Synergy Collaboration of Universities and the Industrial World

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ABSTRACT: The aim of this research is to test the management of synergistic collaboration models that can meet the expectations of universities resulting in graduates who have extensive knowledge, build an innovative mindset and are able to respond to the challenges of future lives. Research uses qualitative descriptive methods on the objects of central Java private universities. The results concluded that the collaboration of universities and industries requires intensive communication, knowledge transfer, institutional planning, curriculum adaptation, learning material planning based on the world of work, the division of teaching materials professionally and proportionately to the world of work, provision of R&D collaboration facilities and infrastructure. The development of educational institutions is important, because it prepares the competent next generation in its time, so that the collaboration model is ideal that provides benefits to both parties. Follow-up so that this collaboration can be effective in integrating knowledge resources, the main role of industry-university synergy is the output of quality talent by universities and R&D collaboration. Industry can fully rely on knowledge resources, and universities supply skilled labour and R&D cooperation to achieve synergistic effects. Thus, the industry can solve weak technology problems, improve business units, make technological innovations and management, and further make great progress and gain a leading position in a highly competitive market.

KEYWORDS: College and Industry Collaboration, Research and Development, Technology, Business.

I. INTRODUCTION

Competition and increasingly high professional demands pose the pressures that universities must face in today's competitive environment, making the college to continue to spur itself to adapt and innovate to environmental changes in order to survive in the course of educational service development. These demands can be met through collaboration between high management and industry, to overcome the mismatch that occurs between the two parties. Prof. Dr. Kusmayanto Kadiman, Minister of Research and Technology in the United Indonesia Cabinet (2004-2009) stated that "solving the mismatch: the need for campus-industry synergy", that the relationship between universities and industry has not shown understanding and harmony between the two sides, because there is a difference in the mission owned by the university and industry that causes a gap. The university's main mission is to create and develop knowledge for the public sector, while the industry's mission is to maximize profits for its stakeholders [1].

To overcome the mismatch that occurs between the two parties, collaboration is needed that aims to create knowledge transfer from university to industry. Knowledge transfer can be done through various mechanisms between the university's research centre and industry. Many benefits of collaboration, such as cost savings, multidisciplinary science, employee reputation, and various contrasts and expertise [2]. The collaboration [3] aims to prepare students and alumni to compete in a highly competitive environment as it is today. A series of collaboration benefits have a positive impact on increasing high innovation and increasing competitiveness [4].

Moreover, the cooperation strategy between the high education, the industrial world, and the government is also mandated in Sisdiknas Law No. 20 of 2003. But reality shows that the world of education still relies on the internal work system of the campus and has not taken advantage of chances and opportunities to build a synergistic cooperation system with stakeholders. Therefore, the demands of transformation in a better direction are very likely to occur when the teaching and learning process is associated with cooperation programs with stakeholders, because learning according to [5], becomes the centre of human evolution.

According to [6] the form of relationship between higher education and its stakeholders must be professional, advocacy, and partnership. The Collaboration Model contains the division of responsibilities and initiatives between them, which is aimed at achieving the target of the study program, namely giving birth to quality graduates. The relationship among universities, industry and government is often discussed in the studies of innovation and the development of science and technology [7].

In general, the industry focuses on technological innovation and knowledge applications, while colleges focus on the dissemination of knowledge and the development of high-quality talent while engaging in scientific innovation and knowledge

transfer. Through industrial cooperation with universities, industry can acquire new knowledge resources, and then absorb, internalize and apply knowledge to promote sustainable innovation. As a collaborative partner with industry, the university has strong scientific research capabilities, has the hallmarks of academic and professional disciplines, and encourages the improvement of corporate innovation capabilities. Therefore, industry-university synergy is an important way to transfer knowledge from university to company [8].

At the core of industry-university synergy is knowledge sharing, where the industry can acquire an abundance of knowledge so as to reduce R&D and transaction costs [9]. The university, driven by the industry's demand for cutting-edge knowledge and technology, accelerates the progress and depth of basic research, so as to consolidate the power of the university, keep up with the demands of the times, lead the development of disciplines and enhance academic reputation. Therefore, industry-university synergy is not only a win-win choice for universities and industries, but also to innovate. Based on the above description, the demands of the development of a mutually trusting collaborative relationship between universities and industry becomes very important for knowledge transfer, increased innovation and overcoming the challenges of changing environment and market competition. The issue raised in this research is how the management model of college and industry is synergistic so that it can prepare graduates who have competence so that they are able to compete in a very competitive environment.

II. LITERATURE REVIEW

College and industrial collaboration is a scientific collaboration reviewed from the behaviour of scientists who become facilitators in the process of developing and dissemination of science [10]. The importance of university-industry collaboration and interaction to drive innovation, which makes universities rethink established goals, Table 1 shown state of the art collaboration universitas and industry from previous researches. The college is not only responsible for developing human resources i.e., education which is the first mission, and also for generating new knowledge i.e. research results are stated as the second mission, but must also be involved in the establishment and development of the area as the third mission. The third mission for universities to actively participate in regional development, and certainly requires more action in entrepreneurship, such as creating spin-offs, promoting an entrepreneurial culture among students and/or participating in the development of intelligent specialization [11].

In the application of modern management, the collaboration between universities and industry is understood as the implementation of the vision and mission of the organization, and there is an understanding in the management and development of synergistic inter-institutional programs. Industry is a user of knowledge and dominates in the process of industrialization of scientific and technological achievements, while universities as science providers play an important role in entrepreneurial and innovation activities, especially in technology transfer and commercialization [12]. Cooperation between industry and universities in R&D and innovation projects together becomes a source of innovation [13].

The results of the study [2] determined that effective collaboration has six important keys, namely: 1). The university has a structure that supports research projects efficiently; 2). The existence of management that is able to communicate and conduct appropriate supervision; 3) Cultivate young researchers who are able to identify the economic environment; 4). Develop new partners and support existing projects to take advantage of opportunities. Organizational culture is an important pillar on which universities are open to collaborating with industry [8].

Singley & R. Anderson, (1989) concludes that collaborative cooperation breeds the transfer of knowledge at the individual level, in other words knowledge gained and applied in one situation to another. Transfer of knowledge from universities to industry or vice versa which has categories, namely: focus on corporate issues in allocating resources and partnerships; focus on strategic issues, such as licensing, incentives for the resulting patents, as well as intellectual property policies; focus on geographical issues, namely the relationship of universities and industry and their influence on the success of knowledge transfer; focus on knowledge transfer (publication, patent, and consulting) [15].

Table 1. State of the art collaboration universitas and industry

Description	Indicator
Fernandez (2015) Find 5 (five) important items related to business and university collaboration	1. Flexible curriculum design 2. Quality of work-ready graduates 3. Student exchange and mobility 4. Lifelong and sustainable learning 5. Entrepreneurial program
Wilson (2012) Find 6 (six) items of university and industrial cooperation	1. R &D collaboration 2. Academic mobilization 3. Student mobilization 4. Commercialization of research results 5. Curriculum development

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Description	Indicator
	6. Lifetime learning
Ivascu (2016) Find a set of evaluation matrix that has the capacity to assess the power of university-industry collaboration.	1. Culture shares knowledge 2. Knowledge transfer 3. Financial support 4. Communication 5. Management support 6. Facility support
Banal-Estañol (2015) Some things that need to be implemented in university-industry collaboration	1. Curriculum management, 2. Education personnel management 3. Using education personnel effectively, 4. Financial management and financing 5. Management of facilities and infrastructure is carried out in procurement and maintenance

The results of the study of [18] states that effective collaboration between universities-industries in creating open innovation has 6 keys, namely:

1. The existence of the university has a structure that supports research projects efficiently;
2. The presence of effective project management and being able to communicate and conduct good supervision;
3. Cultivate young researchers who are able to identify the economic environment;
4. Build new partners and support the existence of projects to capture opportunities.
5. Organizational culture becomes an important pillar where universities have openness in collaboration with industry;
6. Dissemination strategies become a force to share research results and become an important element in the promotion of research results to attract new partners.

Collaboration in the application of modern management is assumed to have an understanding of vision and mission, understanding of management and development of inter-agency programs that synergize. Therefore, among partner institutions there should be a major actor in the activity, as the institution responsible for the success of the program. Scientists involved in such cooperation must be able to provide additional knowledge and have a high commitment to the cooperation. The weaknesses and advantages of each institution become the basis for the achievement of the spirit in collaborated that must be shared with the aim to complement, add and mutually beneficial. Collaboration also has principles that must be an understanding between partners and must be applied in its implementation, among others: the principle of participation, the principle of cooperation, the principle of transparency, the principle of law enforcement (rights and obligations, awards and penalties and sustainability principles [19].

The university acts as a source of knowledge and a supplier of professional talent that not only creates new knowledge and develops new technologies, but also effectively promotes the dissemination of knowledge, information and technology, and provides knowledge support for the industry and technological innovation.

III.METHODOLOGY

This research uses qualitative descriptive methods that focuses on the implementation of university collaboration with industry. Data collection is done through social facts that occur, and is used as a guideline for interviews in the field. This study took data on Private Universities in Central Java. The types of data collected are secondary data and primary data, Table 2 shown data types and research data sources. Research informants are those who know the issues of college and industrial cooperation, namely leaders at the university level, especially vice rectors for academic, cooperation, Research and Community Service Institute.

The selection of informants uses purposive methods, through the snowball process (Mason 2002), while data collection through in-depth interviews, observations, and documentation. Data analysis techniques through the data reduction stage, present and display data / information, interpret, conclude and verify, increase the validity of results, then interpret data results and conclusions. Data reduction is the process of selecting, simplifying, abstracting, and transforming, followed by the withdrawal of conclusions through inductive methods, namely the process of collecting data and specific facts, then making general conclusions as a result of research.

Table 2. Data types and research data sources

No	Information	Note	Data source
1	Agency regulations related to collaboration	Related to collaboration with DUDI	University of PGRI Semarang, Unika Soegijapranata Semarang, UDINUS Semarang, Unimus
2	Academy rules		

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No	Information	Note	Data source
3	Quality assurance		Semarang, and UKSW Salatiga
4	Strategic plan	5 years	
5	Operational plan	Every year	
6	Culture of knowledge sharing	Internal and external	
7	Financial support		
8	The benefits of collaboration	From the academic aspect	
9	IT facilities	Scope of cooperation (regional, national, international)	
10	Industry partners		

IV. RESULTS

Data analysis is done by descriptive and inferential methods. The results of data analysis are presented in the form of Table 3 equipped with explanations.

Table 3. Data analysis results

No	Information	Aspects	Note
1	Empirical results of the role of university-industry collaboration	Collaboration: 1) Teaching and learning 2) Research and development 3) Business development 4) Community, industrial and regional development	The development of university-industry collaboration concepts includes: 1) Evaluation of parameters: collaboration, knowledge sharing, culture, financial support, communication and barriers 2) Success factors of each category that contribute to the development of relationships based on open win to win innovation for maximum results 3) Tangible outcome of cooperation between universities/industry partners. Tangible output – the main pillar for both 4) Obstacles in this cooperation
2	Description of Collaboration Variables, University - Industry	Various activities are carried out to explore the options in establishing cooperation that turned out to be still many challenges, such as: 1) Efforts to improve cooperation contracts and other services, 2) Difficulty in finding industry partners, 3) Limited network of academics and business people, 4) Initiative in creating collaboration	Policy consequences in an effort to strengthen collaboration that need to be considered include policies: 1) Curriculum-flexibility (on-campus, e-learning and off-campus) 2) Curriculum-flexibility administration (inter- and cross-study programs, faculty, domestic and foreign university) 3) Budgeting-cooperation and follow-up cooperation 4) Inter-and cross-study cooperation, faculty, college 5) Cooperation across the business world, the industrial world and the world of work 6) Inter-border and cross-border cooperation 7) University-business cooperation, r&d cooperation 8) Academic mobility, students 9) Commercialization of R&D results
3	Description of the success factor	1) From the university's point of view	1) Universities tend to choose companies that have high investments in R&D 2) The university is not very familiar with the market and culture of the industry.

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No	Information	Aspects	Note
			3) The university does not yet understand the dynamics of the market 4) Not yet aware of the mechanisms of dissemination of findings and technology 5) Limitations in actualizing what the university has done
		2) From a business or industry point of view	Can be identified several characteristics: 1) Limitations position technology competitive advantage factors to adopt strategies based on intangible factors or technology 2) Investment in intangible factors (product quality, delivery time, marketing access and direct access to consumers) is still very limited. 3) Misperceptions about academic reality 4) Companies tend to assume the output of academics has not been grounded (can solve practical problems) 5) Academics are less reliable and limited to providing effective solutions. Required transfer of knowledge from university to industrial world – collaboration 6) The first step starts from the form of collegial interchange, seminars, and publications. 7) Consulting and technical services that emphasize the university's responsibility in providing advice, information and technical services to the industrial sector
4	Description of Obstacles	The university's main challenge: in transferring the right knowledge and expertise to graduates who will be absorbed in the industrial world	1) It is necessary to resolve the gap between universities and industries in the process of knowledge transfer through collaboration where both parties can find the best solution. 2) Mutually beneficial cooperation that impacts society through small and medium-scale industries

University and industry collaboration benefits both parties involved. In this case there are at least two aspects contained in the collaboration of universities - industries, namely [12]:

1) The university as a source of knowledge and education providers has a role in creating and disseminating knowledge through research and teaching activities, as well as providing systematic knowledge for the industry. The university not only develops students as having professional talent for a workforce that has potential for companies, but also provides the scientific and technological knowledge on which the theoretical basis for corporate R&D, and is also involved in practical innovation and is responsible for research projects conducted by the company.

2) The university is the most important public resource to support innovation for the industry, because the university has a knowledge advantage and wants to establish partnerships with companies. If there are appropriate opportunities for collaboration between universities and industrial companies, there is great potential to create technological knowledge and gain more innovation space to increase production. Further over, it also has a contribution to small and medium-sized businesses that are weak in doing R&D and do not have independent innovation capabilities, so universities can mobilize the results of technological innovation and turn them into new products or improve existing technology.

Through industry-university collaboration, the university's knowledge supply is on industrial demand on the basis of the disclosure of knowledge resources, and the realization of effective flow and optimal allocation of innovative resources between the university and industry. Both parties are looking for the best solution to the problems faced through research collaboration.

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The thing to think about is how to build a knowledge-based industry so that innovation can be achieved through cooperation between industry and universities. The university as a higher education can provide knowledge-based economic improvement through mutually beneficial cooperation with industry, and the impact is also expected to be felt by the community through small and medium-scale industries [12]

The hope for the college through this collaboration approach is to be able to bring graduates to have a broad knowledge, build an innovative mindset and be able to respond to the challenges of future lives. Therefore, various management efforts in learning in Higher Education Institutions should lead to preparing graduates who can meet the demands of globalization and industrialization.

Management of learning in college should lead to the process of student interaction with teachers and learning resources in the learning environment in building effective, innovative and constructive management of learning. The results of the study [21] concluded that the problem of the learning process carried out by each college is the quality gap of graduates who have not been in accordance with the needs of the world of work. Facing this problem requires a communicative learning model with the source of the job market in the form of the business world and the industrial world, external institutions and organizations.

Communicative learning is defined as learning that brings together and synergizes learning goals with graduate users. Sugiyanti et al., (2013) mentioned that one of the effective collaborative learning models carried out between educational institutions and industry is the Mixing Model (Cooperative-Dual). As for the indicators in the implementation of this learning model, namely: (1) a detailed and clear alloy / manual, (2) equitable division of duties and authorities, (3) accurate data about the business / industry world, (4) existing institutional empowerment, (5) commitment of lecturers / teachers, students, and parents, (6) good communication on all parties, (7) appropriate and operational learning packages, and (8) the format of training plans, training agreements, and monitoring and evaluation.

Learning collaboration that has been built by universities with the industrial world (Cooperative-Dual), there are still many shortcomings to achieve common goals, among others: a) communication that is still less intensive, b) curriculum structure that contains two interests, c) Infrastructure facilities that support the achievement of learning collaboration are still lacking., d) the commitment of information transformation is still weak [23].

Building a collaboration strategy based on the model of collaboration of universities with the business world and industry, as a model of implementation of Independent Learning and Independent Campus (MBKM program) that has been proclaimed by the Ministry of Education and Culture, among others, can be done through: 1). Information transfer, interpreted as a form of communication between study programs and partners, which is usually done incidentally, 2). partner involvement in the dissemination of research results, 3). Scientific publication through journals reduces less effective communication. Exchange of experts and information either from the industry to the study program or vice versa from the study program to the industry through classroom learning activities on lectures in the study program, while the study program experts conduct management development, human resources, production, marketing, performance at the requesting Institution.

Universities are also required to formulate learning planning from a collaborative learning institutional approach consisting of 2 (two) subsystems, namely subsystems of learning in industry and sub-systems of learning on campus, meaning that learning must be done in two institutions, namely, in internal study programs and learning in the industry. Institutional models of learning like this as offered in the MBKM program with a minimum of 84 credits must be taken in the study program and maximum 20 credit courses taken outside the study program and maximum 40 credits of experience in other universities and non-universities.

Furthermore, the curriculum structure in the study program is comprehensively structured consisting of all learning activities, while the curriculum for the industry is in the form of practice guidelines (training guidelines), which are simpler, more practical than the curriculum of educational institutions. The design of the study program collaboration curriculum with industry begins with the formulation of graduate profiles formulated with the study programs association, graduate users, to obtain agreement on competencies that must be generated based on the Higher Education Standards (SN-DIKTI) and oriented to the Indonesian National Qualification Framework (KKNI), which is a framework for the extension of competency qualifications that can juxtapose, equalize, and integrate between the field of education and the field of job training, as well as work experience in the framework of providing recognition of work competence.

College learning materials are more emphasized on learning higher theories, while learning materials in the industry emphasize more on working practices that are inseparable from the theories studied in the study program. Thus, the study program must be able to use industry (the world of work) as a foothold in curriculum planning, so that learning in study programs is integrated with practical learning carried out in the industry. Learning activities carried out in the study program are more systematic because the teaching material has been systematically arranged based on the rules of learning theory. While learning in the industry is more applying to the learning process of certain job skills. The teacher is responsible for the implementation of learning in the study program. While in the practice learning industry is entirely the responsibility of the instructor. The determination of practice teaching staff / instructors is done with intensive communication, and should understand and be able to practice learning methods in practical learning activities in the industry. Thus, learning work practices in the industry can really improve the quality of the competence of students / interns.

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College collaboration is not only on learning activities but includes other three dharma activities of universities, namely research and devotion activities that are also the subject of high school and industry collaboration. Research development is directed at development research, namely: institutional development, product development, human resource development, marketing development, and external benefits for the community, product safety in the community and others. Development research cooperation requires a large enough budget so that it cannot be done by universities or industry independently, this collaborative framework requires synergy from the government, both central and local governments, the research community (college academics), and the business and financial community.

In general, industry and colleges have various models of collaboration to build symbiotic relationships to achieve synergistic innovation of industry-university. The model of industry-university collaboration can be divided into different types of different views. From a knowledge perspective, such as: knowledge transfer, knowledge sharing and knowledge creation. From the point of view of contract relations, such as: technology transfer, assigned R&D, joint development, and R&D alliance entities. As for the direct impact on the success of cooperation activities with universities for industry, among others: government policy, environmental support, knowledge absorption capacity (technical), level of industry-university synergy [12].

From an industry perspective the focus point is on technological drive, market concentration, and innovative environmental influences. All of these impacts encourage companies to gain the power to combine creativity and entrepreneur initiative as well as engage in technological innovation. Under market economic conditions, companies naturally have innovation attributes, so as to be able to find opportunities and identify technological innovation prospects. Meanwhile, technical knowledge resources are essential as a basis for increasing innovation. This can happen if the industry acquires new technology or products and has sustainable innovation capabilities. Therefore, industry takes a leading role in technological innovation and utilizes knowledge in production practices and economic activities [24]. Thus industry-university collaboration promotes knowledge synergy and technology development between universities and industries. Industry and universities use complementary knowledge resources and win-win benefits as opportunities to collaborate, build close cooperative relationships, engage in knowledge transfer and industrialization, and ultimately promote enterprise technological innovation and the sustainable development of the industry.

V. CONCLUSIONS

University and industrial cooperation require intensive communication, information transfer, institutional planning, curriculum adaptation, learning material planning based on the world of work, professional and proportional distribution of teaching materials with industry / world of work, provision of facilities and infrastructure of collaborative research development. Growing up the industry is very necessary because the industry plays an important and dominant role in sustaining the strength of the national economy. The development of educational institutions is also important because educational institutions prepare competent next generation in their time to find and synergize each interest, so that an ideal collaboration model will be built that will provide benefits to both parties. The university as an institution that conducts the process of human formation has competitiveness and responsiveness to the demands and needs of the times through the learning process, of course, requires a flexible management model into and out responsively.

Follow-up so that this collaboration can be effective in integrating knowledge resources owned by companies and universities, the main role of industry-university synergy is the output of quality talent by universities and R&D collaboration between universities and industry. However, universities and industries are very different and independent organizations with very different value and demand benefit orientations. To achieve mutually beneficial results in the industry-university synergy process, both parties must increase cooperative encouragement and awareness of responsibility with confidence in placing human resource chains and innovation chains in universities. College education increases cooperative willingness and knowledge service capabilities. The two sides are making joint efforts to encourage the development of universities and industries.

In short, the industry can fully rely on knowledge resources and universities supply skilled labor and R&D cooperation to achieve synergistic effects. Thus, the industry can solve weak technology problems, improve business units, make technological innovations and management, and further make great progress and gain a leading position in a highly competitive market.

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