

THE UNIVERSITY FOR THE INDUSTRY OF THE FUTURE

Mauricio de Campos Porath

Universidade Federal de Santa Catarina
mauricio.porath@ufsc.br

Xisto Lucas Travassos Júnior

Universidade Federal de Santa Catarina
lucas.travassos@ufsc.br

Jonas Tilp

TreeCom Coworking
jonas.tilp@treecom.club

Abstract

In the last decade, global industry has undergone rapid and profound changes induced by the introduction of new digital technologies. This paradigm shift is called fourth industrial revolution or "Industry 4.0". The impacts of these changes on labor relations and the education systems are inevitable. The 1st International Workshop: The University for the Industry of the Future - U4i 2018 aimed to promote the debate about university-industry relations within the context of the fourth industrial revolution. U4i 2018 was attended by both university and business participants. The event included an activity called World Café, in which participants sought answers to six questions pertinent to the theme of the event. This paper presents the results of the discussions carried out under this activity. Participants emphasized the need to improve communication and integration and to increase agility in university-industry relations. It was also emphasized that entrepreneurs need to be aware that they must take a more proactive and bold approach to the new reality. In relation to the governmental action in the context of industry-university cooperation, the lack of continuity of development programs was criticized.

Keywords: Fourth Industrial Revolution. Industry 4.0. University-industry Cooperation. World Café.

A UNIVERSIDADE PARA A INDÚSTRIA DO FUTURO

Resumo

Na última década, a indústria mundial tem passado por rápidas e profundas mudanças induzidas pela introdução de novas tecnologias digitais. Essa mudança de paradigma é denominada quarta revolução industrial ou "Indústria 4.0". Os impactos dessas mudanças nas relações de trabalho e no sistema de educação são inevitáveis. O 1^o Workshop Internacional: A Universidade para a Indústria do Futuro – U4i 2018 objetivou promover o debate acerca da relação universidade-indústria frente à quarta revolução industrial. O U4i 2018 contou com participantes da universidade e de empresas. O evento incluiu uma atividade denominada World Café, na qual os participantes buscaram respostas a seis questões pertinentes ao tema do evento. Este artigo objetiva apresentar os resultados das discussões realizadas no âmbito dessa atividade. Os participantes destacaram a necessidade de se melhorar a comunicação e a integração e de se aumentar a agilidade nas relações universidade-indústria. Também ressaltou-se que os empresários precisam conscientizar-se de que devem assumir uma postura mais proativa e arrojada frente à nova realidade. Em relação à atuação governamental no contexto da cooperação universidade-indústria, criticou-se a falta de continuidade de programas de fomento.

Palavras-chave: Quarta Revolução Industrial. Indústria 4.0. Cooperação Universidade-indústria. World Café.

LA UNIVERSIDAD PARA LA INDUSTRIA DEL FUTURO

Resumen

La industria mundial pasa por rápidos y profundos cambios inducidos por la introducción de nuevas tecnologías digitales. Este cambio de paradigma se denomina cuarta revolución industrial o "Industria 4.0". Los impactos de estos cambios en las relaciones de trabajo y en el sistema educativo son inevitables. El 1^{er} Workshop Internacional: La Universidad para la Industria del Futuro - U4i 2018 objetivó promover el debate acerca de la relación universidad-industria frente a la cuarta revolución industrial. El U4i 2018 contó con participantes de la universidad y de empresas. El evento incluyó una actividad denominada World Café, en la cual los participantes buscaron respuestas a seis cuestiones pertinentes al tema del evento. Este artículo tiene como objetivo presentar los resultados de las discusiones mantenidas dentro de esta actividad. Los participantes destacaron la necesidad de mejorar la comunicación y la integración y de aumentar la agilidad en las relaciones universidad-industria. También se resalta que los empresarios necesitan concientizarse que deben asumir una postura más proactiva y arrojada frente a la nueva realidad. En relación a la actuación gubernamental en el contexto de la cooperación universidade-industria, se criticó la falta de continuidad de programas de fomento.

Palabras clave: Cuarta Revolución Industrial. Industria 4.0. Cooperación Universidad-industria. World Café.



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INTRODUCTION

Global industry is undergoing rapid and profound changes. These changes are primarily related to intense industrial automation and to the use of information technology throughout the product lifecycle. The introduction of new digital technologies in the industrial environment, such as Internet of Things, artificial intelligence, big data analysis and cloud computing, has the potential to set new paradigms in both the business environment and the job market. This paradigm shift has been called the “fourth industrial revolution” or “Industry 4.0”.

This new reality represents an opportunity for economic prosperity and social development. However, this opportunity will only be appropriately seized if all stakeholders are willing to change, especially regarding education systems and working relationships, as pointed out by Klaus Schwab, founder and executive chairman of the World Economic Forum, in the preface to the “Future of Jobs 2018” study (WORLD ECONOMIC FORUM, 2018).

Aware of this development, the Universidade Federal de Santa Catarina (UFSC) promoted on October 31 and November 1, 2018 the “1st International Workshop: The University for the Industry of the Future - U4i 2018”. The event was held in the Joinville School of Technology at UFSC and was partnered by the German university TH Ingolstadt and by Perini Business Park. U4I 2018 brought together university professors, students and researchers with business people, executives, civil society organizations and industry professionals. Thus, the much needed debate about the university-industry interaction in the face of the mentioned transformations was promoted.

The U4I 2018 was attended by 70 professionals from companies of various segments and of all sizes, 30 professors / researchers and 60 undergraduate and graduate students. The event program included keynote talks, round tables and laboratory visits, as well as an integration and brainstorming activity called U4I World Café. This latter activity resulted in a very interesting discussion, in which answers to six questions related to the topic of the event were sought. This article presents the results of this discussion.

METHODOLOGY

World Café is a methodology to encourage participation by stimulating dialogue and establishing relationships between participants. Within the scope of U4I, the objective of this activity was to improve the relationship between university and industry. The method was thus modified to meet this specificity.

Modifications to the method considered: the context, number of participants and objectives of the event. The U4I World Café had the following characteristics:

- 1) Comfortable environment: tables prepared to accommodate five participants with assistance for quick and accessible note-taking;
- 2) Introduction and welcome: Jonas Tilp, entrepreneur and founder of Treecom Coworking (operating at Perini Business Park), acted as facilitator of the event, welcoming guests to the World Café presenting the context, and objectives of the event, and orienting participants towards the expected results;
- 3) Rounds: The process of interaction between participants was divided into five rounds of up to ten minutes of conversation between participants at each table. Each table had a UFSC faculty member as host. After ten minutes, all participants except the host changed tables. Participants arriving at a new table were informed by the host about what was discussed in the previous rounds;
- 4) Questions: At each table, a question directly linked to the objective of the event was proposed to the participants, thus focusing the debate;
- 5) Conclusion: At the end of the five rounds, the event facilitator gave a plenary talk on the points discussed and possible future actions;
- 6) The participants of each table freely took notes of the points discussed. These notes were organized and made available to the community.

Eight representatives of universities and 17 representatives of companies of various sizes and segments attended U4I World Café.

RESULTS AND ANALYSIS

The questions asked to the U4I World Café participants were:

- What will the industry of the future look like?
- What is missing for the Brazilian industry to be the “industry of the future”?
- How can the university support industry?
- How to bring university and industry closer?
- How to educate the professional of the future?
- How should government participate in the university-industry relationship?

The result of this debate, reinforced by recent publications, will be presented in the remainder of this section.

What will the industry of the future look like?

According to participants at U4I World Café, the industry will be increasingly open, connected and involved with society. The use of the aforementioned information technologies will facilitate new forms of relationship between companies and customers and also between companies from different segments. In turn, these new connections can generate new business opportunities.

The way we produce will change. The low cost of additive manufacturing equipment will allow, for instance, that customers themselves produce the product, or part of it, in their homes. In addition, product lifecycles will continue to shorten, requiring agility and reduction of non-value-added activities across all sectors of the organization. At the same time, society will increasingly value companies that conduct their business in a sustainable manner, with particular attention to minimizing environmental impacts and practicing social responsibility.

This profile, drawn by U4I World Café participants, coincides with the expert view. The results of the Industry 2027 study commissioned by the Brazilian National Confederation of Industry - CNI (2018) indicate that by 2027 all productive systems will include advanced digital technologies, generating integrated, connected and smart business models. This approach will allow the optimization of the entire production chain by combining scale with customization.

What is missing for the Brazilian industry to be the “industry of the future”?

The low productivity of the Brazilian industry was mentioned as one of the main barriers to its development. This low productivity would be caused by a set of factors. Lack of skilled labor and low staff efficiency would be some of them. The isolation of Brazilian industry was also mentioned as a reason for low productivity and competitiveness. Being very focused on the domestic market, it is not under pressure to launch innovative products, with quality and price as available abroad.

According to one of the participants, there is no innovation and entrepreneurship culture in Brazil. Brazilians do not allow themselves to make mistakes and are therefore risk averse. The development of an innovation culture would need to be encouraged through government-funded

programs and promoted at universities. Entrepreneurs, in turn, need to realize that they must take a more proactive and bold stance, increasingly devoting themselves to the long-term strategic management of their business.

A broad overview of the current state of development of the Brazilian industry is presented in the “Industry 2027” study (CONFEDERAÇÃO NACIONAL DA INDÚSTRIA, 2018). It is alarming, for example, that in 2017 only 2% of the companies surveyed in the study were in the most advanced stage of digitization, namely, companies that are integrated, connected and intelligent. Approximately 37% of companies were still in the early stages of digitization, corresponding to the application of non-integrated digital technologies.

How can university support the industry?

According to the participants, firstly, it is necessary to improve communication between university and industry. Channels are needed for the companies to forward their demands to the university. In addition, the university should expand the dissemination of its faculty competencies.

Companies would be open to various forms of cooperation, which should not be limited to research, development and innovation projects. Consulting and training activities should be expanded. The vision of a professional outside the company was mentioned to be of great value to support the solution of daily technical problems.

The profile of Brazilian engineering degree programs was also cited as an obstacle to industrial development. The courses would be excessively theoretical and moreover based on outdated knowledge. Many newly graduated professionals would need a long time to be able to apply the theoretical knowledge acquired at university in practice. Further integration between business and universities was mentioned as a possible solution to this problem. This integration would allow students to have greater contact with the professional environment during the course and allow professors to keep up to date.

In fact, the interaction between university and industry is still quite restricted in Brazil. According to a survey conducted by Lemos and Cario (2017), only 12.74% of Brazilian research groups registered with the National Council for Scientific and Technological Development - CNPq declare to cooperate with industry. In the UFSC's home state, Santa Catarina, this rate is only slightly higher: 18.92%. As benefits for professors and students who engage in university-industry cooperation projects, Lemos and Cario (2017) mentioned the gain of knowledge and

skills that are closer to the reality of the job market, thus reinforcing one of the observations of U4I World Café participants.

How to bring the university closer to industry?

It was noted that there is little information on ways to start cooperation with universities. To overcome this problem, the participants suggested the production of booklets with procedures for the various forms of interaction, such as intern recruitment, signing of cooperation agreements and hiring of technical consultants and short courses.

Some possible strategies to bring the university closer to industry would be the development of graduate research directly in companies, the offer of elective courses by industry professionals and project-based courses proposed by companies. The promotion of university-company events to present demands and competencies was also suggested.

The suggestions made by the participants are supported by the work published by Bruneel, D'Este and Salter (2010). This research evaluated the main barriers to university-industry cooperation for the development of applied research and innovation projects. Solving conflicts related to the generation and dissemination of knowledge was identified as the main challenge. While academics are measured by the quantity and quality of published research results, companies need to protect the generated knowledge to develop competitive advantage. Overcoming this barrier, complex intellectual property negotiations often remain.

The same study highlights the development of a sense of inter-institutional trust as the main way to overcome these obstacles. Building this trust requires long-term investment in interactions between academia and industry, aiming at understanding the differences in objectives and ways of operating (BRUNEEL; D'ESTE; SALTER, 2010).

Moreover, in Brazil, it is often still necessary to overcome barriers that are internal to universities. In general, there is still no broader understanding of the nature and benefits of university-industry cooperation, generating internal resistance and leading to ideological discussions (LEMOS; CARIO, 2017).

How to educate the professional of the future?

According to the participants, there is a need to train professionals with an interdisciplinary profile who are able to quickly apply theoretical knowledge in solving practical problems. Computer programming was mentioned to be a basic technical skill for professionals

in the industry of the future, especially in the context of reading and interpreting sensor signals of various types.

The importance of training people prepared for the new industrial paradigm was confirmed in the World Economic Forum's "Future of Jobs 2018" study. According to this study, most of the companies surveyed pointed to the availability of qualified personnel as the most important factor in defining the geographical location of their operations (WORLD ECONOMIC FORUM, 2018).

The WEF study infers that, as early as 2022, the introduction of new digital technologies will require professionals to focus on developing skills that cannot be replaced by machines, such as programming, analytical and critical thinking and creativity (WORLD ECONOMIC FORUM, 2018).

How should the government participate in the university-industry relationship?

The promotion of research, development and innovation projects and the establishment of long-term goals and policies were mentioned as the main responsibilities of the government in the context of university-industry cooperation. As specific forms of promotion, the participants suggested: scholarships for students to develop projects in companies, funding of cooperation projects that promote the development of backward regions of the state and country, and promotion of internships. The current lack of continuity of funding programs was criticized. This lack of continuity would make it difficult to carry out complex projects that require long-term dedication.

The current form of action of public universities was also criticized. These would be too bureaucratic and therefore too slow to respond to industry demands. In addition, it was pointed out that graduate programs should act as vectors of university-industry interaction. This would require some policies and legislation to be reviewed. It was mentioned that the metrics used in the evaluation of professional master's programs are practically the same as those used for academic master's programs, that is, they are based on the quantity and quality of publications. In addition, scholarships from public funding agencies with company-paid grants would not be allowed at present. This situation would make it difficult to capture talent for the development of applied research and innovation projects.

CLOSING REMARKS

Industrial production is facing a paradigm shift driven by the integration of advanced information technology into machines and equipment and the rapid expansion of industrial automation. In this context, it is expected for technology schools at universities to assume a leading role, both in the development and introduction of new technologies and in the education of professionals aligned with this new reality. For universities to meet this expectation, they need to be more agile and more integrated with the industrial environment. This was one of the messages left by the participants of U4I World Café.

The results of U4I World Café will be one of the elements used to guide the strategic planning of the Joinville School of Technology (CTJ) at UFSC. CTJ aims to be a successful example of university-industry integration. The U4i event is one of the actions in this regard. The most important initiative, however, was the transfer of the headquarters of UFSC Joinville Campus to the “Perini Business Park” industrial condominium in early 2018. The operation model resulting from this transfer is unprecedented in Brazil.

The physical proximity between UFSC and the companies that operate in the park has already resulted in several project and internship opportunities for students. These students can literally walk from university to the company and thus combine periods of study with periods of work. Technical visits within undergraduate and graduate courses have also become frequent.

The transfer also motivated the creation of the “UFSC-Perini Hub”. The Hub, created and operated by a group of UFSC professors and professionals of companies in the park, has the mission of facilitating the connection of businesses with the university by organizing meetings and guided tours.

UFSC also actively participated in the conception of the Ágora Tech Park. Ágora is a 70,000 m² technology park, also located in Perini Business Park, which started operations in March 2019. Several technology and innovation-related ventures and initiatives, such as incubators, accelerators, research centers and startups are being installed in Ágora.

In the teaching area, UFSC currently offers eight undergraduate and two graduate degree programs in Joinville. Among the undergraduate programs is the Interdisciplinary Degree in Science and Technology, which is especially aligned with the trends pointed out during the event. It is a three-year program with a flexible curriculum that aims to enable the student to build a solid knowledge base in exact sciences and technology according to their interests and vocation.

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CREDITS

U4i 2018 Organizing Committee: Anne-Sophie Lohmeier (TH Ingolstadt), Leonardo Vinícius de Souza Silva (UFSC), Marcos Alves Rabelo (UFSC), Maurício de Campos Porath (UFSC), Modesto Hurtado Ferrer (UFSC), Xisto Lucas Travassos Júnior (UFSC).

U4i World Café planning and facilitation: Jonas Tilp (Treecom Coworking), Vanessa Aparecida Alves de Lima (UFSC), Xisto Lucas Travassos Júnior (UFSC).

U4i World Café participants: Ademir Camillo Junior (SENAI), Alessandro Zimmer (TH Ingolstadt), Carlos Mauricio Sacchelli (UFSC), Carlos Henrique Barbado (BMW), Cristiano Vasconcellos Ferreira (UFSC), Dalton Hardt (4Factory), Edson Jeske (Gridya), Emerson Edel (Perini Business Park), Fábio Reway (TH Ingolstadt), Francielly Hedler Staudt (UFSC), Gabriel Bottós (Welle Laser), Gustavo Bay Gonçalves (Sensorville), Igor Luduwichack da Silva (Agrize), João Carlos Germani (Alutec), Jose Luiz Baccan (Siemens-Healthineers), Kleber Vieira de Paiva (UFSC), Leonardo Artur Biazzi (SMETRO), Luís Fernando Peres Calil (UFSC), Maria Fernanda Monteiro (Pixida), Natanael Kaminski (Pollux), Ricardo Santin (BMW), Roberto Marques (Zeiss), Rodolfo Cereghino Lagreze (Embraco), Rodrigo Mendes (Rhode-Schwarz), Roger Cardoso dos Santos (Docol), Sueli Fischer Beckert (UFSC), Thiago Chiarotti de Oliveira (Schulz).

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