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DETERMINANTS OF EFFECTIVE SCIENCE–BUSINESS COOPERATION IN BIOTECHNOLOGY

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Purpose: The purpose of this article is to identify conditions favorable effective cooperation agile companies with institutions scientific in the sector biotechnology. Analysis submitted meaning attributes organizational agility in the context of building permanent Relationship science – business.
Design/methodology/approach: Applied approach qualitative in the form of a case study, focusing myself on analysis cooperation PROTEON PHARMACEUTICALS SA with the University of Technology Lodz. The data was collected on on the basis of structured intelligence questionnaire conducted with a representative management enterprise.
Findings: Cooperation with the university higher Maybe to be effective provided existence Relationship based on trust, complementarity resources, flexibility operational and common orientation on Implementation innovation. Agility organizational companies it favors initiating and maintaining effective relations with the sector science.
Research limitations/implications: Limitation research is his disposable and quality character, based on analysis one case, which limits possibility generalizations results. No triangulation data Maybe to influence on subjectivity conclusions.
Practical implications: Conclusions they can constitute basis for design effective models cooperation with universities in the sector biotechnology. Article indicates specific mechanisms and attributes organizational, which They support partnerships scientific and industrial.
Social implications: Strengthening Relationship science - business contribute to accelerate transfer knowledge and innovation, increasing employment high qualified Staff and Improvement competitiveness economy based on knowledge.
Originality/value: An original theoretical model was developed cooperation agile companies with a university higher, which integrates perspective practical with assumptions theory organizational agility. Article he brings new value for discussion over cooperation science and business in the condition's uncertainty and dynamic changes.
Keywords: agile enterprise, institutions scientific, biotechnology, cooperation, theoretical model.
Category of the paper: research paper.

1. Introduction

Contemporary companies biotechnological they operate in dynamic and turbulent environment surroundings. Key meaning is gaining skill cooperation with institutions scientific. Complexity processes research and development, high costs innovation and necessity fast reacting on changes market and technology they make effective cooperation science with business it stands myself condition necessary for development. In this in context special meanings is taking agility organizational. It enables She flexible and responsive management knowledge, relationships and resources.

The aim of this article is to identify factors favorable cooperation agile companies' biotechnology with the university higher, on example PROTEON PHARMACEUTICALS SA and rate values this one cooperation in the context of practices organizational and building advantages competitive. Article contains review literature, description Methodology research qualitative, analysis case, comparison with the results others research and wording recommendations. The value-added publication is an original model of cooperation. It can be practical tool supporting building Relationship science - business in reality economy based on knowledge.

1.1. Conditions functioning companies in the area biotechnology

Conditions functioning companies in the area biotechnology they characterize myself high degree complexity, uncertainty and risk, both on level operational and strategic (Eslami, Jungbauer, 2024). Companies these they operate in the environment strongly regulated, in which requirements formal, norms quality, processes Certification and restrictions legal they influence directly on the pace of introduction innovation and possibility of their commercialization (Mu'azzam et al., 2024). High threshold Entry on market, resulting from expensive research laboratory, necessity conducting long-term tests, and also requirements regarding safety and ethics (Anyanwu et al., 2024), makes development biotechnology is the domain of organizations that they have appropriate background capital, technological and competence (Javanmardi et al., 2024).

Important element the environment of biotechnology companies is strict interdependence with the sector science. It is also important necessity transfer results research basic for applications industrial. In practice this means that companies functioning in this sector they must constantly stay in touch with universities and institutes research and networks innovative. Through this they provide myself access to the latest knowledge, infrastructure and high qualified staff (Hojeij, 2024). Cooperation with the sector scientific constitutes therefore condition necessary for permanent development and maintenance advantages competitive (Afolabi et al., 2024).

Dynamic development technology (including development Engineering genetics, bioinformatics, diagnostics molecular Whether bioprocesses production) forces on company's big flexibility organizational and before ability to quickly adaptation (Afolabi et al., 2024). Changes in the environment market, emergence myself new threats health and environmental pressure on balanced development and growing expectations social regarding transparency and responsibility of actions, cause that companies biotechnological they have to invest in innovations as well shape culture organizational (Vojnovic et al., 2024; Nath, 2024). The latter has to to favor cooperation, openness and continuous learning (Mehta et al., 2024; Li, Duan, 2025).

Additionally, a challenge it remains access to financing activities research and development. This access to a large extent is largely dependent on instruments public and private sources capital high risks (de Morais et al., 2024). In this perspective important it stands myself skill design and implementation common projects with institutions scientific. Equally is also important skill preparation applications within programs national and international. Programs these They support innovation and research applied (Mu'azzam et al., 2024). Contemporary companies biotechnological They function therefore on contact science, economy, technology and politics public. However, it requires from them developed competence management relationships, projects interdisciplinary and wallets innovation (Javanmardi et al., 2024; Fei et al., 2025).

In the conditions Yes strong dynamics and multidimensionality surroundings, more and more bigger meanings is taking agility organizational. Means She ability to quickly reacting on changes, identification chances market and transforming knowledge scientific into real solutions product and process (Wasyłeczko et al., 2024). Enterprises biotechnological, which they want remain competitive and effective implement innovations, must to develop own resources technological, but simultaneously too they should strengthen your own ability to cooperate, adapt and integrate scattered sources knowledge (Li, Duan, 2025; Mehta et al., 2024; Arnold, 2024).

1.2. Agile attributes companies' favorable cooperation with institutions scientific

In terms of dynamic and complex the environment in which it came function to companies biotechnological, special meanings they are taking these attributes Agility organizational, which They support effective cooperation with institutions scientific (Shi et al., 2023). Agility, understood as ability to quickly reacting on changes, and at the same time predictions trends and flexible customization to the new ones conditions, manifests among others in the way initiating relationships, management knowledge and integration resources within intersectoral projects research and development. An important attribute is the proactivity of the company (Plotnikov et al., 2024). This feature means that undertaking actively I am looking for partnerships and co-creation agenda research with universities (Ju et al., 2020). Organizations distinctive myself high level autonomy decision-making and openness on new ideas faster They

identify potential areas cooperation. In addition, efficiently they turn them into action in line with the goals both both scientific and commercial (Omowole et al., 2024; Sharma et al., 2022).

As the ability to quickly is important taking up decisions. It is also important Moreover Ready for testing new solutions (Claudhary, Trzcieliński, 2021; Olszewski, 2023). This is especially important in the phases early research and prototyping, which they bind with a lot uncertainty about the effects finals (Andriyani et al., 2024). These companies that they can flexibly to manage risk and use approach iterative in implementation projects, they show bigger effectiveness in relationships with partners (Zhao et al., 2022). Such cooperation requires skills implementation new technology and openness on corrections and improvements in progress implementation common goals (Kocot et al., 2023; Wahab et al., 2024; Mishra et al., 2021; Sharma et al., 2022). It is necessary to have on in view of the fact that agile organizations are part of networks interdependence in which flow knowledge, open communication and integration external resources are the foundation of long-term cooperation (Thomas, Suresh, 2023). In this in context especially important it turns out myself culture organizational, which is based on trust, willingness to cooperate and respect for competence partner. Such a culture it favors building interdisciplinary teams research and implementation (Claudhary, Trzcieliński, 2021).

The next one a distinguishing feature agile the company is flexible structure organizational (Plotnikov et al., 2024; Wahab et al., 2024). It allows She on fast creation teams task-oriented and efficient allocating resources, depending on the changing myself needs design. Such adaptability operational allows on more effective Implementation results research (Omowole et al., 2024; Plotnikov et al., 2024). It enables also their current adaptation to conditions technological, market Whether regulatory. Enterprises capable of fast reacting and reorganizing in response on variables factors external they gain advantage in cooperation with universities (which also are subject to pressure design and institutional) (Brendzel, 2023; Ju et al., 2020).

Not to be underestimated it remains also ability to absorb knowledge. Such ability means skill identifying, assimilating and practical use results research conducted outside the organization (Shi et al., 2023). In this take school it stands myself active partner in the process Creating innovations that they can to be implemented in the form of new products, processes or models management. The ability to transform knowledge scientific solutions market shows high level maturity organizational and position companies in the system innovative. Only organizations agile, which are Open on sharing competence and ready for continuous learning they will be able to fully to use potential cooperation with the sector science. They will be probably create from it real value added (Zhao et al., 2022; Mishra et al., 2021; Kocot et al., 2023).

1.3. Conditions effective cooperation enterprises and institutions scientific in the area biotechnology

Effective cooperation between companies and institutions scientific in the area biotechnology requires fulfillment specified conditions. They go beyond formal partnership and include compatibility goals, complementarity resources and ability to work together creation and implementation knowledge (Subha et al., 2024; Xue, 2025). Key has strategic importance approach both pages, based on mutual trust, openness on teaching and willingness to share Risks and results. Report science - business she should to be perceived as process long term. It requires a joint defining goals research and implementation and mechanisms of their implementation (Javanmardi et al., 2024).

In the conditions specifics biotechnology, where processes innovative are expensive and time-consuming, it is necessary to develop both pages competence coordination, flexibility operational and abilities absorption (Hojeij, 2024; Vráblová et al., 2024). Cooperation she should include both Actions experimental and implementation. They are supported by appropriate instruments management projects and mechanisms translation knowledge scientific on Tongue applications market. It is also essential assurance clear legal and institutional framework. They promote transparency of activities, protection property intellectual and Equality pages (Afolabi et al., 2024). Efficiency cooperation depends also from presence external ecosystem supporting innovations (including system financing, institutions intermediaries and policies public promoting partnerships scientific and industrial). Only in such conditions That's possible it stands myself building permanent Relationship intersectoral, which They translate myself on real innovation and competitiveness companies biotechnological (Durand, Hassan, 2024). In addition to the concept of organizational agility, it is worth referring to the theory of open innovation and absorptive capacity. Open innovation assumes the active acquisition and use of external knowledge, including through cooperation with universities. This promotes the creation of joint solutions. In turn, absorptive capacity refers to the ability to identify, assimilate and apply external knowledge in practice. Both concepts help to better explain how science-business cooperation can lead to lasting innovations in the biotechnology sector.

2. Methods

The purpose of exploration research was deepened recognition conditions favorable effective cooperation between institutions scientific and business operating in the sector biotechnology, which shows characteristics agile, and which you can define as organization agile. Intention researchers was capture dependence between dynamics this one cooperation and ability companies to generate innovation, adaptation to the changing myself surroundings and building long term advantages competitive.

Point exits for conducted analysis was hypothesis assuming that effective cooperation between sector science and agile enterprise biotechnological he is leaning myself on flexible approach to common goals, mutual trust, complementarity resources and readiness to share myself responsibility and risk within common ventures research and development.

Within the framework of Exploration formulated following questions research: (1) What forms is gaining cooperation between the company biotechnological and the unit science and how it evolves she in time? (2) What factors institutional, organizational and interpersonal they are conducive efficiency this one cooperation and what I limit? (3) In what way way cooperation with science it affects on development innovative products, technologies and processes in the enterprise biotechnological? (4) What role in this in the process plays exchange knowledge, resources human and infrastructure research? (5) Is cooperation with the university higher is seen as an element of long-term strategy development organizational and technological enterprises?

The above questions they served as frame analytical for interpretation content obtained as a result qualitative interview with a representative management companies Proteon Pharmaceuticals SA Empirical data They were obtained on the basis of a structured interview questionnaire, which he was left forwarded to management companies Proteon Pharmaceuticals SA Answers granted They were By person managing , having detailed knowledge on topic activities operational and strategic companies, including also on topic the previous one cooperation with institutions scientific and research, especially with the University of Technology Lodz.

Research questionnaire He was folding myself total of 20 questions. 13 questions It had character closed (with answers one-time or multiple choice), while 7 gained form open, enabling development answers and presentation opinions, experiences and suggestions. Questions Closed They served categorization data and ensuring comparability answers in terms of quantitative, while questions Open made it possible Exploration qualitative aspects cooperation, subjective evaluations and reflections regarding relations with the sector science.

Range thematic questionnaire included five main areas: characteristics organizational companies (profile activities, employment, facilities R&D), history and scope cooperation with institutions scientific, forms being carried out projects research, involvement in initiatives educational and conference, as well as assessment the previous one cooperation and proposals for its improvement. In particular included questions regarding time duration cooperation with the university, sources of its initiation (or it was an initiative universities, companies, or another entity), purposes original and current, scope cooperation (research, implementation, work diploma, licensing), and also expectations in relation to potential benefits flowing from commitment students and young scientists in the field companies.

Collected material empirical he was left subject qualitative analysis content. Its purpose was isolation the most important determinants of effective cooperation between science and the sector business. This analysis made it possible Identification both factors both supporting and barriers limiting development Relationship intersectoral, in the context of industry biotechnology, having on in view of the fact that This industry is characterized by myself high dynamics changes, risk technological and requirements regulatory. At the same time, it is possible was recognition characteristic features model organizational examined companies that shows marks agility – including ability to be flexible shaping relationships with partners external, fast reacting on needs market and Integration knowledge from various sources in the process creation innovative solutions.

3. Results

Analysis of results intelligence questionnaire conducted with the management companies Proteon Pharmaceuticals SA allows to capture important problems and dependencies regarding cooperation companies' biotechnology with the institution scientific - University of Technology Lodz. Each of the raised issues is treated as a separate research problem which in a relevant it affects on quality, intensity and durability cooperation on contact science and business (see Figure 1). Figure 1 shows eight key areas cooperation companies Proteon Pharmaceuticals SA with the institution scientific - University of Technology Lodz (identified) on on the basis of analysis intelligence questionnaire). At most rated They were Three aspects (value 4 on a scale of 0-4), i.e. profile and specialization companies, facilities R&D and the need cooperation, and character and motivations for cooperation. Values 3 were assigned such areas such as: effects cooperation and barriers financial, forms and continuity cooperation, cooperation Educational and HR and possibilities development model cooperation. The lowest rated connections cross-sectoral (value 2), which can to indicate on area demanding further reinforcements. Fig. 1 allows to illustrate which elements cooperation are strong side

Relationship science - business, and which ones whereas they require further development or support systemic.

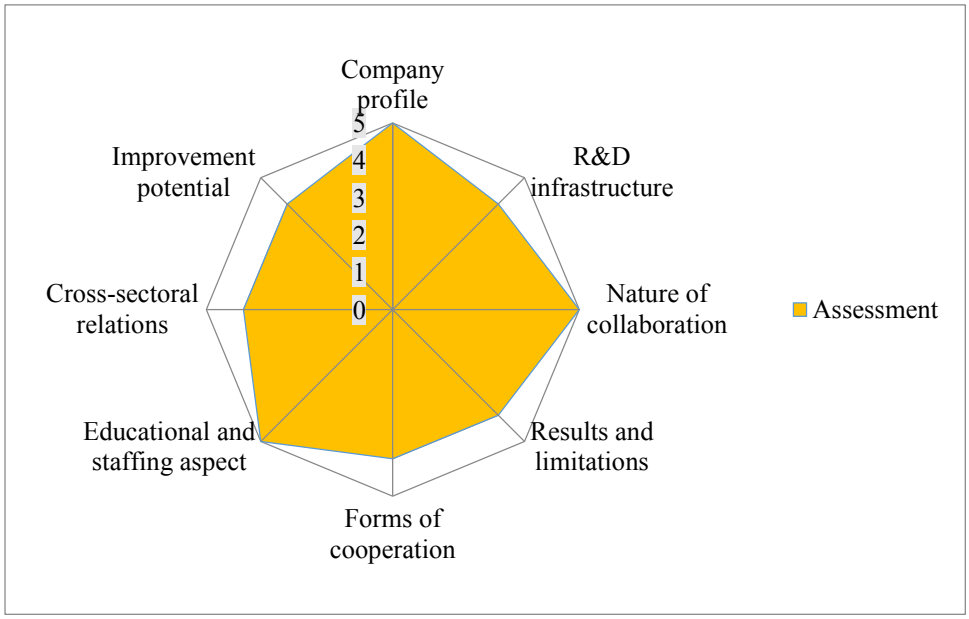

Figure 1. Area's analysis cooperation companies Proteon Pharmaceuticals SA with the institution scientific.

Source: Prepared by own.

The first a problem subjected the exploration is the identity and scope activities analyzed enterprises. Determination the organization profile allows to assess, on How many activity given companies it holds in the sector biotechnology, and also whether its functioning requires advanced support scientific. Proteon Pharmaceuticals SA is an organization fully rooted in biotechnology, with high level specialization, concentrating myself on research over bacteriophages and the creation of advanced preparations biological. Such a profile activities determines the necessity maintaining relations with the sector science, mainly in the field of conducting analysis, implementation innovation and testing effectiveness solutions.

The second the problem that emerges from the analysis, there is a question backroom research and development companies. Answer granted by management companies clearly indicate that Proteon Pharmaceuticals has own, good developed R&D facilities. This statement leads to the key questions, or possession such backroom weakens need cooperation with universities. Answer to this question it turns out myself complex. On one pages undertaking he can independently to lead significant Hi wash research and implementation. On the other hand, on the other hand, he notices need cooperation with units scientific. First of all, it is clearly visible in the areas that they go beyond apart from my own expertise technological or they require specialized infrastructure and competences external.

The third problem concerns character cooperation with institutions scientific and motivation to establish it. Answer indicates that cooperation with the University of Technology Lodz she was initiated by itself company and at the same time initiated by implementation doctorate implementation. This relationship included initially character individual. Then she expanded myself on commissioning specific research and licensing material biological. This indicates a model of cooperation based on trust, long-term and fit substantive. The problem research, which here myself appears, there is a question about the extent to which to a degree initiative and commitment companies are condition necessary start cooperation with the university. It is also interesting how the universities they answer on needs reported by business.

Another problem is related to the effects the previous one cooperation and its evaluation. Proteon Pharmaceuticals positively I am evaluating the previous ones relations with the University of Technology Lodz, considering that every time they led to the achievement intended goals. This observation raises but important the issue limitations. Barrier, it turns out myself lack sufficient financing some initiatives research, independent of good will pages. This problem shows structural the challenges that often NO they concern quality the relationship between science and business, but systemic support financial for innovation and research industrial.

Next a significant problem concerns scope and forms of cooperation. Enterprise emphasizes that cooperation with the university she had various nature: from implementation research on order, by cooperation over specific products, up to education and development staff. Answer provided indicates also, that business NO it leads Currently common projects research with the university. Maybe raise this question of continuity cooperation and the conditions for its re- intensification. This problem is directed attention to whether or not cooperation is of a nature project and cyclical, or is also embedded in the long-term strategy both institutions.

It is also interesting meaning cooperation in the context of Educational and HR. Management companies clearly indicate on significance relations with students and graduates Polytechnics Lodz. Employment many of them, including people associated with the company from the beginning activities in the area bacteriophages, proves that school full function Suppliers high qualified staff. This problem opens up a field for reflection over whether and in what way in scope cooperation with universities full function capital investment human, not only in solutions technological.

A separate problem concerns connections intersectoral, including cooperation with administration and institutions support innovation. Proteon Pharmaceuticals indicates on necessity integration knowledge and infrastructure from various sources (also from outside sector strictly biotechnological). In this in context the role of institutional partners, such as agencies, is highlighted regional. Their share Maybe support complex development products. This raises the question of how to a degree institutions surroundings business are active intermediaries and animators' cooperation scientific and industrial. And in what on the other hand are only passive participants ecosystem innovation.

The last one analyzed problem refers to model direct cooperation and possibilities his improvements. Although formal cooperation model he was left worked out, appears myself reflection that it is possible enlargement on new areas. This applies to areas procedural, not Just product and research. This statement allows to formulate the conclusion that even All right functioning Relationships between science and business they can evolve and require redefinition in response on changing myself needs technological, personnel and market.

Whole analysis leads to the conclusion that cooperation companies Proteon Pharmaceuticals SA with the sector science has a character advanced, flexible and embedded in real life needs companies. This cooperation is example practical Applications agile methods cooperation intersectoral in terms of economy based on knowledge and innovation despite the fact that is not free from systemic barriers.

Based on presented considerations theoretical and a case study by PROTEON PHARMACEUTICALS SA, developed he was left original theoretical model cooperation agile companies with a university higher, presented on Figure 2. This model is attempting synthetic takes dynamic Relationship taking place between sector science and enterprise operating in a demanding and turbulent environment environment biotechnological. At the center of the model, he finds myself agile enterprise. The enterprise is as subject flexible, pro - innovative and adaptable, constantly interacts with the environment knowledge, which is the university higher.

The model assumes that effective cooperation only possible then, when both pages they are in a relationship based on trust, complementarity resources and co-responsibility for the effects projects research and development. University contributes to cooperation potential expert, access to high specialized infrastructure and capacity for education future employees' companies. In turn undertaking introduces this Relationship market recognition needs, possibility testing solutions in conditions practical and ability to quickly commercialization results research. Flow knowledge has a character bidirectional. This means that both both the company and the university they teach myself from myself each other and at the same time They modify own actions in response on appearing myself challenges.

The model illustrates also conditions shore necessary to maintain such cooperation: openness on changes, flexibility organizational, systemic support Financial and common vision long term development. Agility in this take NO it limits myself only to the structure organizational companies, but refers myself also to the way design Relationship intersectoral – short cycles collaborative, iterative approaches to implementation goals research and readiness to introduce corrections on every one stage cooperation.

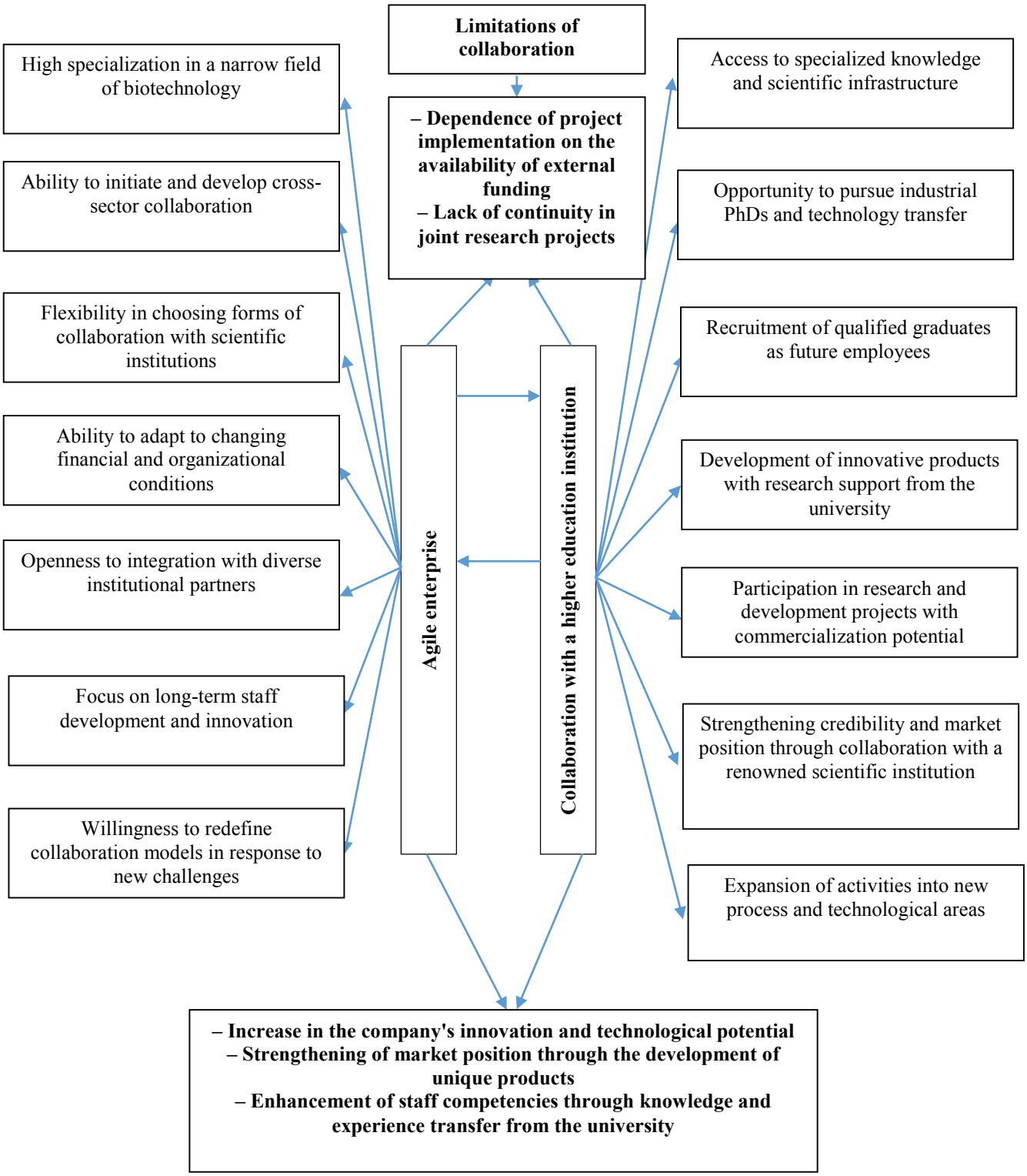

Figure 2. Author's theoretical model cooperation agile companies with a university higher.

Source: Prepared by own.

The value added developed the model is his application potential. It can be practical tool For managers and leaders research, wishing efficiently build relations with universities. And at the same time, I want keep high responsiveness organizational and the pace of

innovation. The model integrates because both elements cognitive (recognition factors success cooperation) and operational (mechanisms implementation cooperation). It gives at the same time possibility diagnosing existing barriers and indications areas for improvement. Thanks ago it supports development companies towards bigger agility and synergy with the sector science (especially in the area of biotechnology constitutes key condition survival and development).

4. Discussion

Presented considerations and results tests qualitative conducted at PROTEON PHARMACEUTICALS SA allow on wording in a row conclusion relating to the conditions effective cooperation between school higher and agile enterprise operating in the sector biotechnology. Collected material empirical indicates that key meaning For Good luck this one cooperation I accept possession appropriate resources infrastructure and competence. However, the most important thing is the organization's openness to sharing knowledge, trust in the partner institutional and flexibility in implementation common solutions. Effective cooperation has to it is clear from specific needs and aspirations both pages and its structure she should to be dynamic. It should because enable adaptation to changing myself conditions market, financial and technological. Specific importance in this in context is gaining mutual replenishment myself resources. University he brings competences research, potential intellectual and access to laboratories, while undertaking provides knowledge about the market, needs users final and possibilities fast commercialization innovation.

In order to cooperate was durable and effective at the same time she should include both common projects research and development, as well as activities of a nature educational and personnel. Example PROTEON PHARMACEUTICALS SA shows that hiring Graduates universities, implementation doctorates implementation and co-creation programs practice student Maybe lead to building integrated ecosystem innovation. In the area this, knowledge academic penetrates with knowledge practical. Such cooperation requires but appropriate support institutional, including access to funds financial, stable mechanisms Coordination and systems grades quality effects common actions.

The culmination carried out the analysis is an original theoretical model cooperation agile companies with a university higher, which I am tidying up dependencies between elements influencing on efficiency this one relationship and indicates That's possible directions further improvement. This model emphasizes necessity leaving from rigid framework of cooperation on thing approaches iterative, adapted to variables conditions surroundings and the supporting myself on relational competences of partners. This approach is included into modern concepts management knowledge, innovation and relationships inter-sectoral. Their effectiveness in the

sector biotechnology you can consider as a condition necessary to achieve permanent development and construction advantages competitive.

Based on carried out considerations theoretical and case study analysis by PROTEON PHARMACEUTICALS SA, formulated They were Recommendations For companies operating in the area biotechnology, which the goal is to build effective and long-term cooperation with universities higher. First of all, to all it's worth it strive to create Relationship based on trust, mutual respect competence and willingness to share myself knowledge and responsibility for the implemented projects. Cooperation with universities she should to be treated as strategic element of the system innovative. It should She to support development new products and technologies and at the same time capital human organization.

It is recommended taking up initiatives of a nature long term. These include common doctorates implementation, commissioning research universities in response on specific challenges technological, co-creation programs practice and active participation in life scientific by conferences, workshops and publications. Enterprises they should to be also Open on cooperation procedural, including activities in the field management, optimization processes technological, analysis Risks Whether implementation ICT tools. In the context growing uncertainty market, it's worth it to develop competences organizational related to agility in management resources, fast taking up decision, iterative implementation solutions and readiness to redefine goals and models cooperation.

It is also important systemic approach to building relations with the environment institutional. It is recommended active engaging in activities regional and national Agency development, network cooperative and consortiums research and industrial. They can be platform for acquisition financing, exchange experiences and initiation common projects. It is also necessary taking action on thing reinforcements competence relational employees, both on the managerial and expert side. They will enable effective moving myself on contact science and business.

To sum up, in the conditions dynamically developing myself market biotechnological, enterprise they should to treat cooperation with universities as durable component strategy organizational. It is an investment in the future and source advantages competitive. Efficiency this one cooperation will be depend both from outlays financial, however first of all to all from quality relationship, clarity goals and abilities both pages to share learning and adaptation to changing myself conditions surroundings.

5. Conclusions

Based on presented case study PROTEON PHARMACEUTICALS SA and analysis results research others authors, you can to notice important similarities and differences in terms of cooperation agile companies with institutions scientific. In the study carried out by Calefato et al. (2020) in a large the company programming in Italy, it was emphasized meaning appropriate selection tools communication and management projects in the context practice agile. Implementation tools such as Slack and Jira, along with clear the rules of their use, contributed to improve communication and efficiency teams.

In the context cooperation between the sector biotechnology and institutions scientific it's worth it to relate to the Agile BioFoundry report (2023). It indicates meaning integration resources and competences different partners in order to acceleration processes research and development. This cooperation is based myself on flexible structures organizational. They allow for fast adjustment to the changing myself conditions market and technological.

Comparing these results with experiences PROTEON PHARMACEUTICALS SA, notes it turns out that effective cooperation with universities higher requires both appropriate tools and structures organizational, but also education culture organizational favorable openness, trust and common striving for innovation. In both cases key the ability to adapt and be flexible is important reacting on appearing myself challenges, what is characteristic for approaches agile. Enterprises operating in the sector biotechnological they should invest in development competence agile (both on level both individual and organizational), and actively look partnerships with institutions scientific in order to common creation values and innovations.

In the light changing myself surroundings scientific and economic, future directions research they should concentrate myself on deepened analysis dynamics relations between universities and enterprises biotechnological in the long term on the horizon time. Special meaning Maybe to have identification factors conditioning durability cooperation (including variables social, institutional and technological). It is worth return attention on influence tools digital and systems IT on coordination of activities in models' cooperation agile, taking into account scattered teams design and exchange platforms knowledge.

Important direction research maybe to be also to investigate role universities in shaping competence future employees, taking into account needs agile organizations. Interesting would be too rate effectiveness programs internships, doctorates implementation and joint initiatives didactic. Needed are also tests comparative including different sectors economy based on knowledge. This would allow determining to what extent to a degree mechanisms developed in biotechnology are universal or specific for this sector.

It's worth it to direct attention on aspect culture organizational as factor conditioning willingness to cooperate and mechanisms management relationships intersectoral in terms of uncertainties and limitations financial. Another area demanding exploration is evaluation

influence cooperation with universities on efficiency innovative businesses in perspective quantitative, including through measurement effects commercialization, numbers implemented solutions Whether shortening time developing products.

Tests they can also embrace issue role institutions intermediaries (such as clusters, agencies development regional and consortium, in initiating and maintaining Relationship science - business and mechanisms financing projects common). Finally, an interesting the direction is analysis cooperation transnational, especially in terms of programs European and international, which they create new frames institutional for cooperation between science and industry in terms of global.

In the context of dynamic changes in the scientific and economic environment, further research should focus on the analysis of long-term relations between universities and biotechnology companies. It is particularly important to identify factors influencing the durability of cooperation (including social, institutional and technological variables). It would be interesting to examine the importance of digital tools and IT systems in coordinating activities within agile cooperation models - especially when working in distributed teams. A valuable area of research would also be the assessment of the role of universities in shaping the competences of future employees and the effectiveness of internships, implementation doctorates and joint teaching initiatives. Comparative analyses with other sectors of the knowledge-based economy are also needed. It is also worth conducting research on the impact of organizational culture on willingness to cooperate, as well as assessing the impact of cooperation with universities on the innovativeness of companies and examining the role of intermediary institutions and international cooperation within EU and global programs.

In future research, it is worth focusing on the analysis of long-term effects of cooperation between science and business, primarily in terms of its impact on the commercial results of enterprises and the scientific achievements of universities. It would also be important to examine the durability of partnership relations, their evolution over time, as well as to identify factors that support maintaining cooperation in a changing technological and market environment.

Limitations carried out research they concerned first of all all of their quality the character that based was on single case study, which limits possibility generalizations results on other companies biotechnological. Additionally, the source data was only perspective management one companies, what could affect on subjectivity granted answers. No triangulation methods and limited access to data quantitative made it impossible deepened analysis comparative.

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