General presentation:

project title

Complex Engineering Systems Performance Amelioration in Environmental, Energy and Resilience Aspects

project acronym: **CESPA**

project duration: July 1, 2021 - November 30, 2022

Type of action(s) proposed:
Exploratory research: Component 1a Environmental Aspects + Component 1b Energy Aspects,
Europeanization: Component 2 methodological studies, setting up of degree or certificate training courses, capacity-building, joint publications, applications for project/financing tenders;

Partners: presentation and contact details of the academic and non-academic partners identified
project developers: -French Team at Univ. Tech. Compiegne-Alliance Sorbonne Univ. (UTC-SU):
-components leaders: MM les Profs. Adnan Ibrahimbegovic, Florian De Vuyst, Abdellatif Ouashine
(-participants: Mme Adela Mejia-Nava, Mme Simona Dobrilla, M. Cong Nguyen, M. Ivan Rukavina)
-Bosnia-Herzegovina Team at-Univ. of Sarajevo (UNSA), Bosnia-Herzegovina:
-components leaders: Mme les Profs. Naida Ademović, Emina Hadžalić, Emina Hajdo
(-participants: M. Ismar Imamović, M. Emir Karavelić, M. Suljo Ljukovac, M. Samir Suljević)

project manager, their job titles: M. Adnan Ibrahimbegovic, Prof. Classe Exceptionnelle & IUF Senior
Mme Emina Hajdo, Assistant Professor

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Project description: Components 1a Environment + Component 1b Energy + Component 2 Europe. (summary; current situation and general problem; justification for the project with regard to the partner institutions, the country, and the region; the value of the project with regard to the public policies in higher education and research in the partner countries; identification and anticipation of possible difficulties;)

COMPONENT 1a Environmental Aspect (Exploration): Improving environment and energy balance efficiency of high-rise buildings in reducing the air pollution in Sarajevo Canton: feasibility study of repair by adding external facades for better ventilation, 'double' ceilings for better heating, and roof wind turbines for environmental cleaning and energy production. *[lead developers: Profs. Ibrahimbegovic, De Vuyst, Hajdo; participants: Mejia-Nava, Nguyen, Ljukovac]*

This part of the project belongs within the strategic goals of Sarajevo Canton, and it especially concerns the following: responsibly manage the environment, space, natural and infrastructural resources, especially in relation to electricity consumption or energy balance of business and residential tall buildings in the Sarajevo Canton, as well as reducing air pollution inside buildings and outdoor areas. The main subject of research in this part of the project is the problem of energy balance efficiency of high-rise buildings and the computation of their contribution to reducing air pollution in the Sarajevo Canton. Pollution is not only the problem of Sarajevo Canton, but this is an open issue for almost all major cities in the world. We emphasize here that besides Sarajevo Canton, all major cities in Bosnia and Herzegovina need to take huge steps to resolve the pollution and its consequences. Furthermore, this issue also concerns the majority of the cities in the Western Balkan countries. The focus of this research is

comprehensive, as we consider simultaneously the development of a new concept of high-rise buildings with a positive energy balance, as well as assessing the feasibility of significant energy balance repairs for existing high-rise buildings in Sarajevo Canton by adding secondary structural elements. In this part of the project, we will focus on the Sarajevo Canton, but it is important to point out that the knowledge gained could simply be applied to other cities, both in Bosnia and Herzegovina and in the Western Balkans countries. The development of a new concept of high-rise buildings with a positive energy balance follows modern world trends, with the aim to contribute to the reduction of negative impacts of global warming, to which the urban environment contributes significantly. Improving the energy balance for new constructions of (business and residential) tall buildings is part of interdisciplinary studies located at the crossroads between architecture, construction, and mechanical engineering. For example, in some of the developed countries, significant progress has been made in repairing the insulation properties of building materials or a new concept of fitting the building placement with respect to the sun exposition. However, the solutions of this kind cannot be directly applied to all existing facilities, and usually their total cost is excessive and unacceptable. This is certainly the case in Sarajevo Canton, where almost all high-rise buildings were built either in the pre-war or post-war period without the use of special insulation materials nor optimal position of the building on the existing site for construction within the urban zone of Sarajevo Canton.

Therefore, in this project, it is necessary to explore alternative solutions that can be obtained from the aspect of improving structural elements or secondary structures, which can be easily mounted on all existing buildings or fit into the ecologically improved concept of new construction of tall buildings. Some of these solutions include the addition of external facades for better ventilation, 'double' ceilings for better heating, and the addition of roof wind turbines for energy production, while contributing to air purification (see Figure 1 for illustrations). A great advantage of such solutions is that they relate to secondary structural elements, which can be applied to a large extent to many existing (business and residential) high-rise buildings in the Sarajevo Canton. On the other hand, the elements of this kind should be verified with respect to safety to vibration and instability (Ibrahimbegovic et al. 2013, Ibrahimbegovic et al. 2018, Imamovic et al. 2019, Hajdo et al. 2020, Hajdo et al. 2021).

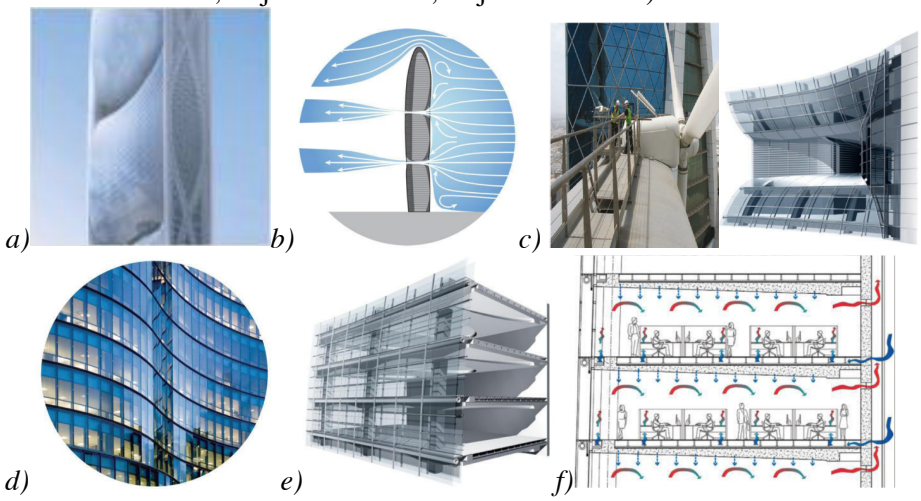

Figure 1. - Illustrations of the proposed environmental and energy efficiency repair solutions for tall buildings: a) disposition of a tall building; b) details of the airflow representing the energy production stock; c) wind turbines installed in existing tall buildings for dual role of energy production and air purification; d) facades of tall buildings; e) external facades to improve ventilation; f) installation of double ceilings to improve heating.

The research and teaching activities of this kind require combined expertise of computational structural and fluid dynamics, which is precisely covered by the French and BH teams (Ibrahimbegovic 2016, Hajdo et al. 2021). It is thus envisaged to involve the French educational teams as they would transfer their knowledge and research results that they have conducted in France. It is planned to organize advanced course at UNSA on tele-teaching platform, which could be attended by colleagues and students from other

universities in Bosnia and Herzegovina. Moreover, once the results are available, many colleagues from other Balkan countries would be interested, since many of the Balkan countries have pollution problems. In this way, academics from the French universities would share their knowledge and get acquainted with the environment pollution problems that the Balkan region are facing. This would be a perfect precondition for future long-term co-operation. One difficulty to deal with is to involve the private sector (the owners of the tall buildings) for implementing this technology.

Since the problem of pollution requires the engagement of experts from different fields, we will also organize interdisciplinary workshops and conferences resulting in the exchange of knowledge required for solving this very complex problems. Namely, the problem of energy efficiency and pollution is not just an engineering problem, as environmental issues affect people, social and human sciences have to be involved. Social sciences should more effectively research "human causes, vulnerabilities and impacts" of environmental change given that it affects people's livelihoods, chances of survival, and ways of life. This would be an opportunity for the colleagues in the social and human sciences to collaborate with us and to get in touch with colleagues from the same fields of research from French Universities, which would open up opportunities for their future cooperation in various fields of their interest.

References:

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<u>COMPONENT 1b Energy Aspect (Exploration)</u>: Global safety assessment of dams of capital importance for the energy system of Bosnia and Herzegovina: deterministic and probabilistic approach with taking into account damages in concrete occurred during the exploitation period

[lead developers: Profs. Ibrahimbegovic, Ouashin, Hadžalić; participants: Dobrilla, Rukavina, Suljević]

This part of the project falls within the strategic goals of Canton Sarajevo and Bosnia-Herzegovina, which pertain to responsible infrastructure resources management in relation to the energy resources in the country. Hydraulic power plant count for more than 80% of the power supply in Bosnia-Herzegovina. Yet, with many dams constructed decades ago (during the period of ex-Yugoslavia), and since exposed to environmental and man-made extreme solicitations, there is pressing issue of verifying their safety and durability.

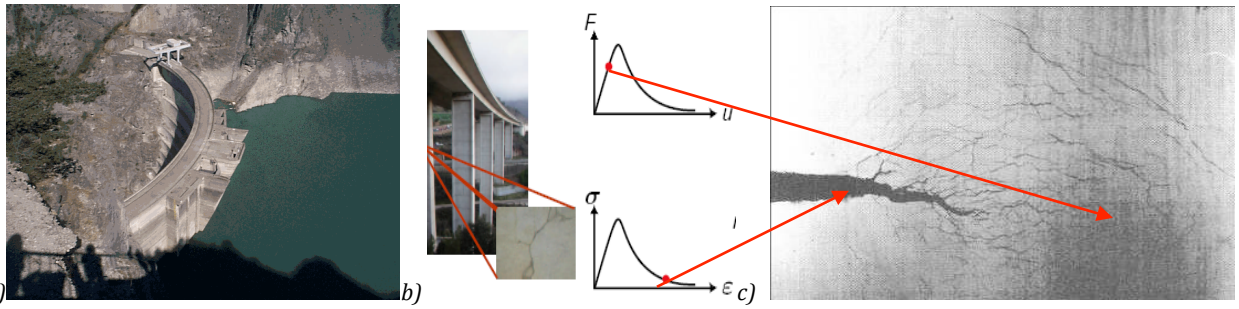

Figure 2. – Illustrations of hydraulic power plant (dam), as the main source of energy in Bosnia-Herzegovina : a) typical dispositive of concrete arch dam ; b) durability issue of concrete structure with cracks that reduces the life-span and their integrity and durability ; c) detailed prediction models of concrete failure (needed for durability computations) with micro-crack that can merge into macro-crack that leads to failure

The main research subject in this part of the project is the problem of safety and durability of the hydraulic structures (dams) in Bosnia and Herzegovina with the focus on the safety and durability assessment of the existing dams which are of capital importance for the energy system. All dams in Bosnia and Herzegovina are built in the pre-war period and have experienced damages with the appearance of (visible) cracks during their exploitation period. A delay (due to maintenance) in the functioning of dams can lead to significant problems in electricity supply, while the complete failure of any existing dam can have catastrophic consequences for human lives and the energy system. For these reasons, it is necessary to have reliable predictive models that will be able to assess the global safety of the dam structure to be able to take preventive and safety measures. Therefore, the main subject of this part of research is the development of a model that provides an accurate assessment of the safety of existing dams, with the improvement of the monitoring process and parallel assessments of their residual safety. The proposed approach is directly applicable to the design of new dams within the energy system of the country.

The basis for further development in this research area would be using an existing 2D numerical models (Hadžalić et al. 2019) for the safety assessment of dam structure in interaction with the reservoir as well as extreme load conditions. The model is currently able to take into account existing cracks, and perform a global safety assessment taking into account not only operating static loads (self-weight, hydrostatic pressure, annual temperature change cycle) but also extreme dynamic loads (earthquake, impact in dam). Many different model ingredients are developed in (Hadžalić et al. 2018a,b,c, 2020).

In this part of the project, we plan to extend and generalize the developed model to a 3D case, which would allow us to take the actual geometry of the particular dam structure and thus increase its predictive capacity. The most important obstacle in this regard is the very significant increase in computational costs and the need for very powerful computers. The need for increased computational costs is also related to the probabilistic approach, which is planned to be conducted in line with the recent work conducted by (Karavelić et al. 2019) Namely, most dams in Bosnia and Herzegovina are built of cement-based composite material, such as concrete, which in previous engineering practice, as well as, in commercial programs for the structural analysis is considered a homogeneous material. This is something that cannot be justified especially if one is to take into account the risk of potential failure. Therefore, within these computations, it is very important to take into account the structure heterogeneity, with the accumulation of existing structure defects that are of great importance for triggering failure at fine scales (micro or meso level). Thus, any uncertainties arising either from insufficient knowledge of crack modeling or from insufficient measurements and other sources should be taken into account when determining the durability and safety of dams. To form such a model, it is necessary to combine knowledge from fracture mechanics, numerical methods, and probability theory.

Namely, from the aspect of such numerical modeling, it is necessary to develop models that can describe the inelastic behavior and fracture of material taking into account its heterogeneous structure, which results in model parameters described by “random” variables. Such an approach has lead to the model of fracture and cracking in concrete based on probability theory, which can connect different estimates of the level of uncertainty of the material, and transfer from a lower level (material safety factor) to a higher level (structural safety factor) with appropriate results which significantly increase the predictive quality of the model. This is the knowledge of the French team (Ibrahimbegovic et al. 2021), which will be transferred to B-H team in this project.

Dams are one of the main sources of energy in almost all countries, not only in Bosnia, but also in France. Hence, the issue of having powerful tools to analyze and assess its global safety is of common interest. These problems have to be solved with experienced researchers from developed countries that have been dealing with these problems in their work. So, for the project to be successful, it is of the utmost importance to work together with the French research team (e.g. contribution of Prof. Ouashine to defining extreme conditions by hydraulics computations).

This part of project will be an excellent basis for advance course in dam structures and hydraulic engineering, which will be taught to Master level engineering students. The tele-teaching can be organized in order to enlarge the potential audience to other universities in Bosnia-Herzegovina. Moreover, such interdisciplinary topic would present a great opportunity to organize workshops, where research and

educational teams from France would meet and discuss with the teams from Bosnia and Herzegovina and other Western Balkan countries, in which the issue of dam safety should be addressed. These meetings would as well enable us to gain insight into the existing connections between universities from France and Western Balkan countries, and also the possibilities to establish new collaborations or to strengthen the existing ones.

Another aspect that should be explored in this part of the project is the human aspect. Namely, many people are employed by hydropower plants, and taking into account the difficult economic situation in Western Balkan countries, a delay in the work of the dam can endanger their financial existence. Last but not least, social and human sciences from French and Western Balkan universities could help with building stronger everyday social interactions between recently warring communities, who happen to jointly own some of the most important infrastructure including hydraulic power plants.

References:

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Component 2: "EUROPEANIZATION" *[lead developers: Profs. Ibrahimbegovic, Ademović; participants: De Vuyst, Ouashin, Hadžalić, Hajdo]*

One way for extending this project to "Europeanization" is through jointly focusing by two teams upon building resilient engineering systems. The topic of resilience is currently of utmost important for many complex systems (Ademović, Ibrahimbegovic 2020), as the ability of the system to react to perturbations, internal failures, and environmental events by absorbing the disturbance and/or reorganizing to quickly recover maintain its functionality. In the last 40 years, resilience has spread across different fields and domains, it is a multidisciplinary topic crossing natural science, social sciences, and engineering (Carhvalo 2021, Cumming 2005, Fraccascia 2017). In this specific case resilience is connected to the complex problems (engineering, environmental science, ecology) aforementioned, but as well to organizational and knowledge transfer resilience in the frame of academic institutions.

Components 1a and 1b offer perfect playground for development of resilience expertise. For example, all dams in Bosnia and Herzegovina (BIH) are built before 1992 and during this period they have visible cracks, which have been noted during their exploitation time. They are about to exceed (and some have already exceeded) the average 50-year lifespan. The two key factors which have the highest contribution to the increase of the infrastructure crisis are the aging of the dam structures together with the shifting of environmental conditions. In times of a changing climate, water security is a dominant component of long-term resilience – and dams are vital for the preservation of such safekeeping. According to the World Bank, dam safety and resilience is an increasing area of concern worldwide. Some of the notable issues, in developing countries particularly, are pertaining to sustainable operation and management of dams, including financial and human resources and resilience to geophysical hazards: earthquakes, landslides, floods, drought, and in Bosnia, man-made hazards, such as wars.

The resilience of civil engineering structures exposed to extreme actions has been quantified in several

important studies (Cimellaro 2010, Bochini 2013, Ibrahimbegovic, Ademović 2019). Until today there have been only a few studies regarding the resilience of dams. Possible retrofitting measures and upgrading of existing dams in relation to the economic and loss of life perspectives were done by (Graham 2000). It is believed that the most comprehensive report was published by the USA National Research Council regarding the resilience of dams. A framework for evaluating dam safety strengthening alternatives concerning flood control by the concept of resilience was researched by (Kim 2014).

Inter-crossing among Components 1a, 1b, and 2.

As explained in Components 1b, the model capable of taking into account not only the static but also the extreme dynamic loads will be the basis for conducting the resilience of dam structures. On the other hand, regarding Component 2 many strategies are available to reduce the energy and climate impact of buildings and construction. One of the key priorities identified by the Global Alliance for Buildings and Construction roadmap is to reduce climate-change-related risks of buildings by adapting building design and improving resilience. In the view of the high-rise buildings, it is envisaged to conduct their assessment and provide the strategies of increasing the resilience for a case study of the City of Sarajevo in respect to the energy balance efficiency of high-rise buildings in the contribution to reducing air pollution.

Collaboration between the University of Sarajevo Faculty of Civil Engineering and University of Technology Compiegne/ Sorbonne Universities continued with the Agreement of Academic collaboration, which was signed on September 16, 2019. During this period, collaboration was implemented through networking and exchange of academic staff, as well as joint participation and application for funds designated to research projects, as well as the joint organization of conferences. Collaboration was conducted in the proposal of 4 projects from which two received grants. The projects that were implemented were: Global safety assessment of dam structures of capital importance for the energy system of BH, including assessment of the influence of damages in concrete due to weathering and extreme conditions – deterministic and probabilistic approach financed by Canton Sarajevo ministry of education, science and youth in 2019 and A new approach in the structural safety assessment of hydropower plants in BH financed by Federal Ministry of education and science in 2019. The universities jointly organized an ECCOMAS MSF 2019 meeting together with the Faculty of Mechanical Engineering (url: http://gf.unsa.ba/eccomas-msf-2019/), which created further links and collaboration with the prestigious international universities (UT Compiegne-Alliance Sorbonne University in France). More importantly, this meeting allowed bringing many international experts of BIH origin, currently active in European countries, whose participation further increased the high scientific level of the meeting. It should be emphasized that this kind of organization enabled a formation of a “critical mass” of experts’ participation, motivated by the shared desire to help students and teachers-researchers from Bosnia and Herzegovina and renowned experts from UTC-SU. The cooperation between the two Universities continued through the short scientific stays in France organized by the Embassy of France in Bosnia and Herzegovina. As a result of this stay, an article was produced by Prof. Ademović from the Faculty of Civil Engineering in Sarajevo and Prof. Ibrahimbegović and accepted for presentation at the forth-coming ECCOMAS MSF 2021 Thematic Conference URL: http://gf.unsa.ba/eccomas-msf-2021/.

Proposed actions on Europeanization:

Through this project, it is envisaged to further build upon relations between the two universities that will be organized in several ways. First of all, due to COVID 19 lockdown and restrictive measures, the collaboration will be first organized through tele-teaching, and once the measures are reduced short visits of staff and students will be organized. Given the diversity of the proposed activities, the main idea of the short visits will be the exchange of ideas and the creation of a possible **Erasmus + program with a focus on the resilience of complex structures exposed to extreme actions**. It is foreseen that the University of Technology Compiegne-Alliance Sorbonne Universite will provide its technical support and capacity-building for the Faculty of Civil and Faculty of Mechanical Engineering of Univeristy of Sarajevo, with the goal to attract international financing, within the framework of Erasmus+ projects. It is important to expand the community of the Erasmus+ projects and this can be done by becoming an Erasmus+ project coordinator who will take part in the online networking events. From this exchange inspiring practices will be obtained and experiences will be exchanged regarding common challenges, which many have

come across during the implementation of the Erasmus+ projects.
Finally, during the whole duration of the project several visits will be organized for both French and Bosnia-Herzegovina teams in order to spur more dynamic exchange of ideas and research results. It is planned to organize working sessions during which the team will work on the creation of the Erasmus+ project with a focus on the **resilience of complex structures exposed to extreme actions**.
References:
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Overall and specific **objective**, **group targeted** and **end beneficiaries**;
It is planned for several visits of both the French team and Bosnia-Herzegovina team, where they can spend sufficient time for joint works. The members of the French team will come to Bosnia and Herzegovina for the duration of 5 working days + 2 travel days in December 2021, and then in April 2022 with massive participation to better steer the project developments. Final visit is scheduled for September 2021 for preparation of project conclusion and reports. All three members of the BIH team will visit France in October 2021 and February 2022 for the duration of 5 working days + 2 travel days, during which unanswered issues will be solved for the preparation of the project. Final visit will be organized in November 2022, so that the project conclusion and reports can indeed be joint product of two teams.
The ***participation of women in science is very much promoted by this project*** *(=added value of the project)* since all the leaders at UNSA are female professors, who are successfully building their careers in engineering science. This project, if approved, should give them ample opportunities for further growth.

Implementation method enabling objectives to be achieved and main advantages that the leader believes to have to successfully carry out the project, in particular as regards previous experience in the area;
We have very considerable experience in a previous collaboration between experts UTC-SU and UNSA. Namely, all three colleagues have been involved in teaching a short course in the framework of ECCOMAS MSF 2019 Thematic Conference URL: http://gf.unsa.ba/eccomas-msf-2019/ and all three colleagues UNSA have participated in the organizing committee of this meeting. We plan to build upon these successful collaboration practices and re-apply many of them in this project, with frequent exchanges on tele-teaching platforms, sufficient number of visits between partner teams.

Through permanent communication between the partner Universities, we plan to gain insight into existing and potential cooperation between French universities and universities from the six Western Balkans countries, which would allow to further enlarge the circle of participants. The Europeanization action geared towards resilience under extreme conditions will provide the perfect platform for such an enlargement, since the chosen topic is very much interdisciplinary, drawing upon the skills and expertise of several engineering domains (civil, mechanical, material, architecture), society actors (the owner of

high-rise buildings and dams) and all the way to government institutions in charge of legislation and planning.

Expected results with calculated results indicators and situation at project end;

We plan to prepare the professional tool that can bear upon engineering practice and help solve the problems in Environmental Aspect (Component 1a, targeting the pollution issue in large cities in Bosnia-Herzegovina, and most notably Sarajevo), in Energy Aspect (Component 1b, targeting the safety and durability of hydraulic power plants, which constitute by far the main source of electric power in Bosnia-Herzegovina. Given that some of the main power plants are jointly shared by different communities in Bosnia-Herzegovina (between Federation of Bosnia and Herzegovina and Republic of Srpska), this particular component can also ***contribute to creating links of reconciliation between previously warring population*** *(=added value of the project)*, given that they will share the joint goals.

Conditions to secure the project's future once the FSPI project financing is terminated;

The developments to be undertaken in this particular project have an enormous potential of applications, given that they deal with the most pressing issues in Bosnia-Herzegovina pertinent to environment pollution and energy supply. Of particular interest is the Capital of Bosnia-Herzegovina, both in terms of the highest level of difficulties and the most pressing needs for dealing with this issue.

The recent merger between different faculties within the University of Sarajevo presents an excellent opportunity for further development of the structures and infrastructure for accompanying the project of this kind in terms of Centers of Excellence, which might eventually involve the faculty members from different departments of the University of Sarajevo. Such an institution would certainly be able to secure the project's future, in terms of dealing with numerous applications not only in Sarajevo but also throughout Bosnia-Herzegovina.

Detailed budget (table attached to this call for projects completed): detail of all project costs by specifying the partners' contributions (financial, human resources, material contributions, etc.);

-The total budget in this project amounts to: **37,958.95 Euros** (attached table summarizes financial cost on travel, human resources, and material contributions).

Timetable of activities: the activities can start once the agreement is signed with the FEI agency and must be completed by the end of November 2022.

-The attached file contains a detailed timetable of scheduled activities, including the visits and trips for both partners, all scheduled between the starting date and the end of November 2022.

- Documents attached:

o **Letter of intent by the French and Balkan partners;** Demonstrating their collaboration and their commitment to jointly creating the project;

-enclosed - signed by President UTC-SU (Mr. Guy Christophe) and Rector UNSA (Mr. Rifat Škrielj)

o **Agreement of academic cooperation**

-enclosed – Memorandum-of-Understanding, signed September 16, 2019

o Letter of undertaking from the **non-academic partners**; Letter of undertaking concerning the **covering of co-financing** signed by the representatives of the institutions/structures involved;

- - - no (some contacts will be made during the project with owners of high-rise buildings and dams)

o **curriculum vitae** of the project developers;

-CVs MM Profs. A. Ibrahimbegovic, F. De Vuyst, A. Ouashine, UTC-SU

-CVs Mme Profs. N. Ademović, E. Hadžalić, E. Hajdo

o **any other document** that the applicants may deem useful to provide to the MEAE.

- Timetable of activities
- Detailed budget table

Date :
10/05/2021

To whom it may concern

Letter of support

This is to support the proposal entitled "Complex Engineering Systems Performance Amelioration in Environmental, Energy and Resilience Aspects (CESPA)" submitted in the framework of the 2021 call for projects of the Solidarity Funds for Innovative Projects, civil societies, Francophonie and human development.

In fact, Université de technologie de Compiègne (UTC), member of the Alliance Sorbonne Université, and Sarajevo University entered into a privileged international partnership relation in September 2019 coordinated by Professor Adnan Ibrahimbegovic, Chair for Computational Mechanics at UTC, Senior Fellow of IUF (Institut Universitaire de France) and ANUBiH of the Academy of Sciences and Arts of Bosnia and Herzegovina.

Our agreement was signed at the occasion of the fourth International Conference on Multi-scale Computational Methods for Solids and Fluids (ECCOMAS MSF) that took place in Sarajevo in September 2019. For this conference, organized by Professor Adnan Ibrahimbegovic, a delegation of UTC researchers met with their Bosnian counterparts, which gave way to several successful projects and initiatives.

We are thus fully committed to supporting the joint creation of this new project.

Christophe Guy
Director, UTC

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No: 0101-4467/21
Sarajevo, 10.05.21

Subject: LETTER OF INTENT

Hereby I, professor Rifat Škrijelj, Ph.D., rector of the University of Sarajevo, endorse the participation of the University of Sarajevo in the following project:

Project title:	Complex Engineering Systems Performance Amelioration in Environmental, Energy and Resilience Aspects
Project acronym:	CESPA
Project duration:	July 1, 2021 - November 30, 2022
Type of action(s) proposed:	Exploratory research: Component 1a Environmental Aspects + Component 1b Energy Aspects Europeanisation: Component 2 methodological studies, setting up of degree or certificate training courses, capacity-building, joint publications, applications for project/financing tenders
Partners:	
project developers:	*University of Technology of Compiegne, University of Sarajevo*
project manager:	Adnan Ibrahimbegovic, Professeur Classe Exceptionnelle & IUF Senior, University of Technology of Compiegne Emina Hajdo, assistant professor, University of Sarajevo
Project description:	summary; current situation and general problem; justification for the project with regard to the partner institutions, the country and the region; the value of the project with regard to the public policies in higher education and research in the partner countries; identification and anticipation of possible difficulties

The aim of this project is to build a professional tool that will be able to solve environmental problems related to pollution issues in large cities in Bosnia and Herzegovina, mainly in Sarajevo, while in the energy aspect the main goal is to determine the safety and durability of hydraulic power plantsm, which are by far the main source of electricity in Bosnia and Herzegovina. Through this project, the further strengthening of relations between the two faculties (universities) is planned. This will be organized in several ways. First of all, due to the current COVID 19 pandemic and restrictive measures, cooperation will first be organized through online classes, and after the mitigation of epidemiological measures, short visits of staff and students will be organized. Given the diversity of the proposed activities, the main idea of the short visits will be to exchange ideas and create a possible Erasmus + program with an emphasis on the resilience of complex structures exposed to extreme impacts. It is envisaged that UT Compiegne-Alliance Sorbonne University will provide technical support and capacity building to the Faculty of Civil Engineering of the University of Sarajevo with the aim of applying to an international project such as Erasmus +.

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RECTOR

Professor Rifat Škrijelj, Ph.D.

CVs - FRENCH PARTNER TEAM

M. Adnan Ibrahimbegovic, M. Florian De Vuyst, M. Abdellatif Ouashine

UTC-Université de Technologie de Compiègne – Alliance Sorbonne Université

ROBERVAL- Laboratoire de Mécanique, Energie et Electricité

LMAC – Laboratoire de Mathématiques Appliques de Compiègne

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Adnan Ibrahimbegovic is Professor Classe Exceptionnelle, Member Senior IUF-Institut Universitaire France and Chair for Computational Mechanics at University of Technology Compiègne, a member of Alliance of Sorbonne Université (created with merger of Paris-Sorbonne and Université Pierre Marie Curie). He has obtained his engineering education in Sarajevo, PhD at the University of California Berkeley, USA and Habilitation at University Pierre Marie Curie in Paris, France. He has held professorships and research positions at four different universities (including UC Berkeley, USA; EPFL, Switzerland; ENS-Cachan, France and currently UTC, France). He is the past Chairman of ENS-Cachan Teaching and LMT-Cachan Research Departments and Head of Master Program MaiSE. He has received a number of international distinctions, including IACM Fellow Award, Humboldt Research Award for Germany, Research Award for Slovenia, International Fellow NSERC Award for Canada, 'Claude Levy-Strauss' Chair for Univ. Sao Paulo, Brazil, 'Asgard' Chair for NTNU, Norway, KAIST Invited Professor, South Korea, 'Hôte Académique' Award for EPFL, Switzerland. He has published more than 200 papers in scientific journals and 9 textbooks and monographs**.**

Florian De Vuyst, Professor 1e Classe & Director Lab. Math. Appli. Compiegne
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Florian De Vuyst is Professor at University of Technology Compiègne (UTC). He has obtained his initial degree and his doctoral degree in mathematics at University Pierre Marie Curie, Paris in 1994. He was Professor in Applied Mechanics at Ecole Centrale Paris, ENS-Cachan before joining UTC. He is currently the Director of Laboratory of Applied Mathematics, and future holder of Chair 'Vitrage de Future' an interdisciplinary platform regrouping 4 laboratories at UTC, and several industrial partners, including St. Gobain, Renault and Valeo. His current research is oriented towards high performance computing, multi-phase and free-surface fluid flow and model reduction methods. He has published close to 100 papers in scientific journals in fluid mechanics and applied mathematics.

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Abdellatif Ouahsine is a Professor and member of management board at University of Technology Compiègne (UTC). He has obtained his doctoral degree and Habilitation in Fluid Mechanics from University of Science and Technology Lille. Since 2001, he serves as Head of Laboratory of Computational Hydraulics (LHN), a joint team UTC and CETMEF (French national technical institute of the Ministry of Ecology, Sustainable development and Energy). His current research interests pertain to environmental and computational fluid dynamics (CFD), with special emphasis on fluid-structure interaction. He has published close 100 papers, and organized several conferences on hydrodynamic modeling, currents and waves in coastal area and river management.

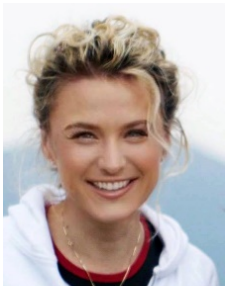
CVs – BOSNIA-HERZEGOVINA PARTNER TEAM

Ms. Naida Ademovic, Ms. Emina Hadzalic, Ms. Emina Hajdo

UNSA-University of Sarajevo – Bosnia and Herzegovina

GFS – Civil Engineerng Faculty Sarajevo

IMK- Institute of Materials and Structures



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Naida Ademović, (Sarajevo, 1973) is an Associate Professor at the University of Sarajevo, Faculty of Civil Engineering. She gained her degrees at the University of Sarajevo, Faculty of Civil Engineering, Bosnia and Herzegovina (Bachelor of Sciences), Rühr Universität, Fakultät für Bauingenieurwesen, in Bochum (Germany) (Master of Science); University of Padova (Italy) and University of Minho, Guimarães (Portugal) (Advanced Master of Science). Her scientific and professional activity covers the field of earthquake engineering, concrete and masonry structures, and bridges, finite element modelling and resilience of structures. She worked on numerous professional and scientific local and international projects. She is a member of scientific committees of international journals and she was involved in organizing several conferences. As well, she is an active reviewer for several international journals. She worked as a consultant for Ove Arup and Partners International Ltd regarding Integrating Seismic Risk Considerations into Energy Efficiency Investments in the Western Balkans and Improving Sarajevo's Resilience through Urban Regeneration. She is an author/coauthor of five book. She participated in the establishment of an interdisciplinary study program Protection against Natural Disasters at the Center for Interdisciplinary Studies, University of Sarajevo where she is an Associate Professor. She is a member of the Ph.D. study course at the University of Padova (Italy). She has published more than 100 scientific and professional papers.

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Emina Hadzalic is an Assistant Professor at the University of Sarajevo, Faculty of Civil Engineering. She is also engaged in professional and scientific projects at the Department of Geotechnical Engineering of the Faculty of Civil Engineering. She obtained her master's degree in 2014 at the University of Sarajevo, Faculty of Civil Engineering. She was awarded the Golden Badge of the University of Sarajevo for outstanding achievements during her studies. She was awarded a joint PhD in 2019. Her joint PhD studies between the University of Technology of Compiegne and the University of Sarajevo, Faculty of Civil Engineering, were supported by the French government scholarship. She is in charge of teaching and research domain placed at the intersection of structural and geotechnical engineering, including soil-structure interaction problems – the main domain of expertise already developed in her doctoral thesis.

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Emina Hajdo is Assistant Professor at University of Sarajevo, Faculty of Civil Engineering. She is also engaged in professional and scientific projects at the Institute of Materials and Structures of the Faculty of Civil Engineering in Sarajevo. She has obtained her engineering education and PhD at University of Sarajevo. She had worked in IPSA Institute d.o.o. Sarajevo as a structural engineer and design associate on projects of various buildings and bridges. She was awarded the Golden Badge of the University of Sarajevo for her outstanding success during her studies. She was a scholarship holder of the French government, and winner of the CEACM nomination for the ECCOMAS Award for the Two Best PhD Theses on Computational Methods in Applied Sciences and Engineering 2020. She is currently in charge of teaching and research in domain of structural mechanics, including the complex engineering structures and their performance in dynamics and instability.