order to develop ideas and processes. With these hubs there will be a collaboration on funding to develop projects. The creation of that dynamic pole of biotechnology based on the technologies we develop will be a leverage for the sector, even though the sector may experience a slowdown, stagnate or grow (in number of startups, size of companies, sales, etc.). Some “Business” respondents seem to think that in order to acquire funding it is necessary to be a world leader in their specific field of innovation and have a disruptive mind-set. “Others” stated that “Portugal has the potential to innovate more and better” but there is a need of convergence of the support measures. They also stated that biological medicines will be more accessible and more efficient to society.

So, there are different possible scenarios envisioned by the different actors of the sector, even though they all converge on the necessity of grouping and the intelligent use of funds raised.

In the next questions, the interviewees were asked to give possible scenarios for a short, middle and long term.

5.4.3.1 Short term

Table 5.31: BIOHEALTH Sector Scenarios, short term (PT)

| C) Regarding the question B), please give your answers about possible scenarios for the BIOHEALTH sector, in the short term (1-3 years) | |
|---|---|
| Organization | Answer |
| Academia | "In the next 3 years, there is an opportunity to create a wider range of offers for financing research projects for product development, but very much focused on COVID-19. I think that in the remaining areas, there may be a reduction in investment interest." |
| Academia | "There will certainly be little evolution. The scarcity of resources due to the Covid-19 pandemic will influence and therefore most of the funding will be directed to social measures and politics." |
| Academia | "Availability for partnerships in placing innovative answers to the Covid-19 pandemic, in addition to the market acceptance of these solutions." |
| Academia | "Some change will begin to take place due to the effect that specific disciplines of entrepreneurship have on exact sciences and life science courses." |
| Academia | "Sector with greater speed in accepting innovation processes. However, due to Covid-19, it could be a little secondary, limiting the creation of specialized jobs and disruptive business units." |
| Business | "Use government and European grants in the best way. Rather than being given the ability to invest in people who have never been entrepreneurs or who do not understand the culture of Start-Ups, experience and know-how in this area should be privileged. Thus, we would remove from the equation some "smart moves" and incompetence in a pure state of players who only go after government funds to use as personal money." |
| Business | "I think it is time to do research on practical applications and always knowing that the available capital will be reduced." |
| Business | "It is probably too optimistic as there is no serious investment in R&D. Not for lack of money but for lack of vision. How many projects financed 10 years ago resulted in new technologies and products? Very few!!" |
| Business | "The BIOHEALTH sector will experience moderate growth over the next 3 years, especially as it will be the sector least affected by the pandemic, although balanced by the economic recession that the pandemic will cause." |
| Business | "This appreciation of health, related on a short term with the Covid-19 pandemic, will bring more efforts from investigation, but also more innovation entrepreneurship." |
| Business | "At this moment we can't escape from the Covid-19 pandemic situation, and therefore all kinds of medical devices will be developed with the utmost importance (for instance mask, visors, among others)." |

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| Business | "Few changes certainly. Doing the same things in the same way with projects to be financed in the same way for the same people." |
| Business | "The two approaches that I mentioned before will certainly be promoted in the short term. In fact, as we can see now during the response in the Covid-19 pandemic, if some information had come out more quickly, the answers had been given in the best way. In that sense, we will be more alert and sharing resources in a more sustainable way." |
| Incubator/Accelerator | "Most likely, the focus on the short term will be on scenario 1; nonetheless, system-wide changes should be discussed to set the long-term goals and allow back casting." |
| Incubator/Accelerator | "In the short term, the scenario at the level of entrepreneurship and innovation in the biohealth sector seems to me that the main thing will be to reduce bureaucracy in order to be able to boost startups and investments, in addition to specific training in entrepreneurship by human capital already trained in the area of biohealth. This human capital already formed and trained for biohealth has largely gaps in the area of entrepreneurship, being a specialist in the biotechnological area but with flaws in the business part, in bureaucracy or in the ability to raise financing. From the moment that an entrepreneurial practice and knowledge becomes widespread, it will be easier to develop processes and raise these funds to allow new practices. This knowledge is also important in order not to drop projects and companies since in the area of biohealth, the processes of placing products and ideas on the market are often time-consuming, which may lead to some investors falling back on financing, limiting the arrival to the market of what is being worked on." |
| Incubator/Accelerator | "A bigger investment in open innovation programs." |
| Other | "Initiatives (such as Bio-All) that bring entrepreneurial projects closer to Universities and Knowledge Centers will have to be a constant soon. Only in this way can we ensure that research & companies respond to society's challenges." |
| Other | "Awareness in the corporate world." |

Source: BIO-ALL, 2020

In the short term, the interviewees stated that the scenarios will be mainly related with three major questions: funding; bureaucracy; and the Covid-19 pandemic. As stated before, there is a need of funding, and that funding will be affected by the Covid-19 pandemic. On one side, the Covid-19 pandemic will focus most of the projects related to the BIOHEALTH sector. There will also be more funding on this area and there will be more innovation and entrepreneur action in order to solve or prevent future pandemics. Accordingly, that funding can lead to the development of new projects drifting from those new, related to the Covid-19 pandemic.

The “Academia” interviewees are keen on that short-term scenario regarding the Covid-19 pandemic, and the investment that it can generate. On the other hand, “Incubator/Accelerator” interviewees, state the importance of structural decisions, reducing bureaucracy and leveraging bigger investments in programs to reach long-term goals. “Business” interviewees, on the other hand, speak on the necessity of good use of resources, mainly in R&D and investigation as the scenario on a short term. Last, “Other” interviewees state that there is a need of awareness in the corporate world. That can be shortened through initiatives (such as BIO-ALL), where the cooperation between universities and business reaches new heights.

Therefore, the Covid-19 pandemic is present in all the changes that may take part soon. It is important to realize that the BIOHEALTH sector is working directly to be able to act in this or other future pandemics, which implied greater recognition and a possible change of rules, both in terms of financing but also in terms of regulation. The actors interviewed believe that in the short term this will be the sector's scenario. But will these factors influence the sector only in the short term? In the following points we have the vision of the different sector’s actors in the medium and long term

5.4.3.2 Medium term

Table 5.32: BIOHEALTH Sector Scenarios, medium term (PT)

| D) Regarding the question B), please give your answers about possible scenarios for the BIOHEALTH sector in the medium term (3-7 years) | |
|---|---|
| Organization | Answer |
| Academia | “The projects associated with COVID-19, should start to give results, so there may be the possibility for stakeholders to return to interest in work areas in the Biohealth sector.” |
| Academia | “It will depend on the world’s geo-politic development. If there is no global union or a favorable environment to investment, investors and business angels will not invest their money and consequently there won’t be a leverage in order to develop new ideas or companies.” |
| Academia | “Governmental approval and licensing as main facilitators.” |
| Academia | “Greater bet and risk propensity, with more students and researchers creating their start-ups or allocating intellectual property.” |
| Academia | “A deliberate investment in this sector, especially if it starts with fundamentals, such as research and development.” |
| Business | “Creation of Accelerators that support the transfer of IP from Universities. Reformulation of the investment system to support projects in a "Death Valley" phase where they are not yet attractive to investors, nor do they succeed with small investments of 50 or 100 thousand euros. When we talk about the health sector, the costs are much higher than a developer in a basement and the internet.” |
| Business | “Admitting that developments in this sector take years to materialize, I think that it will only be in the medium term |

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| | that there will be the capacity to attract traditional investors with 7-10 year fund management cycles.” |
| Business | “The same as the previous one! Probably nothing will change in 3-7 years.” |
| Business | “The BIOHEALTH sector will experience moderate growth, which may be accentuated if there are signs of economic recovery and/or a government bet on this sector.” |
| Business | “If we take in consideration what is already being made for entrepreneurship education in our schools and universities, on a medium term, will bring new things. Not only because of the will and the challenge that young people bring with them, but also because they know they can be helped by older entrepreneurs, in order to fulfill their entrepreneurial dreams. They can be helped not only with funding but also from the experience.” |
| Business | “Improvements of the specifics of the devices already created.” |
| Business | “If there is a change in mentality and evaluation of the projects, there may be some changes. However, if there is no desire to produce effectively, it will be difficult.” |
| Business | “In the medium term, certainly, environmental sustainability programs and ways to develop innovation will be put in place, whether in health monitoring (wearables, etc.) but also in ways of prevention.” |
| Incubator/Accelerator | “On the medium term, a greater interoperability between centralized healthcare providers and distributed/home care units should be achieved (scenario 2).” |
| Incubator/Accelerator | “In the medium term it seems to me that biotechnology will already be included in most of the business fabric, the result of the passage of ideas and research from paper to the market. Thus, there will already be some inclusion in the research market in the area of BIOHEALTH, and there will also be recognition by the population of its advantages. This will start a vicious cycle of strengthening technical (and entrepreneurial) knowledge in research, innovation and improvement of sustainable processes.” |
| Incubator/Accelerator | “Biggest startup successes going to big companies, like Genzyme with Sanofi.” |
| Other | “Even if it is not an easy process, the interaction with the bodies responsible for the regulation of the BioHealth sector will have to be progressively facilitated, under penalty of the entrepreneurial initiatives ending up, even before reaching their target markets.” |
| Other | “Academic and scientific studies.” |

Source: BIO-ALL, 2020

In the medium term, the interviewees pointed the beginning of the maturity of the BIOHEALTH sector. It will be marked mainly with the entry of financing from more traditional investors. This was also fostered by the greater recognition of the sector combined with what had already been done in the prevention and

control of pandemics (specifically in Covid-19). In addition, the sector's recognition will allow for more assertive regulation and substantial investment.

Regarding the “Academia” interviewees, they state that on a medium term the scenario will be of the real results of the projects associated with Covid-19. From there, many possibilities should arise for the stakeholders. The “Incubator/Accelerator” interviewees said that on a medium term we could watch some start-ups being included in big companies. Also, the BIOHEALTH sector will be included more and more in the society. The “Business” interviewees see on a medium term a moderate growth if there is a clear bet from the government on this sector. Also, the “Other” interviewees clearly indicated on medium term, a greater regulation, and the fostering of academic studies in the BIOHEALTH sector that will have the need to be progressively facilitated, under penalty of the entrepreneurial initiatives ending up, even before reaching their target markets.

The Covid-19 pandemic will also be influencing the scenario on a middle term. The different respondents state that the BIOHEALTH sector will be highlighted, and on a middle term the sector will gain influence, and with a clear and greater regulation be a safe bet for the stakeholders. In that order of ideas there can be a massive growth on new academic studies in the BIOHEALTH sector that could be translated with innovation and new entrepreneurs, and this evolution could generate new kinds of investment.

5.4.3.3 Long term

Table 5.33: BIOHEALTH Sector Scenarios, long term (PT)

| E) Regarding the question B), please give your answers about possible scenarios for the BIOHEALTH sector in the long term (10-15 years) | |
|---|---|
| Organization | Answer |
| Academia | “If awareness of the Biohealth sector results, it is to be expected that there will be a greater stake in this sector, driving business growth in this area.” |
| Academia | “With conditions, there will be a boom and science will develop so much more in 10 years compared to the last century. The seeds will grow and what we sow will contribute to that giant leap in the BIOHEALTH sector.” |
| Academia | “Screening massification (if there are new pandemics) and consequent responses to those new happenings.” |
| Academia | “Quicker answers with a bigger connection between universities and businesses.” |
| Academia | “Scaling up forms of innovation, new business initiatives, attracting foreign investment, all of which are replicable.” |
| Business | “The support of entrepreneurs, who have had international success with their start-ups, to remain on the Board of Directors of national funds would contribute ten times more than any other measures that “excel sheet” managers |

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| | without any knowledge of the market could bring for this ecosystem. Additionally, the creation of an extended network of validated mentors would be critical to support entrepreneurs and minimize errors in the initial and ramp-up phases.” |
| Business | “In the long run, I think the situation in the sector will be more favorable, admitting that ideas had more time to materialize. I think that most of the companies in the sector that are going to grow at this stage will be associated with the Academy, which will have to finance the initial developments. However, I do not think that Portugal will increase its level of global competitiveness, having in my opinion a tendency to become less relevant. However, I think that the globalization factor will be able to make it easier for national companies to leave the country and attract international investment.” |
| Business | “The same as the previous one! Probably nothing will change in 10-15 years. If the investment of the last 20 years has served mainly for the promotion of careers. How much of this investment has resulted in innovative and pioneering technologies in the world? Where are companies like Atomwise, Petachem, Schrodinger, ...?” |
| Business | “It is more difficult to predict in the long run, but at the outset, as in the medium run, the BIOHEALTH sector will experience moderate growth, which may be accentuated if there are signs of economic recovery and/or a government bet in this sector.” |
| Business | “On a long term, new projects will be taken in place, but also there should be fewer bureaucracy in order to have new entrepreneurial bets, also in places not so entrepreneurial prone. Those new places (typically away from the “chamber of power”) will be strongly impacted by entrepreneurship and innovation.” |
| Business | “Direct connection with health professionals through mobile devices. Getting treatments and constant monitorization from the medical part through smartphones or mobile devices even more efficient or effective.” |
| Business | “On a long term the biggest turn point would be the entry of major technological players in the sector, revolutionizing the way biohealth is seen and reaches bigger publics.” |
| Business | “Changing panoramas in sustainability and preservation of ecosystems. The Covid-19 pandemic has shown us this need to be more alert for everyone and in that sense in the long term there will certainly already be a reflex of changing the panoramas.” |
| Incubator/Accelerator | “Sustainability in healthcare will require system-wide change and scenario 3 is our current best bet.” |
| Incubator/Accelerator | “In the long run and after the business and entrepreneurial stabilization, the products will reach the market. As I mentioned above, custom made drugs, the genetic manipulation of seeds and plants to be able to resist weather changes or herbicides/pesticides, for example. |

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| | Thus, there will be a contribution to the longevity of the populations and an improvement in the access to food by the populations. In addition, the use of sustainable production processes will minimize the effects of pollution in the atmosphere, reduce energy consumption or minimize waste, for example. In terms of innovation, I think that the scenarios will be mainly in improving the living conditions of all populations, especially in the most disadvantaged." |
| Incubator/Accelerator | "Co-creation between innovators and corporates" |
| Other | "In a sector that implies constant innovation it is difficult to present long-term scenarios..." |
| Other | "Becomes cultural practice" |

Source: BIO-ALL, 2020

In the long term, the interviewees state that although being difficult to predict, in a perfect situation there will be a good regulation, biohealth will be a "cultural practice" and with a massive business growth. Successful entrepreneurs could be called to give advice on the national funding, also being called to be mentors for new start-ups, co-creating by this way.

If we analyze the answers from the different organizations, we can retain that the "Academia" interviewees stated that on a long term it is expected that there will be a greater stake in this sector, driving business growth in this area. Also, from the "Incubator/Accelerator" interviewees, the focus on a long term will be directed to the sustainability in the sector, but also the co-creation and the need for entrepreneurial stability.

The "Business" respondents said that there will be a more favorable situation on the long term. There will also be a bigger connection between Academia and Business, growing on a moderate run if there is a strong bet by governments and authorities. Lastly, the "Other" interviewees stated that it will be difficult to predict on a long term, even though BIOHEALTH should become a "cultural practice".

Although being hard to realize scenarios on a long term, this growth of attention on the BIOHEALTH sector could lead to a growth in both business but also entrepreneurship. The interviewees see a long-term scenario with a more favorable situation with a better regulation, government incentives and a better cooperation between Academia and Business. But if these are the scenarios envisioned by the interviewees, what are the main trends and drivers for which the sector could respond to on a short, medium and long term? The following points will give us those answers.

In the figure below, we can see the different possible scenarios of the BIOHEALTH sector, considering entrepreneurial and innovative processes by the interviewees in Portugal.

Figure 5.13: Representation of the Portuguese respondents BIOHEALTH Sector Scenarios



5.4.4 Drivers and trends in future scenarios for the BIOHEALTH sector

What follows is a brief appraisal of the drivers and trends the interviewees feel are going to be in the BIOHEALTH sector's future scenarios. Although it is important to point out scenarios, the prediction of future trends and drivers for the BIOHEALTH sector is a somewhat a hazardous exercise. As of that this will only be a glimpse of what can happen in the future, even though we can find similar paths and ways of convergence amongst the answers. Below is the table with the interviewees' responses.

Table 5.34: BIOHEALTH's Main Drivers and Trend Scenarios (PT)

| F) What will be the main drivers and trends in future scenarios of the BIOHEALTH sector? | |
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| Organization | Answer |
| Academia | "The drivers will be the emergence of new, but also well-known, pathologies that more often and broadly will profoundly affect the world economy. Not only viral or acute pandemics, but also pandemics with chronic pathologies that will increase with the aging of the world population. So, the trend will be to create business targeted at these scenarios." |
| Academia | "It will be universities, science parks and regions (Regional Development and Coordination Commission and Regional Community)." |
| Academia | "The fact that there is no treatment or vaccine for the Covid-19 will make a need to a faster and effective screening, as well as testing, therefore, it will be a driver to this trend." |
| Academia | "Bringing universities and business much closer should be a reality. There must be a much more natural conversation |

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| | between them, and that conversation should be initiated by any one of them.” |
| Academia | “There needs to be more funding for research and development, strategically allocated. The innovative bet is relatively recent (it should be about 10 years old), although there are several qualified people but there are few physical structures (for example, incubators). From the moment they establish incubators linked to biotechnology, bioengineering, health, among others, there can be greater leverage in development and specialized research, also diversifying activities here.” |
| Business | “Use of successful entrepreneurs in investment positions; Accelerators; International partnerships with experienced players; Creation of professional hubs at Universities to function as the first point of contact with Entrepreneurship.” |
| Business | “Portugal's biggest advantage is its Universities and human capital. Therefore, these are the factors that will have the most influence on the growth of the sector.” |
| Business | “The main driver will be the EU with substantial, long-term, high-risk projects. Basically, projects that create disruption and non-promotion in academic life.” |
| Business | “Telemedicine, eHealth, Artificial Intelligence applied to Health, medical devices and biotechnology.” |
| Business | “A strong investment in apps that allow people to realize how is their health or the environment outside their house. The levels of comfort and availability have reached new highs in the last few years and keep on rising. This will also impact the health literacy of populations. New therapeutical investigation (nano's, sampling, quicker, more data, etc.) will be a tendency also. Managing people's data will also be a leverage in order to know more about populations, raising new questions, and therefore innovation.” |
| Business | “Future pandemic situations (which will be, no doubt). People's concern with health will be the main driver, since big players will want to be on the forefront in order to solve these same problems.” |
| Business | “Openness to other types of players and willingness to incorporate new ideas and new technologies. Only then we will be able to work more assertively and achieve results without losing valuable ideas along the way.” |
| Business | “Robotization and artificial intelligence (AI) will be inevitable. It will certainly make our life easier. I believe that one of the areas of fundamental development will be emotional intelligence. The protection of our socialization, of distinguishing ourselves clearly from what is robotic. AI will be instrumental in making our lives easier, but innovation regarding the maintenance and promotion of our human side (and we saw this now during times of confinement at home during the pandemic), we highly value this socialization and on our side human. This area of |

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| | the biohealth sector is going to have to be developed and will set trends.” |
| Incubator/Accelerator | “Personalized and preventive healthcare will mostly be driven by biotech and digital.” |
| Incubator/Accelerator | “I believe that the main thing will be in minimizing the effects of production on the environment, in sustainability and in eliminating the barriers of disparity between populations.” |
| Incubator/Accelerator | “Accelerators, academic professors/academic entities, champions within large companies.” |
| Other | <p>“1) The current pandemic context. It is increasingly necessary to promote research in the field of Health (new laboratory techniques, new medical devices, new ways of working ...)</p> <p>2) the characterization of the population. Population aging (in general) refers to a new reality and new challenges</p> <p>3) global access to information. It allows the strengthening of cooperation networks, which in scarcity/limited resources is essential!”</p> |
| Other | “Easy access to biohealth in society.” |

Source: BIO-ALL, 2020

The above table has the answers the interviewees gave for what will be the main drivers and trends in future scenarios of the BIOHEALTH sector. They state that with the dissemination of biotechnology in the society, medical devices to detect and act will become mainstream. Also, the personalized customization, sustainability and prevention healthcare issues will be trending.

Following the answers, and grouping them by organizations, we can see that “Academia” states as main drivers and trend scenarios “the emergence of new, but also well-known, pathologies that more often and broadly will profoundly affect the world economy”. So, there will be a need to create business to target those scenarios. They also point out the need to have better physical structures in order to develop investigation but also to “close the gap” between academia and business. The “Incubator\Accelerator” interviewees affirmed that the main drivers will come from “personalized and preventive healthcare mostly be driven by biotech and digital”, but also sustainability and environmental protection ideas on the BIOHEALTH sector, and the inclusion of the University-Business Cooperation as being one of the main players on fostering them. If we analyse the “Business” interviewees’ responses, we can understand that for them the main drivers will be the use of highly skilled human capital in order to develop artificial intelligence and medical devices related to the BIOHEALTH, but also the openness to other types of players and willingness to incorporate new ideas and new technologies, such as robotics or artificial intelligence. Finally, “Other” interviewees stated that there will be a need for an easy access to BIOHEALTH in society, but also the strengthening of the cooperation, in order to promote research in the field of health.

Taking the same direction as previously answered in the short, medium- and long-term scenarios, respondents stated that the main drivers and trends will be

directly involved with the rapid response to situations resulting from the Covid-19 pandemic. Also, the personalized and preventive healthcare will be a trend, but also the competent use of highly trained people, not only scientifically but at the business level.

It is important not only to know the future trends but also to try and understand how to reach the speculated scenarios, which strategies to use. In the following points, we will analyze the respondents' answers about the strategies necessary to achieve these same scenarios.

In the figure below, we can see some of the main drivers and trends in future scenarios in the BIOHEALTH sector.

Figure 5.14: Representation of the BIOHEALTH's Main Drivers and Trend Scenarios, according to Portuguese respondents



5.4.5 Strategies and actions to achieve scenarios in the sector, considering the entrepreneurial and innovative processes

It is always tempting to take desires for reality. Although visions of the future or scenarios appear desirable, the choices and strategic direction of an organization or a sector do not necessarily match a single proactive vision. One must also be proactive and prepared for expected changes to a sector's future environment (Godet, 2000). That is why it is important to define strategies and actions in order to achieve the scenarios envisioned.

We asked the interviewees about the practical strategies and actions that will be necessary to achieve the scenarios. In the tables below we can see the answers they gave.

Table 5.35: Table 8: BIOHEALTH's Most Practical Strategies and Actions (PT)

| G) Describe the most practical strategies and actions to achieve these scenarios in the sector, considering the entrepreneurial and innovative processes. (Definition of "Strategy": a detailed plan for achieving success ") | |
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| Organization | Answer |
| Academia | "In order to be able to address the predicted scenarios and avoid them or reduce their impact, it is crucial to have a way to more accurately predict the behavior of various pathologies and their impact on the economy, in order to be able to design successful approaches to prevent them. A greater association between health, management and bioinformatics is crucial for this. Thus, training must also be directed in this direction, which is increasingly multidisciplinary." |
| Academia | "Entrepreneurial policies in teaching since the beginning of schooling. There must be more investment programs and start-up implementation challenges. At the University level, there must be course units integrating the different colleges and universities. The current communication facilities will clear some edges and that interconnection between universities and colleges." |
| Academia | "Testing and tracking leverage." |
| Academia | "It is not easy to manage the connection between the academic world and the business world, both in terms of publications and patents, but also in going to produce those ideas. There should be a strategy of valuing academic or productive path, and PI patenting should be a stimulus." |
| Academia | "In addition to the aforementioned, it is important that specialized and competent people arrive at the institutions. In the Portuguese case there is a need to attract these same people back to their country or regions of origin. It is crucial to foster specialized work and specialized workers. The aim will be to stop (what often happens), where specialized jobs are on the biggest cities, leading to many specialized people settling there. Even those who come from abroad with critical capacity and are convinced to settle down must not enter a "revolving plate" in which they come and then end up leaving." |
| Business | <ul style="list-style-type: none"> - Creation of a national network of University and Entrepreneurship Professional Centers; - Reformulation of government funds to boost innovation; - Creation of a Corporate network to validate and create a scale for successful concepts." |
| Business | "Increase in the capacity of Universities to direct projects to the market. The "technology transfer" in Portugal is non-existent when compared to the USA. Portuguese Universities are doing a terrible job in this regard." |
| Business | "The strategy we follow is to develop a disruptive technological core that may interest international investors. Again, others will profit much more but "c'est la vie"!" |

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| Business | "Proximity between academia, industry and entrepreneurship, support to promote scientific production and protection of intellectual property. More funding available for Science & Technology. Partnerships with internationally renowned institutes and universities." |
| Business | "Establishing networks in order to exchange new ideas. This rise of networking and know-how exchange will be good in order to give answers to necessities. Investing in training (since the beginning of schooling) will be more and more important as well as the networking between academia and business, both in how to act but also in how to think. This connection will lead to a much more effective communication, rising new solutions in both parts." |
| Business | "It is important to foster this connection between business and universities. Also, fostering support for start-ups, mostly when going from ideas to prototypes and then commercialization, since students and new entrepreneurs don't have that kind of know-how. Therefore, university's direct incubators would help in a large scale. In my opinion sometimes great innovative ideas and with a bunch of potential won't pass from the "paper stage" because of that lack of know-how and support." |
| Business | "Projects must stop just being workshops, conferences, articles and meetings and become defined and tangible products. It is necessary to aim and try to ensure that what is actually created is made available to the market." |
| Business | "Investing in research. There must be a focus on research in the social and human sciences that are often left out. There is a need for an interface between the social and human sciences and AI. This is because the more research is interconnected between these areas, the more easily we can remove importance and value it. Furthermore, it is important to have a valued connection between companies and universities. This is because it is often necessary to have a "translator" to get the message across. There is a strategy of placing "bridges" on both sides to have a better understanding." |
| Incubator/Accelerator | "1) Develop competencies on innovation in healthcare providers; create dedicated organizational structures to connect to the ecosystem, lead pilots and drive adoption; 2) Integrate solutions that address market needs; expose challenges and opportunities to the ecosystem; target developments to address those challenges; support the creation of consortiums and other partnerships; participate in collaborative projects, co-create; 3) Engage all stakeholders to design the healthcare system of the future; experiment and disseminate." |
| Incubator/Accelerator | "I believe that the main action will be to promote training for entrepreneurship. This for a simple reason, much of the research in biotechnology is just that, just research. There are many highly educated staff in the area but who do not pass the part of the researcher to an entrepreneur. There is |

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| | no such transition from idea/research to an experimental prototype, a company or a marketable product. From the moment there is a change to the entrepreneurial mind-set, everything else will be a strategic consequence, that is, from the moment the researchers know the weights of starting an investigation and translating it into a product/company, also knowing how to go about looking for investment/investors and how to respond to bureaucracies, it will be easier to define medium/long term goals, organize the idea and company and put everything into practice. Basically, put this strategy in motion." |
| Incubator/Accelerator | "Forming champions within companies, supporting the academic world, success stories in accelerators and incubators - creating a successful generation that can advise future generations." |
| Other | "Creation of support networks for business initiatives; development of collaborative projects." |
| Other | "Allied to public policies, protectionist laws for the development of biotechnology." |

Source: BIO-ALL, 2020

As for the most strategies and strategic actions proposed to achieve the scenarios in the sector, the interviewees state that there must be a clear connection between academia and business. Therefore, a dedicated organisational structure to connect the entire ecosystem must be created. Fostering entrepreneurship and innovation, promoting scientific creation. Also, gathering experienced workers (investigators, innovators or entrepreneurs) will foster the connection between business and universities

Following the answers presented above, the "Academia" respondents stated that as a practical strategy there will be a need to foresight future scenarios of pandemics (such as Covid-19), in order to be able to design successful approaches to prevent them. They also state that a greater association between health, management and bioinformatics will be crucial for this. In addition, there is a need to "speak the same language" in the academia but also in the business part. "Incubator/Accelerator" respondents state that there is a need to promote entrepreneurship training in order to form Champions within companies. For that there is a need on supporting the academic world and all the success stories that come from incubators and accelerators. It will foster investigation but also stimulate new entrepreneurs. If we analyze the "Business" responses, they all focus on the capacity of Universities to support technologies. There is a need to a bigger interaction between Academia and Business. "Others" on the other hand state that there is a lack of funding and a short proximity between academia and business (as stated also by "Business" organizations). The benchmark with American universities could be crucial.

The next three subchapters will analyze the interviewees' answers about possible strategies for the BIOHEALTH sector in the short, medium and long term, in order to achieve the strategies.

5.4.5.1 Short term

Table 5.36: BIOHEALTH's Most Practical Strategies and Actions, short term (PT)

| H) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the short term (1-3 years) | |
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| Organization | Answer |
| Academia | "Postgraduate courses and advanced training courses must be rethought and quickly implemented so that the future involved in the Biohealth sector has a broader view and greater power of action." |
| Academia | "Tenders and interconnection between universities." |
| Academia | "Same answer, testing and tracking will be essential." |
| Academia | "Try and have a better university-business connection, crating demand autonomies from part to part." |
| Academia | "The focus on infrastructure and specialized personnel is vital in the short term. There must be a strategy of bringing qualified professionals and creating conditions for them to settle in the regions in order to create knowledge, companies and jobs." |
| Business | "Definition of a concrete plan by university on the main strategic objectives and the existing gaps. Creation of a point with ANI or IAPMEI in order to finance the creation/reinforcement of the current structures." |
| Business | "Copy the North American model. Just yesterday I was contacted by Nuada about an exoskeleton innovation that took place in the USA and asked if I wanted to commercialize." |
| Business | "A matter of luck." |
| Business | "All previous measures can be carried out, in the short, medium or long term." |
| Business | "Students' training in a short term will be essential." |
| Business | "Bigger and better connection between universities and business." |
| Business | "Projects to become more and more productive. Defining who leads the consortia for real and who gets into the projects to effectively do what is up to them. If we do not change this mindset it is very difficult to move forward." |
| Business | "Creating links between universities and companies is essential. On both sides, there must be a path leading to a better communication as both parties need each other, developing, publishing and producing." |
| Incubator/Accelerator | "All 3 strategies should be pursued concurrently, with intermediate milestones for the short-, medium- and long-term. For the short-term, the focus should be on developing competencies." |
| Incubator/Accelerator | "In the short term, in addition to the aforementioned training and openness for the entrepreneurial part, I believe that it will be necessary to define the areas of activity, clustering the various areas so that specific support can be |

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| | created to launch financing and have a specific strategy for each cluster.” |
| Incubator/Accelerator | “Open innovation and training programs.” |
| Other | “Cooperation between entities: Academy, Companies, Authorities” |
| Other | “Fostering innovation.” |

Source: BIO-ALL, 2020

On a short term, the interviewees stated that the most practical strategies and actions to achieve the scenarios in the sector will be a mix between funding, university support and business support. As of that, that UBC will support the development of new business, innovation and entrepreneurs, fostering innovation and training programs for new entrepreneurs.

That being said, and considering the responses of the organizations, “Academia” respondents stated that there is a quick need for postgraduate courses involving the BIOHEALTH sector. They also state that there is a need of a better university-business connection. “Incubator\Accelerator” interviewees state that the training programs should be crucial. “Business” respondents re-stated the benchmark of American universities but also the creation of specific funding and the connection between universities and business. “Other” respondents also affirmed that a better cooperation between Universities and Business is desirable but also the need of fostering innovation should be the most practical strategies and actions on a short term.

So, on a short term, the most practical strategies and actions are all connected with learning, advanced training programs or even a close relationship between Universities and Business. Next, we can see what the respondents consider as being the possible strategies for the sector on the medium term and on the long term.

5.4.5.2 Medium term

Table 5.37: BIOHEALTH’s Most Practical Strategies and Actions, medium term (PT)

| I) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector in the medium term (3-7 years) | |
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| Organization | Answer |
| Academia | “Companies should be able to go to Universities to search for people with the necessary know-how to put into practice the development of application tools to the scenarios that will become the new challenges.” |
| Academia | “Entrepreneurship programs in high schools and courses involving various universities.” |
| Academia | “Identify problems by tracking the source. Overcome some bureaucracies (such as data protection).” |
| Academia | “The fact that there are more and more companies created in universities shall use generated knowledge in order to put it in a more and more specialized production.” |
| Academia | “Biohealth and Bioeconomy will always be a fund strategy based on specialized personnel and specialized infrastructures.” |

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| Business | "Creation of institutional partnerships with defined, clear and simple KPIs with companies that really want to invest in innovation." |
| Business | "Focus on creating quantifiable and applicable value; bet on lean development strategies; create international partnerships and with ASAP companies." |
| Business | "After 3 years and with investment, startups will have more reason to be optimistic." |
| Business | "All previous measures can be carried out, in the short, medium or long term." |
| Business | "On a medium term I think the connection between academia and business will already be enrooted, leading to new terms of communication, thinking, and leading also to progress in innovation." |
| Business | "Developing contests in order to foster new ideas, new companies, but also for already established companies to have access to those students' new ideas, but also in order to fund them." |
| Business | "There must be a stimulus to the result, having something to show. All of this is better than having a beautiful study and not giving something that can be produced and with interest." |
| Business | "Using these links to satisfy everyone's needs will certainly bring substantial development to both parties. Furthermore (I hope) there is a greater demand from side to side to develop more projects." |
| Incubator/Accelerator | "All 3 strategies should be pursued concurrently, with intermediate milestones for the short-, medium- and long-term. For the medium-term, the focus should be on integrating solutions." |
| Incubator/Accelerator | "This clustering is already in place and there is a need to explore the potential of each cluster. Bet on the formation of specialized staff for each cluster and its innovative ideas. To do so, take advantage of the support already created for their development and commercialization." |
| Incubator/Accelerator | "Sharing good practices." |
| Other | <i>Didn't Reply</i> |
| Other | "Protectionist laws to encourage biotechnology." |

Source: BIO-ALL, 2020

On a medium term, the interviewees stated that the most practical strategies and actions to achieve the scenarios in the sector will be the creation of partnerships in order to invest in the start-ups. Also, the share of good practices and the growth of the number of start-ups could improve new investment and new business ideas.

There are no great differences if we analyse through the different organizations' respondents. As of that, "Academia" respondents affirmed a need of a wider cooperation between academia and business, where business could go and procure better human resources with a specific know how. Also, "Incubator/Accelerator" respondents stated that sharing good practices could be a medium-term strategy, but also the specialized human resources ready to

integrate solutions on the business matters. If we take in consideration the “Business” respondents, the creation of institutional partnerships and on lean development strategies could be a plus on a medium term. Finally, the “Other” respondents stated that there is a need for protectionist laws to encourage biotechnology.

So, also on a middle term, we can see that the interviewees relate the strategies with the importance of education and a close cooperation between academia and business. They take it in consideration not only because of its importance regarding better entrepreneurship training, but also in order to get the best human capital possible that is coming out from the Universities.

5.4.5.3 Long term

Table 5.38: BIOHEALTH’s Most Practical Strategies and Actions, long term (PT)

| J) Regarding the question G), please give your answers about possible strategies for the BIOHEALTH sector, in the long term (10-15 years) | |
|---|--|
| Organization | Answer |
| Academia | “If business-university communication is carried out successfully, it is expected that there will be more and more Hubs in the Biohealth sector capable of responding quickly to the needs of the population.” |
| Academia | “Pedagogical transversely in all teaching cycles regarding entrepreneurship and innovation. Worldwide interconnection between universities.” |
| Academia | “Same answer as before.” |
| Academia | “On an ideal scenario there would be a strict connection between companies and universities, using all the know-how for both to grow stronger.” |
| Academia | “Taking into account the aforementioned, with this structure and the capacity to establish specialized personnel, biohealth will generate knowledge in the various areas indicated and will bear fruit for the regions where they can be established.” |
| Business | “Central strategic plan at government level to create opportunities and benefits for Universities, Corporates, Mentors, Investors, ...” |
| Business | “Focus on the international market for partnerships and financing.” |
| Business | “The same as the previous answer but with greater strength.” |
| Business | “All previous measures can be carried out, in the short, medium or long term.” |
| Business | “Although difficult, on a long-term education towards entrepreneurship will be a reality and will stimulate new answers and innovation.” |
| Business | “Big players should try and reach universities and incubators in order to get access to new and exciting research but also new entrepreneurial minds.” |

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| Business | "If you manage to pass this part and you can effectively define and put each one to do what they must do, without guerrillas and with defined objectives, there will certainly be results." |
| Business | "In the long run, the understanding will be a so-called "normal" situation, which will encourage investigation, the hiring of more people, more adapted and suitable for the functions." |
| Incubator/Accelerator | "All 3 strategies should be pursued concurrently, with intermediate milestones for the short-, medium- and long-term. For the long-term, the focus should be on materializing the vision of healthcare of the future." |
| Incubator/Accelerator | "In the long term the objective will be to have a strategy for creating, for example, several specialized laboratories within the business clusters in order to be able to increasingly specialize research. Based on the principle that there is already a business network through which innovation can flow, the companies present in this cluster can absorb innovative ideas for their production." |
| Incubator/Accelerator | "Utilizing successful entrepreneurs for investment and mentorship." |
| Other | <i>Didn't Reply</i> |
| Other | "Easy access to the population." |

Source: BIO-ALL, 2020

On a long term, the interviewees stated that the most practical strategies and actions to achieve the scenarios in the sector will go with connecting successful entrepreneurs for investment and mentorship. Also, the focus on internationalization for partnerships and financing will be a good strategy. It is also pointed out the need to carry on with the business-university cooperation, in order to build new hubs, fostering innovation and entrepreneurship.

If we take in consideration the "Academia" responses, they lean on the university-business cooperation in order to create more hubs, but also the capacity to establish specialized personnel should help the regions on creating new jobs and new start-ups. Also, the "Incubator/Accelerator" interviewees stated that those created hubs or simple start-ups could benefit from the guidance of successful entrepreneurs not only for mentorship but also for investment.

Reading the "Business" responses, we can analyse that there must be a strategic plan on a governmental level, but also a focus on the international market for partnerships and financing. "Other" interviewees stated that there is a need to a quick and easy access of the BIOHEALTH solutions to all the population.

So, on a long term the organizations tend to follow what they envisioned on a short and medium term, that is, a real need for a strong connection between academia and business, creating the solid foundations for hubs to flourish, which could lead to an extended and higher attention from financiers, grants and other kinds of partnerships for all new and present entrepreneurs. This will boost new

investigation, more innovation, and obviously more and better solutions in order to solve problems for the populations.

In the figure below we can see some of the strategies and actions considered in order to achieve scenarios in the BIOHEALTH sector, considering the entrepreneurial and innovative processes.

Figure 5.15: Representation of the BIOHEALTH's Most Practical Strategies and Actions, according to Portuguese respondents



It is important to consider the key role of innovation and entrepreneurship in the BIOHEALTH sector. The incorporation of innovation requires strategies aiming to increase the BIOHEALTH's sector market share, the quality of the offered goods and services, production capacity, business visibility and health and safety guarantees.

There are very few regions that successfully generated a biotech industry. To generate a successful regional cluster, the existence of world class scientific talent is a necessary condition (Audretsch, 2001). The relationship between knowledge management and entrepreneurial activity is affected by institutional quality, competitive industry conditions, resource limitations and complementarities between distinctive elements of external and internal organizational knowledge (Audretsch et al., 2020).

University and industry are important in providing the key ingredients (knowledge, institutional support and money) to facilitate innovation and commercialization (Bagchi-Sen, 2007) other important ingredients include the presence of venture capital and other forms of financing, the existence of an entrepreneurial culture, and transparent and minimal regulations hindering the start-up and growth processes (Audretsch, 2001). Considering the importance of high-tech sectors in developed economies such as Portugal, it is suggested that policy makers create special lines of credit or substantial tax incentives,

especially directed towards exporting high-tech SMEs that face chronic difficulty accessing external sources of finance (Nunes et al., 2012).

It has also been suggested that policy makers should reinforce international mobility programmes directed towards hiring holders of doctorates and master degrees as well as the integration of researchers in business projects (Nunes et al., 2012).

With this question we wanted to know what the interviewees see as the upmost important strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector, choosing only a maximum of two answers from a list: "Policies at European, National and Regional level"; "Innovation - R&D + I, Patents"; "Business incentives: tax, subsidies, credits"; "Education and advanced learning"; "Entrepreneurial capabilities in biotechnology"; "Entrepreneurial processes in the biotechnology sector (phases, deadlines, composition, potential entrepreneurship rate, dropout rate, regulation, certification)"; "Potential markets"; "Others".

Table 5.39: Strategies and actions to promote innovation and entrepreneurship (PT)

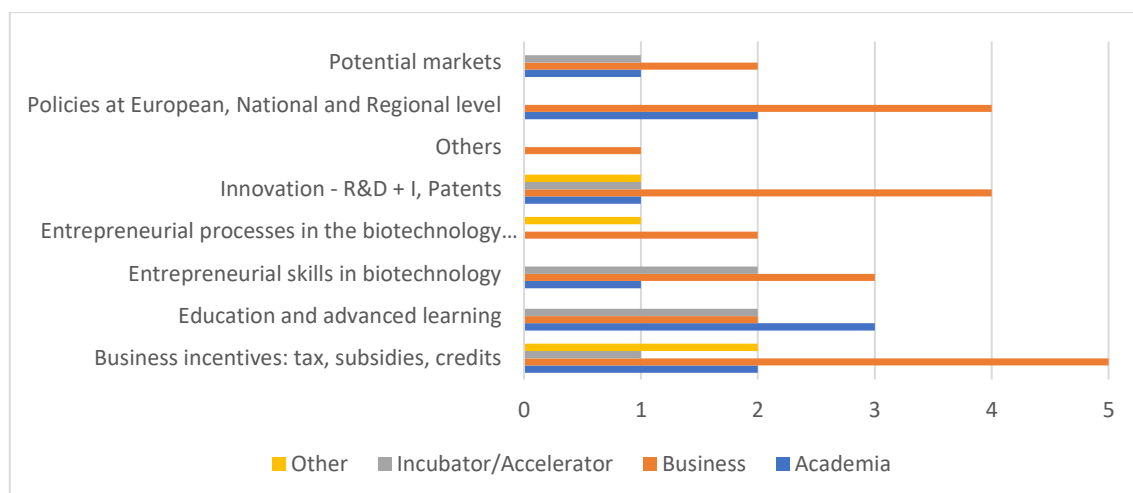
| K) In your opinion, what are the strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector? Please provide a maximum of two responses | |
|---|---|
| Organization | Answer |
| Academia | "Innovation - R&D + I, Patents, Education and advanced learning" |
| Academia | "Policies at European, National and Regional level, Education and advanced learning" |
| Academia | "Business incentives: tax, subsidies, credits, Potential markets." |
| Academia | "Business incentives: tax, subsidies, credits, Entrepreneurial skills in biotechnology" |
| Academia | "Education and advanced learning, Policies at European, National and Regional level" |
| Business | "Policies at European, National and Regional level, Entrepreneurial capabilities in biotechnology, Potential markets" |
| Business | "Policies at European, National and Regional level, Innovation - R&D + I, Patents, Business incentives: tax, subsidies, credits, Entrepreneurial skills in biotechnology, Entrepreneurial processes in the biotechnology sector (phases, terms, composition, potential rate of entrepreneurship, rate abandonment, regulation, certification), Potential markets, |

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| | transfer of real technology; university and business relations.” |
| Business | “Policies at European, National and Regional level, Innovation - R&D + I, Patents, Education and advanced learning” |
| Business | “Innovation - R&D + I, Patents, Business incentives: taxes, subsidies, credits” |
| Business | “Entrepreneurial skills in biotechnology, Business incentives: tax, subsidies, credits.” |
| Business | “Entrepreneurial processes in the biotechnology sector (phases, deadlines, composition, potential entrepreneurship rate, dropout rate, regulation, certification), Innovation - R&D + I, Patents.” |
| Business | “Business incentives: tax, subsidies, credits, Policies at European, National and Regional level” |
| Business | “Education and advanced learning, Business incentives: tax, subsidies, credits.” |
| Incubator/Accelerator | “Business incentives: tax, subsidies, credits, Education and advanced learning, Potential markets.” |
| Incubator/Accelerator | “Education and advanced learning, Entrepreneurial skills in biotechnology” |
| Incubator/Accelerator | “Innovation - R&D + I, Patents, Entrepreneurial skills in biotechnology” |
| Other | “Business incentives: tax, subsidies, credits, Entrepreneurial processes in the biotechnology sector (phases, deadlines, composition, potential entrepreneurship rate, dropout rate, regulation, certification)” |
| Other | “Innovation - R&D + I, Patents, Business incentives: taxes, subsidies, credits” |

Source: BIO-ALL, 2020

In this question, the interviewees identified the strategies and actions to promote innovation and entrepreneurship in the BIOHEALTH sector. So, they opted mostly for the options: “Business incentives: tax, subsidies, credits”, “Innovation - R&D + I”, and “Education and advanced learning”. To better analyze this question, we will utilize a graphical display of the responses, that can be seen below.

Graph 5.8: Graphical representation of the Strategies and actions to promote innovation and entrepreneurship (PT)



Source: BIO-ALL, 2020

From observing the previous figure, we can observe that the Business were the ones who dispersed their answers, being present in every single option. They mostly responded, “Business incentives: tax, subsidies, credits” but also “Innovation – R&D+I, Patents” and “Policies at European, National and Regional level”. Respondents from Academia chose the mostly the responses “Education and advanced learning”, followed by , “Business incentives: tax, subsidies, credits” and “Policies at European, National and Regional level”. Moreover, interviewees from Incubators/Accelerators gave more importance to entrepreneurial knowledge, as they mainly chose the options: “Entrepreneurial capabilities in biotechnology” and “Education and advanced learning”, but nonetheless the options “Innovation - R&D + I, Patents”, “Business incentives: tax, subsidies, credits” and “Education and advanced learning” were also chosen. If we take into consideration the previous answers the interviewees gave, we see that the following is in line with the already stated. In innovation, from what we have already seen about betting on R&D, but also entrepreneurship and the connection between universities and business. In terms of business incentives, due to the need for regulation, in addition to breaking down barriers to investment and because it is an activity that requires not only initial investment but also in the medium/long term. This is because investing in biohealth can only pay off after a few years. Research can take some time to bear fruit and most of the time the investors can’t wait that long. Finally, the entrepreneurship fostering and the need for training for entrepreneurs in biotechnology.

Table 5.40: Strategies and actions to promote innovation and entrepreneurship, answer justification (PT)

| L) Regarding the question K), please justify your answer | |
|--|--|
| Organization | Answer |
| Academia | “Only with advanced education is it possible to bring added value innovation.” |

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| Academia | "Education and regulation on a political level needs to be side by side in order to promote innovation and entrepreneurship." |
| Academia | "Adaptation goes from a need to contribute to society with the knowledge and the products/services we put out there for all people. Therefore, the go-to-market is of importance and stimulating innovative investigation aiming to a market placement is very important. What already exists (such as Horizon2020, for instance) is very fruitful." |
| Academia | "In an ideal scenario already, as universities are betting on entrepreneurship in their curricula, technical incentives are important to leverage companies." |
| Academia | "Education and advanced learning should not be mandatory, but optional, so that they can effectively advance not only in terms of projects and applications, but also in passing and bringing ideas to the market, but only for those who really want it. There is no imposition, but it is necessary to have this offer. Having a focused and diversified but not closed strategy, it must be open to different multidisciplinary areas. On the political side, as mentioned above, there is a need to invest in structures and give value to create those same structures in order to have a future entrepreneurial initiative." |
| Business | "The connection between the academic world and the business is still ineffective and needs support and structuring." |
| Business | "The sector in Portugal is immature and not very productive when compared to software development, for example." |
| Business | "The first 2 are very important. R&D must privilege risk, disruptive technologies and intellectual protection. Policies at European level must make Europe competitive with the US and Asia. Now it is no longer in many sectors. At the national level there is not much to do with the abundance of money that has been there so far, it is not going to happen now! At the local level it is even worse than at the national level. Education must reflect R&D because it leads to it. Stop being a vehicle for promoting IP and become an engine of scientific and technological development!" |
| Business | "Intellectual Property is the cornerstone of BIOHEALTH. Business incentives will underpin IP exploration." |
| Business | "According to what already said before, fostering entrepreneurship capacity is vital in order to generate new ideas and be risk prone. Although it is only allowed if there is a bigger financial support." |
| Business | "As I see it, I did not have that entrepreneur know-how, and so I believe that knowing more about how things work is important. We don't need to know everything or want to know everything, but if we do know something, we won't make some mistakes that on a starting point could just lay it on the ground." |
| Business | "There is a need to implement new models in projects and incentives. We must be able to have answers to specific |

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| | problems. But there is no interest as there are companies that only survive on this financing without making great efforts to do so. It ends up limiting similar or competitive ideas that could even advance but that are lost due to not having critical mass or muscle. It is visible the "technique" of companies to seek financing with the opening of offices where no one is. However, funding is allocated. There is a need for ways to limit some lobbying that harm those in it to effectively do something and not just hunt for subsidy or funding." |
| Business | "This promotion of entrepreneurship in schools has been taking place on a very early stage, something that did not happen before. I think that the universities should have a fundamental role, with short courses for students who want to be entrepreneurs, how to create a company, how to move, etc. In addition, incentives are important as they speed up some situations that would otherwise take much longer. However, there are projects that are made for companies and universities that already have the "machine assembled" and that exclude some companies from the outset." |
| Incubator/Accelerator | "Our main focus should be on promoting widespread adoption of existing and developing innovations." |
| Incubator/Accelerator | "In my view, everything starts with triggering in the researcher the pleasure of being able to put his ideas "out of paper" and to the market. That's the most important. Once the researcher knows he can do it, he will try to find ways to achieve it, either by his own means, or by protecting his idea and licensing it. For that you need to have knowledge. In this sense, there will always be a need to make this stimulus, which in my opinion is only done through more knowledge, in this case specific entrepreneurial knowledge. Everything else (although important) will be a consequence of." |
| Incubator/Accelerator | "Promote the creation of champions in the academic world and more support for innovation - with technology transfer goals and not just publications." |
| Other | "It is often financial constraints and activity regulation that lead to the abandonment of entrepreneurial initiatives." |
| Other | "All important, but both are the first step to getting leverage." |

Source: BIO-ALL, 2020

The justifications given by the various organizations are quite convergent. Considering, for example, "Academia", the respondents stated that there is a real need of advanced education in order to succeed at this level of entrepreneurship. "Incubator/Accelerator" respondents also stressed the need of entrepreneurial knowledge in order to create bigger companies and support further innovation and later IP exploration. "Business" respondents also affirmed that Intellectual Property is the cornerstone for the BIOHEALTH sector and as of that there is a need for education and knowledge. They also state that R&D must

be top of mind for all companies and that the connection between Universities and Businesses should be far more efficient. “Other” interviewees stated that there will be a need to get leverage, and as of that there is a need of regulation in order to avoid abandonment of entrepreneurial initiatives. In the figure below, we can see some of the strategies and actions in order to promote innovation and entrepreneurship in the BIOHEALTH sector.

Figure 5.16: Representation of the Strategies and actions in order to promote innovation and entrepreneurship in the BIOHEALTH sector, according to Portuguese respondents



5.4.6 Recommendations for policy makers to achieve the scenarios and strategies

In times of rapid change, growing complexity, and critical uncertainty, it is required to be prepared for the unexpected. The purpose of this question is to provide a brief guide to strengthening the foresight capacity through a better use of strategic foresight in policymaking onto achieving the scenarios and strategies previously aligned. The answers collected are presented below.

Table 5.41: Recommendations for Policy Makers (PT)

| M) Recommendations for policy makers (what are the objectives and next steps) to achieve the scenarios and strategies you have identified? | |
|--|--|
| Organization | Answer |
| Academia | “Solid support for advanced research and training, making these two national priorities.” |
| Academia | “Politicians must be smart, surrounding themselves with intelligent people. They should get stakeholders in order to launch concerted programs for them to achieve the best for the populations. Obviously, it is important that those processes are clean, honest but also creative.” |
| Academia | “There is a need to control some situations, maintaining all funding and support, that at the moment are quite interesting and appealing.” |
| Academia | “There should be a stronger collaboration between and with universities, mostly on a regional level. There should be someone in the |

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| | government that could foster this kinds of developments. It should be coming from above, and not like it always is, when we must reach out the mountains in order to get to the centers of decision. Something like this could unveil potential locally and nationally, enhancing knowledge transfer, but also innovation.” |
| Academia | “What I would recommend at the local level would be an articulation between the main private companies and the public sector. Public investment in R&D, construction of infrastructures to promote it and create conditions for human capital to make this change. This will have the multiplier effect of both funds, jobs and companies. It will not be with aberrant measures such as payment of incentives to work at a distance from the centers of greater population density that we will be able to develop and grow. On doing that we are just wasting resources.” |
| Business | “1 – Will; 2 - Creation of a network of proven entrepreneurs; 3 - Definition of long-term objectives for the BioHealth ecosystem in Portugal” |
| Business | “Create metrics for the evaluation of Portuguese Universities on technology transfer in a transparent manner and that rewards those who effectively do so. The job must be from universities and promoters. Good ideas and good promoters do not need policy makers. From my experience, more support increases the number of interested parties at an early stage but has little expression in the result (real economy), because whoever is successful would go ahead with the project regardless of the support. Whoever enters because of support loses the entrepreneurial capacity more easily as soon as they finish.” |
| Business | “Start doing what they preach: https://www.portugal.gov.pt/pt/gc21/comunicacao/noticia?i=inclusao-de-empresas-nas-universidades-e-uma-estrategia-de-modernidade-e-of-best-job “ |
| Business | “Firstly, we suggest measures that foster proximity between academia, industry and entrepreneurship, in order to unite and strengthen the ecosystem. As a measure to strengthen the Portuguese entrepreneurial ecosystem, partnerships with internationally renowned institutes and universities are desired, as achieved with the MIT Portugal and Carnegie Mellon Portugal programs. Leveraging projects is still the most difficult, due to the huge lack of support at this stage. Support is needed to stimulate scientific production and to guarantee the protection of intellectual property by universities. In a second phase, more funding is needed for Science & Technology in general, but specifically for innovation and technology transfer. In a third phase, the ecosystem lacks maturity: more private capital financing, more experienced VCs and more ex-entrepreneurs to become VCs. Although tax incentives can be used to attract foreign capital, it is more effective to develop the ecosystem to a point where it is able to attract VCs, CVCs, other entrepreneurs and start-ups.” |
| Business | “It is vital to establish new channels of communication with who is in the terrain. They don’t know what is happening right now if it is not happening in the major decision centers. We must value and foster national exportations.” |
| Business | “There must be a bigger bet in the University-new entrepreneurs connection. Fostering incubation is of the utmost importance. Furthermore, tax burden is of extreme importance to new start-ups. On |

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| | facilitating that process that will be a leverage for who, most of the time, doesn't even have product sales yet." |
| Business | "I would say not to be afraid to take chances on projects and on people who may have already failed on projects. Usually, there can always be something taking advantage of one of the failed solutions. Winning solutions emerge from a failed solution. All the learning gathered can build a basis for new projects. What often happens is that whoever failed once ends up not being considered. Especially in disruptive situations and technologies it is difficult for things to work out right from the start." |
| Business | "Fortunately, I have already had the opportunity to speak with the Minister of Higher Education about the postgraduate training of researchers in companies. I think that one of the situations that generates value in companies is the possibility of having people capable of innovating. But we cannot expect that ability after 10 years at the university. Also, because the mind-set is different, and they come with another way of seeing than the business one. In this sense, there is a need for the possibility of protecting researchers at universities but also at companies. This learning process in companies must be protected through doctoral fellowships in co-promotion from FCT and companies, paid at 50-50. This situation has been lost. The current competition does not respond specifically to the item "doctoral grants in companies". Even by the standards that are applied in companies and certified, it is very important that researchers are involved in these processes from an early stage. This would also be a point for universities and companies to be more easily arm in arm." |
| Incubator/Accelerator | "Focus incentives where the value added is (current and future). Reward based on results and impact." |
| Incubator/Accelerator | "Guide decide and support. Guide towards knowing what you want to do and enable countries to do it, so that there are no regions moving at a speed and others moving at a higher speed, both in terms of research and in terms of production. Decide to choose which way to go, enable the clustering of the sector and the creation of these same clusters or business hubs. Support, facilitating the creation of companies, entrepreneurial training and financial support (which in companies in the biohealth sector is usually a large financial support, as it usually takes a long time before it is ready to go to the market, in addition to the possible laboratory cost, which is also usually expensive.). In my view, without these three aspects, it will not be possible to achieve or leverage the identified scenarios and strategies." |
| Incubator/Accelerator | "Safeguard the use of scholarships as employment and not as support for the launch of new technologies to the market." |
| Other | "Promotion of access to finance (National, European), at all stages of research/development." |
| Other | "Biohealth incentive laws." |

Source: BIO-ALL, 2020

In the above table, there are some recommendations the interviewees want policy makers to take. The good use of funding is the main concern in order to get a good scientific production and then bring that innovation to a product that can go to the market. The funding should be reviewed but also the fellowships and the ways they are distributed. As previously stated, the connection between

Universities and Businesses can be a focus point to unite the biohealth sector. From this connection the long-term objectives can be decided, but also foster start-ups and entrepreneurship. A bigger and better connection between universities.

Analyzing by organization type, the “Academia” interviewees stated that there are two main priorities, research and training. As of that there must be a bigger investment from the government in order to build better infrastructures. “Incubator/Accelerator” interviewees also affirmed the needs for a broader knowledge, but also a guiding for all the entrepreneurs. As of that, specific training for new BIOHEALTH entrepreneurs is one of the main requests and recommendations. “Business” respondents stated that there is a real need of softer bureaucracy. Only then good ideas can translate rapidly to good products. Cooperation between universities and business could come in hand. Finally, “Other” interviewees also stated that incentive laws, but also the promotion of access to funds should be recommended as measures for the policy makers. The following figure illustrates some of the recommendations for policy makers in order to achieve the scenarios and strategies proposed.

Figure 5.17: Representation of the Recommendations for policy makers, according to Portuguese respondents



6 Feedback and insights from the community

The main findings of this Blueprint were presented to students enrolled in the Joint International Post-Graduation on “Advanced Skills for Innovation and Entrepreneurship in the BIOHEALTH Sector” to obtain their feedback and insights. Their different backgrounds were of outmost importance for providing insightful and multidisciplinary visions and recommendations. Their educational profiles range from Biology and Biomedicine, to Computer Science, Chemical Engineering, Biotechnology, Management, Nursing, Administration and Bioinformatics and their professional expertise covers startup founders, sales representatives for big brands in the sector, consultants in biotech expert networks, pharma medical directors, members of business angel societies, former Microsoft executives and university professors. Next, the major outputs and contributions received are reported.

Regarding **Roadblocks**, the discussion led us to the shortage of investment availability, but also to the lack of ecosystems for this specific sector (examples were given, like the MIT ecosystem covering a diverse and complementary set of stakeholders). The rigid regulatory barriers were also identified as roadblocks for the biohealth sector.

The conversation additionally led us to identify that, for example, in the traditional sectors like agriculture, agents are an obstacle to change and improvement.

Moreover, there is a need for spurring cross-fertilization and knowledge, generating Hubs, and thus comprehending diverse actors such as universities, companies, agencies, all dedicated at the sector growth at a faster pace.

When asked about the **Visions** they had for the biohealth sector, the participants stated that small startups need support from big companies. Coopetition needs to exist in order for startups to grow and innovate in an enhanced way.

It was also mentioned that there is a need for diversification, for people with varied skills, for transversal knowledge and skills.

Creating sector hubs is also a necessity, in universities, companies and agencies targeted at common interests and dedicated at scaling the players. There should also be more ecosystems where stakeholders are involved and where everyone know its place, roles, and objectives and how to get there.

On the topic of **Scenarios** for the future of the sector, the participants stated that they depend on each country's national policies that must change and accelerate, and they also depend on how we are communicating with the European Commission.

One scenario identified was the use of biopreservatives, like bacteria for food preservation, or bio stimulants in agrifood. There is a huge frontier in terms of the different stakeholders' interests, fact that impedes or slows down development in the sector.

Taking a turn and thinking of experimental science, there is also a need to understand how the European Union regulates research work, for example in the use of animals in research where regulation is too blocking.

Covid-19 was suggested as a scenario for a new start for biotech companies. There is also a need for the implementation of policies to lessen the taxation and draw more incentives to biohealth startups.

There are diverse scenarios for regulations that need to be standardized, for instance, it is easier for a company to go to the US and scale up there, than it is to grow in Europe. Formal mechanisms, like patent boxes, need to find standard ways in the regulatory processes. Furthermore, the costs of firm creation and living are lower in EU than in the US, which can be an important driver of new firm creation and installation.

Also identified as a scenario, the combination of the IT and the bio sectors that is emergent and growing and needs the right people with the right skills and competences to manage this scenario, as combining the two sides could provide us the leaders of the future in the sector.

The participants also identified a scenario that needs to change in the near future; Europe does not have risky investors. To support seed entrepreneurial ventures a new group is emerging, former startup owners are becoming the new business angels. On the other side, the majority of researchers only focus on grants and do not have a long-term strategy for their innovations, impeding somehow the translation of knowledge to market.

Concerning **Strategies**, the Portuguese participants identified that the national Foundation for Science and Technology (FCT) should be more associated with the business sector, providing more incentives targeted at research with an industry approach, involving also other institutions like the National Agency for Innovation (ANI), the Institute for Supporting SMEs (IAPMEI) and the Internationalization Agency (AICEP).

There is also a need for strategies targeted at insuring financing sources, and spurring conditions to bring research to the market. Academic startups need to have a more professional and business-oriented science communication in order to be more prone to deal with market dynamics.

Participants highlighted the need for the definition of strategies to overcome the bureaucratic and to ease and accelerate granting/financing mechanisms.

Relevant agents must identify the key strategic sectors in order to be able to guide policy measures, instruments and supporting/spurring mechanisms. In Spain there is a need for more cooperation and networking, and hubs can be a response to this need. In Finland, for instance, the government finances a real ecosystem, private biotech firms and hospitals and academia work together in financed schemes. Governments should participate with bigger companies (pharma) and academia in designing supporting schemes. Also, the creation of formal education programs for startups and spinoffs, in order to respond to different needs (financing, startup building, etc.) was suggested.

Last but not least, the participants suggested some **Recommendations for the policy makers**. Skilled people should be used to design customized policies with a multidisciplinary diversity in order to be able to design and map the strategic sectors. This community should pinpoint those specific sub-segments (pharma, cosmetics, devices, digital platforms, etc.), identifying important issues and highlighting specific improvement measures.

It is necessary to incentivize the evolution of the traditional cluster policy to create a sector specific policy that will allow the identification of different actors, to identify the cross-fertilization of diverse sub-segments in the biohealth sector. Policy makers should support innovation in granting processes, as it should not be excessively closed off, limiting researchers in their pathway to innovate. Usually people submitting the proposals know more about the subject than the evaluators, so the evaluators chosen should be tailored and skilled to each proposal; and every application should be validated by the market.

It was also suggested to convey as recommendation the possibility of defining upfront payments in grants. Another important issue is related with the simplification of procedures in grants, being needed that national supporting mechanisms must learn from the European ones. Moreover, the focus in funding innovation should switch from supporting projects to supporting companies as a whole, with a strategy, a dynamic and an integrated systemic approach.

It is important for the sector that policies are targeted at designing appropriate ecosystems to spur these approaches, being of major influence the implementation of a smart policy for biohealth innovation, both internal and external.

The design of fiscal schemes to alleviate new startups from fiscal credit policies was also suggested, for example the exemption over a 10-year period. Some policies are also needed to implement efficient measures for the simplification and digitalization.

Of crucial value is the harmonization process that should be implemented for the regulatory frameworks. Despite the huge effort that has been done to harmonize regulatory frameworks in Europe, there is still a great margin to improve, as for example different small countries like Switzerland have customized mechanisms diverse than the ones in European countries. Moreover, China and Japan had

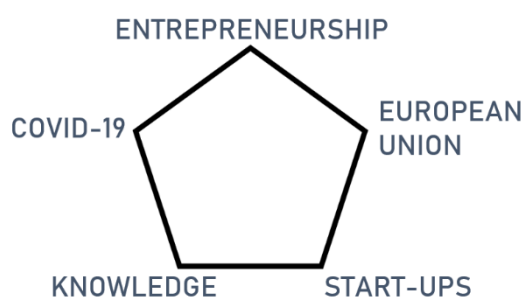
improved a lot in their regulatory processes; but there is still room for development considering the details of each specific sub-sector.

In a broad sense and according to a CEO from the pharma sector: "There is a need for the EU to influence the alteration of the regulation concerning clinical trials. Namely, the mandatory daily manual filling of a form, regarding the reaction to the trial, should be digitally transformed. The main goal is to make the process digital and less manual, thus augmenting the number of responses. It would be useful to use a digital app that sends a daily reminder with quick questions." Also it was suggested by António Portela - BIAL's CEO - that "EU authorities need to create a friendlier environment to innovation on the pharma sector" he also noticed that the startups that contact BIAL for new projects, don't have enough IP protection, don't have adequate business knowledge. Most startups present him with projects that were already published or divulged, and for that they can't be protected.

7 Final Considerations... a Pentagon approach

As it can be observed in the Figure presented below, the COVID-19, Entrepreneurship, European Union, Knowledge and Start-ups are the 5 keywords and most critical factors mentioned along this report.

Figure 7.1: **Blueprint Pentagon: Most Critical Factors**



The COVID-19 pandemic that is now affecting most of the globe has inevitably affected the answers to the questionnaire. Especially in the short term, the energies of many industries in the BIOHEALTH sector have focused on counteracting the spread of the pandemic through the production and marketing of prevention tools, such as masks, or treatment tools, such as respirators. At the same time, industries NOT in the sector have also converted their production in order to contribute to the extraordinary demand for such devices during the worst days of the crisis. COVID-19 was also suggested as a main scenario in

order to boost new biotech companies, by students enrolled in the Joint International Post-Graduation on “Advanced Skills for Innovation and Entrepreneurship in the BIOHEALTH Sector”.

Another important keyword that emerged is the one concerning entrepreneurship. The entrepreneur in the BIOHEALTH sector must be a key-individual, which is prone and able to cope with the unexpected in his field, with a sense of business, with a great capacity for leadership and negotiation, the ability to quickly learn new things even if not strictly related to the research (s)he deals with, and with a high sense of responsibility because its products’ portfolio can reach many people. Another noteworthy aspect is that the BIOHEALTH player is an “international citizen”. He has to interact with a wide range of people in different corners of the world to increase his chances of success and performance.

The European Union already recognizes that after information technology, the BIOHEALTH sciences are the next phase of the knowledge-based economy, creating new opportunities for our societies and economies. That is why BIOHEALTH must remain at the heart of the priorities of the funds in the coming years. Also, there is a need to understand how the European Union regulates research work, for example in the use of animals in research where regulation seems to be too blocking, according to students enrolled in the Joint International Post-Graduation.

“Without knowledge, it is impossible to start a business.” This is a quote of one of the answers in this report. Knowledge is the key to success in this sector. That’s why the academia needs to keep focusing in this sector and fueling the training of key actors on this matter. Moreover, there is a need for spurring knowledge, in order to have the sector grow at a faster pace, as suggested by the students of the Joint International Post-Graduation.

Finally, in a modern economy, the sustainable growth of start-ups is a quite critical issue. The most dynamic start-ups are in fact responsible for creating a relevant portion of the total number of new jobs generated, especially in the BIOHEALTH sector: a factor that should push governments to foster the development of new start-ups rather than focus on saving traditional businesses. Also, as referred by the students of the Joint International Post-Graduation, coopetition between small start-ups and big companies needs to exist in order to have a growth in innovation. Further, there is also a need for a lesser taxation on start-ups so that they can become competitive in a larger scale. That also led to the suggestion of a new design of fiscal schemes in order to alleviate start-ups from fiscal credit policies.

The data collected and the opinions expressed by the respondents, and the outputs and contributions received by the students enrolled in the Joint International Post-Graduation, send encouraging and supportive signals to the challenge launched and undertaken by our Knowledge Alliance Consortium to gather European forces that will try to accelerate the learning of knowledge and

skills to promote efficient innovation and entrepreneurial processes, specifically aimed at the BIOHEALTH sector.

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