

Original Paper

Building Bridges between Science, Technology, Innovation and Global Affairs: A New Graduate Program

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Abstract

The international system has changed rapidly in the last few decades, and Science, Technology, and Innovation (STI) has become a new key factor in the world order of the 21st Century. The interaction between STI and global affairs has increased because of the relevance and impact of scientific and technological development over the main parameters of the international system. Nevertheless, there is still a lack of new approaches that examine this global rising phenomenon from the Global and International Studies perspective. This article raises the academic and pedagogical needs to build bridges between STI and Global and International Studies (GIS) and, especially, the lack of academic programs that focus on this intersection. Therefore, the main objectives of this research are to examine the pedagogical need in the intersection between STI and international relations and introduce a new and original pedagogical proposal. The result is a literature review that confirms the need for educational programs in STI and GIS, and the introduction of a new graduate program as an innovative educational contribution.

Keywords

Global and International Studies, International Scientific Relation, Science, Technology, and Innovation, Innovation in Higher Education, Pedagogical Innovation, Emergence and Development of Higher Education Areas, International Challenges to Higher Education

1. Introduction

Since the end of the 20th century, the international system has entered in a process of structural transformations that are strongly modifying the world order of the 21st century. In this context of systemic changes, the acceleration and intensification of the scientific-technological revolution in the last decades have made Science, Technology, and Innovation (STI) a critical factor in international relations. The scientific-technological revolution has impacted the international global agenda creating

a new variety of issues with a high impact on the entire world system. For instance, commercial competitiveness, nuclear proliferation, terrorism, Internet governance, renewable energy, cybersecurity, space development, genetically modified crops, human cloning, synthetic biology, pandemic diseases, climate change, among many others.

From the Global and International Studies (GIS) the focus on issues in STI is still insufficient. Traditionally, little attention has been paid to the role of scientific-technological advances within the international system. However, the new relevance of scientific knowledge and its revaluation in the international order as a strategic element is awakening a renewed academic interest. In any case, despite the increase in the number of researchers and research that address the phenomenon, even the offer of educational programs is very limited.

The research problem that is introduced in this article is the academic and pedagogical need to build bridges between STI and the discipline of GIS and, especially, this research focus on the lack of educational programs in higher education that approach the strategic interaction between STI and international relations. In this context, the main objectives of this research are to describe and explain the academic and pedagogical needs to address the issues that link science, technology, and international affairs and, at the same time, make a pedagogical contribution by introducing a new graduate program. The result is an explanation about the main academic and pedagogical needs in the intersection between Science and Technology and Global and International Studies, an extensive literature review that proof the lack of educational programs in STI and GIS, and, finally, a pedagogical contribution introducing a new experience of a graduate program at the University of Salamanca.

The essay proceeds in five stages. After the introduction, section 2 describes the main empirical and academic changes in the intersection between STI and GIS. Section 3 identifies the pedagogical need for educational programs that link STI and international relations. Section 4 introduces a new pedagogical experience of an innovative Graduate Program at the University of Salamanca. Finally, in the final section, a summary of the main findings is made, and ideas about potential applications are included.

2. Empirical and Academic Changes

2.1 Empirical Transformations

The profound changes that have taken place within the international system in recent decades have led to a new and complex global configuration. The main characteristics of this new international are a process of repolarization of the main global actors since the end of the Cold War and the dissolution of the Soviet Union (Note 1); the intensification of the processes of globalization, regionalization, and nationalism (Note 2); the erosion of the role of the Nation-State (Note 3); the evolution towards a new phase of the capitalist economic system characterized by the internationalization of its production and global finance (Note 4); the coexistence of a large number and variety of state and non-state actors that coexist disorderly and interdependently (Note 5); and the emergence of a new and complex agenda of

global issues that include environmental problems, migration, terrorism, poverty (Note 6), among others.

We are living in an era of high complexity, an era of interconnectivity, ambiguity, uncertainty, and various kinds of revolutions: military, technological, social, political, economic, and even philosophical (Note 7) that require new and more complex scientific approaches. Essentially, the world order is in the middle of a systemic transition (Note 8) from the old and simplified bipolar order of the Cold War period towards a new, more complex, turbulent, and multipolar global order (Note 9).

Within this convulsive new international reality of the 21st century, STI (Note 10) has become one of the central issues of the new world agenda because of its impact on the main systemic parameters of the international order (Note 11). In recent years, the acceleration and expansion of the scientific-technological revolution has profoundly changed the landscape of international relations. New discoveries and inventions, new scientific areas, the emergence of new technologies, and an impressive number of innovations have increased the speed, magnitude, and complexity of the change in what can be considered a “*turbo change*” context (Note 12). The so-called Fourth Industrial Revolution is understood as a new scientific-technological revolution that is radically changing the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before (Note 13).

Because of this extraordinary scientific-technological revolution, STI has acquired a special and strategic relevance as a critical factor in the global agenda. Although scientific-technological advances have been an important factor in many advanced societies, the novelty now is that it has become a strategic element for this new stage of international relations by becoming the main source of the generation of economic benefits, political power, military development, and social innovation.

The analysis of this new international system helps to recognize the need to fully understand the mutual and profound interaction between STI and international relations and their importance for the international agenda and global governance. This overlap allows us to explore a new and wide range of topics on a global scale with a high impact on the entire international system:

- The role of science and technology in economic growth and development
- The impact of science and technology on security and defense policy
- The rise of science & technology diplomacy in foreign policy strategies
- New technologies applied to transport systems and mass media
- New challenges in the global governance of health problems
- The threat of climate change and the deterioration of the environment
- The multilevel governance of STI
- The geographical, political, economic, and social distribution of the benefits generated by the new scientific and technological advances
- The ethical and moral dilemmas that emerge from the new applications of STI

These are just some of the new issues on the global agenda linked to STI that are affecting the current international dynamics. The interaction between STI with other political, economic, and social factors will be essential variables to determine the winning and losing nations of the future international system (Note 14). In this sense, the relevance of STI in GIS has increased considerably in recent years and has become a necessary point of view to understand in-depth the global challenges that the international system is facing in the 21st century.

2.2 Academic Challenges

All these scientific and technological changes within the international system have promoted an intense and profuse theoretical and methodological debate in Social Sciences, and, particularly, in the discipline of Global and International Studies, on how these new empirical phenomena can and should be approached and studied in their real dimension from the academy. It is evident that the development of new processes of production on STI is not confined only within the national borders and, at the same time, it is recognized that the main problems of international relations cannot be understood without an appreciation of the scientific and technological development. Therefore, in this new stage of international history, the intersection and overlap of STI and international affairs become a new and necessary topic of study.

These changes in the international system in recent decades were not anticipated by any theoretical framework and, especially, in GIS, the lack of predictability of the dominant paradigms has put the discipline itself in crisis (Note 15). The academic failure to analyze the new global empirical phenomena is a deficit well understood by the entire scientific community. In this sense, there is an explicit recognition of the need to face the new academic challenges in their total complexity and avoiding falling into reductionism. Wallerstein (1996) has led this new perspective through the famous “*Opening the Social Sciences*” report, where he explicitly pointed out that most of the new global agenda issues require an approach that studies the new factors in all their complexity, recognizing the multiple causal relations and their numerous interrelations (Note 16).

Historically, International Studies has focused on issues related to security, defense, foreign policy, diplomacy, and even economics, but it has paid less attention to topics such as STI. For some experts, the lack of attention in issues related to scientific-technological developments is evident and it is considered one of the major *anomalies* of the discipline (Note 17). On the other hand, other experts are less pessimistic and, they point out that GIS has always had some sense of the importance of scientific-technological developments within international relations (Note 18).

A brief literature review within the discipline of International Studies allows us to understand that several renowned internationalists (Waltz, Rosenau, Nye, Strange, Keohane, etc.), from multiple perspectives, have addressed the phenomenon of STI in international affairs. However, this analysis has been very tangential and atomized. In recent years, there has been an increase in the interest of researchers to understand the impact that the scientific-technological revolution is having on the international system approaching the phenomenon holistically (Skolnikoff, 1993, 2002; Weiss, 2005,

2015; Deudney, 2000, 2018; Mayer, 2014, 2015; etc.). For their part, Global Studies experts have made a greater analytical effort addressing the role and impact of science and technology in the global system, analyzing how this affects the balance of global power (Note 19), the effect on climate change or the production of natural resources (Note 20) or its consequences in the process of economic globalization (Note 21). In any case, even now GIS is poorly equipped to theorize about the impact and consequences of scientific-technological changes in the international system (Note 22).

The intersection between STI and GIS has opened a new and growing research agenda that includes topics such as scientific diplomacy, global governance of STI, cybersecurity, new emerging techs, and the knowledge gap. This emergent area of study in higher education should be understood as a new subdiscipline within GIS that has become a subject of study of great interest to understand the changes in the world order of the 21st century (Note 23).

3. Pedagogical Problem

The profound changes in the international system and the slow evolution of the scientific paradigms that address the new phenomena of the global agenda open a mystery regarding educational programs in higher education that focus on these empirical transformations. For this reason, it is very important to review in-depth the university programs that link issues in STI with GIS to examine and evaluate the existing offer worldwide.

In recent decades, the rise of academic programs in *Science, Technology, & Society* and *Science, Technology, & Public Policies* have covered part of the academic demand for those issues, although it has failed to meet the need to address the scientific-technological problem from a perspective of GIS. In light of this reality, schools and departments in GIS have opted for two strategies: on the one hand, very few universities have begun to design new pedagogical undergraduate or graduate programs that specifically focus on the interaction between science, technology, and international affairs, and, on the other hand, a large majority have decided to move more slowly through incorporating only some content through courses, seminars, and workshops in STI to their traditional programs.

Higher education institutions in the United States have been the pioneers and main promoters in addressing the critical conjunction between STI and GIS. However, just a few American universities have designed new specific programs that link STI and international affairs. The first-degree program of this type was established by *Georgetown University* over a decade ago in the context of the *School of Foreign Service*, with the name of “*Major in Science, Technology and International Affairs*” (Note 24). Currently, this undergraduate program is the only one that fully addresses the problem raised here, and, it is the most specialized and complete in terms of knowledge that teaches, linking the new scientific-technological development with the impact in the international system. Another pioneer institution in the United States has been the *Georgia Institute of Technology* which, through the *Sam Nunn School of International Affairs*, provides a program in “*International Affairs, Science, and Technology (Ph.D.)*”. This Ph.D. program is the only one to offer a direct link between science,

technology, and international relations at the graduate level, with three main concentrations: i) International Affairs and Security, ii) Globalization and Development and, iii) Studies Comparative and Regional. Parallel to this pedagogical proposal, *The Sam Nunn School of International Affairs* has created the *Center for International Strategy, Technology, and Policy (CISTP)* as a specific field of interdisciplinary research to explore innovative approaches on issues located at the intersection between science, technology, and international affairs, with lines of research related to public policies, defense, and technological development. Meanwhile, *The Elliot School of International Affairs at George Washington University* has created a new “*Master’s in International Science and Technology Policy*” program that focuses on the study of policies in science and technology with concentrations in energy, environment, nuclear safety, space policy, and technological innovation. Although it still has a very high public policy component, there is a clear intention to also address the specific issues that link science and technology to international relations. Finally, the *Woodrow Wilson School of Public and International Affairs at Princeton University* has recently created a “*Certificate in Science, Technology and Environmental Policy*” as its first pedagogical experience in the interaction between international affairs and the scientific-technological field.

On the other hand, other GIS schools in the United States have begun to restructure their undergraduate and graduate programs to include courses and seminars related to the vast agenda of topics in STI and GIS to address these new issues, as well as the demand of students interested in these topics. Among those institutions, we found *The Paul H. Nitze School of Advanced International Studies* (Johns Hopkins University), *The School of Global Policy and Strategy* (University of California San Diego), *Center for International Studies* (University of Southern California), *the School of International Service* (American University), *the School of International and Public Affairs* (Columbia University), *Josef Korbel School of International Studies* (University of Denver), among others.

At the research level, the *Belfer Center for Science and International Affairs*, within the *John F. Kennedy School of Government at Harvard University*, is one of the most prestigious centers worldwide in GIS, nominated in 2019, for the sixth consecutive year, the best Think Tank in the world (Mc Gann, 2018). At the Belfer Center, world-class researchers are studying and debating the main issues on the international agenda that have emerged precisely because of the intersection between STI, and international relations. Among the most relevant research lines are global governance, international security, and defense, bioterrorism, new energy matrix, international economy and business, science and technology policies, etc.

Additionally, the *International Studies Association (ISA)* (Note 25), the main academic organization that gathering the scientific community in International Studies, had opened a new section in 2014 within its organization chart called “*Science, Technology and Art in International Relations (STAIR)* (Note 26)” for considering science and technology as a central part for the study of international affairs. This new section within ISA has grown both in the number of researchers and professors on it and in the number of presentations and panels at the various ISA conferences worldwide.

In Europe, some GIS schools and departments have also begun to include scientific-technological topics as part of their research and teaching lines, but still without having acquired the status of graduate or postgraduate program itself. A good example is the new “*Master of Science in Environmental Technology and International Affairs*” program promoted by the *Vienna School of International Studies*. Among the European GIS departments and schools that have included science and technology in their programs can be considered the *Center for Global Studies, Universität Bonn* (Germany), *The London School of Economics and Political Science* (United Kingdom), *Paris School of International Affairs Sciences Po* (France) and the *Graduate Institute of International and Development Studies, Geneva* (Switzerland).

In Spain, two institutions, the *Institut Barcelona Estudis Internacionals-IBEI* (Barcelona) and the *IE School of Global and Public Affairs* (Madrid), have begun to promote pedagogical spaces for topics in science, technology, and international relations. IBEI is an interuniversity institute that offers postgraduate programs in international affairs and its main program, the *Master's in International Studies*, has recently included optional courses related to science and technology. At the same time, in 2019, IBEI launched a new Summer Program called “*Barcelona Science and Technology Diplomacy Summer School*”. For its part, the *IE School of Global and Public Affairs* (Madrid) offers undergraduate and postgraduate programs in international relations and it has recently included in its degree program a concentration in *Governance of Emerging Technologies and Innovation*, where technological processes are studied and its impact on society and international politics.

Finally, in the rest of the academic world, no specific academic programs have been developed that link STI and GIS, although the relevance of the scientific-technological theme, many higher education institutions have also begun to be considered through the incorporation of subjects and courses in the plans of study of their undergraduate and graduate programs. Examples of this are the *Faculty of Political and Social Sciences, Autonomous University of Mexico*, the *School of International Relations of the Universidad del Salvador* (Argentina), the *S. Rajaratnam School of International Studies of the Nanyang Technological University* (Singapore), the *Department of International Politics of Aberystwyth University* (Australia), the *Graduate School Of International Studies of Korea University* (Republic of Korea), the *Graduate School of International Relations, Ritsumeikan University* (Japan) and the *School of International Relations and Public Affairs of Fudan University* (China).

To conclude, it could be said that there are many programs in Science, Technology, and Policy or in Global and International Studies that have added courses, workshops or classes related to the conjunction of STI and GIS, but just a very few numbers of academic programs that offer in bachelor or graduate levels the integration between GIS and STI. After an in-depth review, it just was found one undergraduate program (Georgetown University) and a recently created Ph.D. Program (Georgia Tech). This comprehensive review of undergraduate and graduate programs worldwide allows us to understand the state-of-the-art in terms of the academic offer of pedagogical programs that link STI with GIS. After this review, it is possible to conclude that although there are first timid attempts at

programs that try to address the problem, even the academic offer is very limited and the field of GIS is responding very slowly to the critical need of undergraduate and graduate programs to meet the demand for this type of training.

4. A New Graduate Program

The previous analysis has demonstrated the main empirical changes operated in the international system in recent decades and the special incidence of STI in the new international order of the 21st century, the inadequacy of academic approaches within the discipline of Global and International Studies to analyze those changes and, finally, the lack of academic programs in the area of *International Scientific Relations* that study the new agenda of topics between GIS and STI. In this context, a new graduate program in STI and GIS was proposed with the express goal to address the needs that have been observed in the previous analysis. Following a basic and traditional model of project management in higher education (Wijnen & Kor, 2000) a new pedagogical program in the intersection between STI and GIS was created, and it will be described above. The model divides the project into phases that make possible to understand the different stages of development the new graduate program went through.

4.1 Initiation Phase

During the first phase of the creation of the new graduate program in GIS and STI, the *initiation phase*, many ideas about the project were explored and elaborated. The main goal of this phase was to examine the problem, offer potential solutions, and analyze the relevance and feasibility of the project. Examining and analyzing in-depth the finding of the previous research, it was clear that the main problem raised in this investigation was the lack of academic programs in the area of *International Scientific Relations* that address the new agenda of topics between GIS and STI. After the brainstorm, exchange of ideas, and discussions for solving the problem, it was considered the idea to design, develop, and implement a new graduate program focus on the intersection between STI and GIS as a potential solution to address the problem.

At this point, the first conversations with Professor Fernando Lopez Alves began. Professor Lopez Alves was working on the idea to develop a new graduate program in Global and International Studies with different specialization. The idea to add a new “*cutting-edge*” specialization on STI was considered and discussed as a part of the new graduate program in GIS. After those conversations, a new phase began with the design and proposal of the new pedagogical program on STI and GIS.

4.2 Design Phase

This phase involved the creative process where the architecture of the graduate program was built. The program was designed based on extensive literature research, educational policy documents, consultation with experts, and the experience of more than fifteen years that the author has in the study in the interaction between STI and international relations. The design process is constantly referred to as disciplinary, methodological, educational, and pedagogical aspects. During this phase, different

stages were taking place in order to design the new pedagogical program. These stages include:

- Empirical, theoretical, and methodological review regarding the new field of the study is constituted by the interaction between STI and GIS: *International Scientific Relations*.
- Review of available information on undergraduate and graduate educational programs in higher education at the international level that addresses the critical issue in STI and international relations.
- Get advice from key experts in the field of STI and GIS in higher education institutions in the United States, Canada, Argentina, Mexico, Chile, and Spain.
- Work together with Prof. Fernando López-Alves to define the main characteristics of a graduate program in Science, Technology, Innovation, and Global Affairs and their fit within the broader context of the *Global and International Studies Graduate Program* of the University of Salamanca.
- Get advice from professors of the University of Salamanca, such as Dr. Fernando López-Alves, Dr. Manuel Alcántara, or Dr. Carlos Fortea for the preparation and final configuration of the curriculum.

This pedagogical design process made possible to reach clear conclusions regarding the essential foundations that a graduate program requires to address all identified needs. In this sense, the program was designed and built based on the following pillars:

- An *innovative* program that offers a set of theoretical, methodological, and analytical tools combined in a novel way to address the complexity of the new processes and phenomena in the area of *International Scientific Relations*.
- A *holistic* program that combines three essential elements: i) a rigorous pedagogical training, ii) a strong impulse to research, and iii) the development of practices in international institutions and organizations.
- A program with a truly *interdisciplinary* sense according to the needs of the study objective addressed, combining professors, researchers, practitioners, staff, and students from a wide range of disciplines ranging from specialists in Global and International Studies, through other Social Sciences, and also experts in technical disciplines in STI.
- An *international and intercultural* program, which includes an academic offer aimed at international students and a genuinely global teaching staff. For that reason, the postgraduate and subjects are taught entirely in English.
- A program located in an appropriate *institutional framework*, which implies being part of a prestigious university institution, which has a sense of the relevance of international studies and, at the same time, it has awareness and interest in STI issues.

4.3 Development Phase

Based on that essential design, a new graduate program named *Master in Global and International Studies: Science, Technology, and Global Affairs* was developed to address directly all identified needs and seeking to solve the lack of international pedagogical offer regarding studies on STI and international relations. Following those needs, the MA program was developed and built with the following characteristics:

4.3.1 Context

The Master in Global and International Studies: Science, Technology, and Global Affairs is presented as part of the Global and International Studies Graduate Program within the Institute of Global Governance and the School of law of the University of Salamanca (Note 27). Both the University of Salamanca and the school of Law have a long and proliferating international academic tradition that makes it an ideal institutional framework to include a graduate program of these characteristics. In this context, the *Global and International Studies Graduate Program* was created as a new and innovative program within the discipline of GIS that offers three Master Programs that are closely related to each other. In addition to the specialization in “*Science, Technology, and Global Affairs*”, there are two other tracks in “*Nationalism and Conflict Management*” and in “*Global Business and Negotiation*”. Additionally, the Graduate Program has a prestigious Think Tank that serves as intellectual support and advice for students accessing the graduate program.

4.3.2 Goals

The *Master in Global and International Studies: Science, Technology, and Global Affairs* aims to provide students with tools, skills, and competences to study, understand and solve complex problems that arise at the intersection of science, technology, and international relations. In order to achieve this main goal, the graduate program offers theoretical, methodological, and practical knowledge that will allow to address the new phenomena of scientific-technological processes within the current international agenda and, at the same time, it will encourage students to reflect on the best scientific responses, public policies, and private strategies to face the challenges derived from scientific and technological innovation within the international system.

Besides this main goal, the program curriculum addresses four main specific objectives:

- Develop in students a critical understanding of the global challenges facing the current international system through a detailed analysis of the main scientific-technological development of the global agenda.
- Ensure that students interpret and analyze holistically and systemically how topics in science, technology, and innovation are linked to historical, political, economic, social, and cultural variables within international relations.
- Provide students with innovative methods and analysis tools, specially designed to understand the close relationship between scientific-technological development and international affairs.

- Train new researchers specialized in the analysis and study of science, technology, and innovation in the international arena.

4.3.3 Competences and Skills

The initial stage of the graduate program development phase needs to identify a list of competences and skills the student is supposed to develop, which includes generic, transversal, and specific competences. In this case, the graduate program aims to develop the following competences:

•Generic Competence:

- Students will possess the skills to understand, evaluate, and apply the key concepts of science, technology, and innovation in the field of international relations.
- Students will possess and understand the theoretical knowledge necessary to identify, interpret, and explain the actors, processes, phenomena, and complex events within international science and technology.
- Students may apply advanced techniques and methods in the field of social sciences to analyze the intersection of science, technology, and global and international studies.

•Transversal Competences:

- Students will develop skills to work in an openly international, multicultural, and diverse context.
- Students will be able to understand the need for interdisciplinary and systemic work to address international analysis.
- Students will develop their critical thinking, and their ability to identify and solve complex problems.

•Specific Competences:

- Students will be able to transmit knowledge about the reality of the current international agenda of topics and their link to science and technology.
- Students will be able to assimilate and apply the theoretical, methodological, and practical foundations to the current agenda of topics that link science and technology with international relations.
- Students will be able to understand, elaborate, and manage public policies and private strategies linked to the best scientific-technological development at national, regional, and international levels.

4.3.4 Program Description

The competences and skills that a student acquires on completing the program help to identify the list of the disciplines which are to be included in the curriculum. The MA Program in Global and International Studies: Science, Technology, and Global Affairs extends two years. The program consists of required courses, two seminars, an internship program, and a final research project. The graduate program was structured in four semesters and required courses are offered in English.

The program includes core courses such as “Methods and Theory in Global and International Studies” and “Critical Thinking and Conflict Resolution”, and specialized courses, such as “Global Health, Energy and Environment” and “Science, Technology and Innovation Policy”. Additionally, there is an online seminar about “Internships, Professional Experience, and Job Searches” and a “Research Colloquium in Global and International Studies”.

In the first semester, a total of five courses are taught (Theory and Methods in Global and International Studies; Critical Thinking and Problem Resolution; History of International Relations; Global Migration and Negotiation). Those classes are considered core courses within GIS where a general theoretical-methodological understanding of international relations is offered. In the second semester (Science, Technology, and International Studies; Science, Technology and Innovation Policy; International Organizations and Trade and Global Health, Energy and Environment) and the third semester (Global Security; Science Diplomacy, and International Project Management) seven specific courses are taught that address in depth the special interaction between STI and international relations. Additionally, a course on professional practices and job search is included in the third semester (Internships, Professional Experience, and Job Searches). Finally, the fourth semester offers the option of conducting a professional practice in an international institution or organization in Europe or in the United States and, at the same time, is the beginning of the research stage for the achievement of the Master’s Thesis.

This organization of the curriculum allows combining theoretical and methodological elements of Global and International Studies with specific aspects of STI development and, at the same time, combine pedagogical elements with professional practices and research tasks.

4.3.5 Professorate

One of the keys to the *Master in Global and International Studies: Science, Technology, and Global Affairs* program is the possibility of offering a faculty staff capable of teaching the new and unique skills and abilities that the students of the program required. In this sense, the faculty board combines different characteristics of great relevance for the success of the program: First, professors from the University of Salamanca are mixed with visiting professors from multiple and prestigious international universities. Secondly, professors specialized in GIS are combined with experts in technical areas of STI. Thirdly, academics and researchers are also mixed with professionals and *practitioners* from the international arena. This composition allows to constitute an excellent body of professors capable of offering a high level of teaching, pioneering research lines, innovative teaching methods, and the transmission of real skills and competences to apply in the professional future, which guarantees that the interaction between STI and international relations will be offered with rigor and academic excellence.

4.3.6 Research and Practice

Finally, there are two more relevant components of the graduate program: develop research competences and the Applied Learning Internship Program. First, research skills and competences are teaching since the beginning of the program, and students are encouraged to do research focusing on the new and innovative agenda of topics in the intersection between GIS and STI. Most of the classes ask for conduct small research, and a final research project must be done in the last semester as a mandatory requirement to get the MA degree. To develop those research skills and competences a Think Tank was created with the explicit goal to help, advice, and support students. This Think Tank is integrated by a distinguished and well-renamed team of experts, scholars, professionals, and practitioners in international affairs and STI. Second, an Applied Learning Internship Program was established in the fourth semester of the program as an opportunity for the student to have truly international experience and practice and applied their knowledge in an international organization. Students can choose to complete an internship during their fourth semester in the program from a long list of opportunities in Salamanca, Madrid, Brussels, or Washington DC. Before their internship experience, students complete the online, core course, “*Internships, Professional Experience, and Job Searches*”, taught by internationally recognized professional facilitators.

4.4 Implementation Phase

The implementation comes in where the pedagogical program become a formal program offered by the University of Salamanca. The main goal of this phase was to move the idea from concept to reality. To do that, a formal proposal was written and submitted to the creation of a new graduate program in *Global and International Studies: Science, Technology, and Global Affairs*. The *Master in Global and International Studies: Science, Technology, and Global Affairs program* was formally approved by the University of Salamanca in April 2016 to be taught within the Graduate Studies Program of the School of Law and the Institute of Global Governance. Finally, the program opened its first cohort for the 2019/2021 cycle in Fall 2019.

4.5 Follow-up and Assessment Phase

A final phase was set in order to follow up and assess the academic program which is still a phase in progress. During the follow-up phase, everything is arranged that is necessary to bring the project to successful completion. Examples of activities in the follow-up phase included writing syllabus, looking for professors, coordinating schedules, promoting the specialization, among many others. Additionally, an assessment phase is coming with the beginning of the first cohort. After the first semester, several types of surveys were conducted with students and faculty to get some feedback about the specialization and evaluate potential changes and improvements.

5. Discussion and Conclusion

Within an international context of profound transformations, the STI has acquired a new and strategic place within international relations. The mutual influence and impact between scientific-technological development and international relations in the international system of the 21st century is an unquestionable fact that requires greater academic attention. The relevance of STI in GIS has increased considerably in recent years and has become a necessary point of view to understand in-depth the global challenges facing the international system in the 21st century.

This research has focused on the links established between STI and the GIS, which has allowed the identification of multiple gaps and needs that require academic attention. First, the scientific-technological revolution has been installed as a critical dimension of many of the central issues of international relations. Second, GIS demonstrates that it is still very poorly prepared to address scientific-technological phenomena and analyze their impact on the entire international system. While it is true that in recent years attention has grown on this new area of study, even GIS requires new and more complete efforts in addressing this new sub-disciplinary field of *International Scientific Relations*. Thirdly, there is a shortage of undergraduate and graduate university educational programs that specialize in the intersection between STI and GIS worldwide, which has exposed the deficiencies and limitations of the existing educational offering.

Essentially, this research raises the problem of the lack of academic programs in the area of *International Scientific Relations* that focus on the new agenda of topics between GIS and STI. In light of this reality, schools and departments in GIS have opted for two strategies: on the one hand, very few universities have begun to design new pedagogical undergraduate or graduate programs that specifically focus on the interaction between STI and international affairs, and, on the other hand, a large majority have decided to move more slowly through incorporating only some content through courses, seminars, and workshops in STI to their traditional programs.

Based on the needs founds in the literature review, a new graduate program was designed, developed, and implemented that directly addresses the gaps identified throughout the investigation. The *Master in Global and International Studies: Science, Technology, and Global Affairs* aims to provide students with tools, skills, and competences to study, understand and solve complex problems that arise at the intersection of STI and international relations. This graduate program also presents unique characteristics: an *innovative, holistic, intercultural, and interdisciplinary* program located within the privileged *institutional framework* offered by the University of Salamanca.

This graduate program presented here seeks to cover all the challenges posed by the growing intersection between STI and GIS and, at the same time, make a pedagogical contribution to the scarcity of degrees in the new subfield of study of *International Scientific Relations*.

Following a traditional model of project management in higher education, a new pedagogical program in the intersection between STI and GIS was created, designed, developed, and implemented. After the implementation, significant challenges were identified that will require further adjustments:

- *Curricular issues*: proportion between core courses in GIS and specific courses that address issues on international scientific relations.
- *Understanding a cutting-edge program*: let students and the academic community know about the existence of a new graduate program focus on the intersection between STI and international affairs.
- *Creating partnerships*: Promote collaboration with key actors for the success of the program. For instance, other departments and schools within the University of Salamanca; other college departments and schools worldwide; STI industrial companies; local, national, regional, and international governments working in public policies in STI, and think tanks and NGOs related to the topic.
- *Follow-up and assessment phase*: Considering the program has opened its first cohort in 2019, it will be crucial to focus on the right implementation and get feedback for future improvement.

Finally, this experience is expected to serve as academic, pedagogical, didactic material and, also, as a source of inspiration for the construction of new and more comprehensive undergraduate and graduate programs that address STI and international relations in the field of higher education and to collaborate in the creation of new bridges in the necessary link between STI and GIS.

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Notes

- Note 1. Muñiz, Manuel. "Technology, China's Rise and the Future of the International Order". Club de Madrid, Working Paper (Nov 2018).
- Note 2. Fernando López-Alves and Diane E. Johnson (Eds.), *Populist Nationalism in Europe and the Americas* (New York: Routledge, 2018).
- Note 3. Susan Strange, *The withdrawal of the State: The diffusion of power in the world economy* (Cambridge: Cambridge University Press, 1996).
- Note 4. Joseph Stiglitz, *Globalization and Its Discontents* (New York: W. W. Norton & Company, 2002).
- Note 5. Thomas Risse, "Transnational Actors and World Politics", in *Handbook of International Relations*, Walter Carlsnaes, Thomas Risse, and Beth Simmons (Second Edition. Los Angeles: SAGE Publications, 2013).
- Note 6. Robert Keohane and Joseph Nye, *Power and Interdependence* (London: Longman, 2001).
- Note 7. Amandine Orsini et al., "Forum: Complex systems and international governance". *International Studies Review*, 0(2019), 2.
- Note 8. The systemic transition process is considered: "the stage that mediates between the 'decline' of a System and the" emergence of a new one" (Dallanegra Pedraza, 2009).
- Note 9. James Rosenau, "The complexities and contradictions of Globalization", *Current History Magazine* (1997).
- Note 10. Science and Technology is defined here as a set of scientific tasks linked to each other and to other socio-economic dimensions with enormous consequences for the actors, interactions, processes and global configuration of the international system (Del Canto Viterale, 2019).
- Note 11. The "systemic parameters" are all those elements and parts of the international system (actors, interactions, processes, agenda items, etc.) that play a central role in determining the final configuration that adapts the world order.

- Note 12. Daniel Deudney, “Turbo Change: Accelerating Technological Disruption, Planetary Geopolitics, and Architectonic Metaphors”, *International Studies Review*, 20(2018), 223.
- Note 13. Klaus Schwab, *The Fourth Industrial Revolution* (New York: Crown Business, 2016), 2.
- Note 14. Eugene Skolnikoff, “Will science and technology undermine the international system?”. *International Relations of Asia-Pacific*, 2(2002), 44.
- Note 15. Mathias Albert, Lars-Erik Cederman, and Alexander Wendt (Edit.), *New Systems Theories of World Politics* (London: Palgrave MacMillan, 2010): 3.
- Note 16. Immanuel Wallerstein, *Open the Social Sciences: Report of the Gulbenkian Commission on the Restructuring of the Social Sciences* (Stanford: Stanford University Press, 1996): 80.
- Note 17. Cf. Charles Weiss, “Science, Technology and International Relations”, *Technology in Society*, Vol. 27, Issue 3 (2005): 295-313; Charles Weiss, “How Do Science and Technology Affect International Affairs?” *Minerva*, December 2015, Volume 53, Issue 4 (2015): 411-430; Tim Flink and Ulrich Schreiterer, “Science diplomacy at the intersection of S&T policies and foreign affairs: toward a typology of national approaches”. *Science and Public Policy*, 37(9), (2010): 665-677.
- Note 18. Cf. Maximilian Mayer, Mariana Carpes and Ruth Knoblich (Eds.), *The Global Politics of Science and Technology* (Vol. 1. Berlin: Springer, 2014); Maximilian Mayer and Michele Acuto, “The Global Governance of Large Technical Systems”, *Millennium* 43(2) (2015), 660-683; Patrick James, “What do we know about crisis, escalation, and war? A visual assessment of the International Crisis Behavior Project”, *Conflict Management and Peace Science*, Vol. 36(1) (2019), 3-19.
- Note 19. Richard Haass, *A World in Disarray: American Foreign Policy and the Crisis of the Old Order* (New York: Penguin Books, 2017).
- Note 20. David M. Kaplan, *Philosophy, Technology, and the Environment* (Cambridge: The MIT Press, 2017).
- Note 21. Dani Rodrik, “Globalization’s Wrong Turn and How It Hurt America”, *Foreign Affairs* (June 11, 2019).
- Note 22. Deudney, “Turbo Change: Accelerating Technological Disruption, Planetary Geopolitics, and Architectonic Metaphors”, 224.
- Note 23. This new subdiscipline is also known as “International Scientific Relations” (Del Canto Viterale, 2019).
- Note 24. Its founder and director until 2014, Charles Weiss, was one of the pioneers in the study of the links between science, technology and international affairs, one of the main critics about the lack of approach on these issues within the discipline of International Relations (Weiss, 2005; 2015) and also one of the precursors in studying and promoting the teaching of these new themes (Weiss, 2012).
- Note 25. ISA was founded in 1959 and currently has more than 7,000 active members in 110 countries. Organizationally, it is divided into 6 geographical subdivisions and/or regions, 29 thematic groups and/or sections (including STAIR) and 4 Caucuses.

Note 26. The section “Science, Technology, Art and International Relations (STAIR)” was approved in March 2014 by the ISA Governing Council because it is considered that: “Science, Technology and Design are at the center of world politics” (ISA, 2015).

Note 27. The University of Salamanca celebrated its 800th anniversary in 2018, in what is considered the second oldest university institution in the world.