



جامعة جدة University of Jeddah

Research & Innovation Strategic and Executive Plan
College of Computer Science and Engineering
University of Jeddah

الخطة الاستراتيجية و التنفيذية للبحث والابتكار
كلية علوم وهندسة الحاسبات
جامعة جدة

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Message of the CCSE Committee for Research & Innovation

Research and Innovation (R&I) in the Kingdom of Saudi Arabia is a critical component of the growth of the economy. Saudi Vision 2030 sets clear aims for how to ensure and sustain the leading position held by the Kingdom in all domains. When research and innovation is organized and planned well, it usually result in gaining new knowledge and promoting innovative products and services that directly impact individuals and societies. We believe that promoting R&I activities should start in undergraduate and higher education. Our R&I Strategic and Executive Plan set by the College of Computer Science and Engineering (CCSE) at the University of Jeddah (UJ) is meant to assist in the realization of that, through utilization of currently available human, material, and community resources and infrastructures.

What is Research and Innovation?

The fundamental objectives of research & innovation is to tackle complex problems and solve global challenges, which help in developing new and innovative technologies and improve existing products and services. Successfully achieving these objectives will create value for not only our societies, but also the university and its colleges. At the CCSE College, we are constantly seeking to develop ideas that meet the needs of the global sociality and provide innovative and impactful solutions. The COVID-19 global pandemic has shown us the importance of science, research, and innovation. The success of our Collage is rooted in our ability to continue improving our research quality while also innovating new technologies that provide solutions for the region's challenges and needs. Achieving this will ensure that our new generations are pre-skilled within the knowledge needed to contribute to different innovative projects and engage in diverse careers.

Mission and Motivation

Our mission is to enable students and faculty from all backgrounds and experiences to engage and contribute effectively to research and innovation. The University of Jeddah has a long track record of aligning itself with the Saudi Vision 2030 goals and objectives through developing and constantly improving its departments, faculties, and students. The creative atmosphere that we have achieved at the CCSE College inspire our student and faculty to produce rich, unique, and valuable research and innovations. This atmosphere motivates us to continue building, organizing, and planning our research and innovation infrastructure within the CCSE College. We plan to have a clear understanding of how society is changing so we can anticipate how we can tailor our research and innovation efforts to meet our society's needs.

Research & Innovation Strategic and Executive Plan

We have built our Research & Innovation Strategy (2021-2024) to serve the local needs and to participate in global development. Our new plan provides a roadmap for promoting a culture of shared responsibility and engage citizens especially youth for a collective effort to solve community problems, facilitating local and international collaboration to enable discoveries and innovation in economic and industry of logistics, investing in innovative research to enrich knowledge-based economy for sustainable development, and enhancing excellency in research to evolve, impact and engage profoundly in serving national sectors through optimal use of CCSE resources.

Research & Innovation Theme

Saudi Arabia is being transformed into a leading industrial powerhouse and a global logistics hub within the next 10 years. This ambitious goal can be achieved through the joint effort of all government and private sectors. The University of Jeddah will be a primary contributor in the realization of that goal by focusing on logistics as the main theme of the university, which is part of the new vision of the modern Saudi university launched in 2019. The CCSE Collage will enrich this vision by developing a clear R&I strategic and executive plan that take into consideration logistics and trending technologies as a primary research and application area.

How the CCSE College will Implement the R&I Plan

The Vice Deanship for Research and Innovation at CCSE will supervise and monitor R&I efforts within the college and insure the alignment with the university overall R&I goals and objectives. The academic departments within CCSE will engage students, faculty and researchers to directly contribute to the overall goals of the R&I strategy.

Research & Innovation Strategic and Executive Plan

The R&I Strategic and Executive Plan set by CCSE is focused on promoting innovative products and services that directly impact individuals and societies and effectively contribute to the Saudi Vision 2030. The plan is driven by the Saudi University Higher Education Research Policy¹ and the University of Jeddah strategies and Research Policy. Our path forward will consist of the following key objectives.

Research and Innovation Principles

1. *Be a leading regional center of research and innovation, and contribute to the local economy through state of the art knowledge that serves national and global needs.*
 - Emphasizing R&I themes leading to greater profitability
 - Continuously improving core technologies and core facilities
 - Fostering an innovation pipeline
2. *Generate intellectual properties and tackle complex problems and solve global challenges in the research domains relevant to national strategies.*
 - Achieving profitability in new technologies early on
 - Acquiring technologies with an eye toward the future national interests
3. *Establish partnerships with world class research institutions and organizations for capacity building and enhancing the impact of research and innovation efforts.*
 - Establishing new partnerships with highly innovative institutions
 - Strengthening ties with current partners
4. *Attract world class faculty and students to engage in different learning and research projects and establish innovative environments that aim at reducing technological barriers.*
 - Hiring and developing human resources
 - Providing an enhanced research environment
 - Develop an innovation-focused culture

¹ https://colt.ksu.edu.sa/sites/colt.ksu.edu.sa/files/imce_images/lyh_lbhth_llmy_fy_ljmt.pdf

Strategic Actions and Operational Steps

We provide a roadmap on how to promote R&I within the CCSE College. These sets of strategic actions are accompanied with executive steps that are needed to be taken into consideration to achieve these R&I strategies. The strategic actions include: focusing on encouraging and building research practices in undergraduate level, alignment between research & innovation strategies and teaching strategies and curricula and key university and government strategies, encourage interdisciplinary collaboration between academic departments inside and outside the college, identify appropriate incentivizes for research & innovation within the collage for faculty & students, ensure that the environment can support conducting research in the highest standards possible, and encouraging research-based entrepreneurship spirit within the college for faculty & students.

STRATEGIC ACTION 1:

Focus on Encouraging and Building Research Practices in Undergraduate Level

The large number of undergraduate students in the various academic departments of the college is a good source for the growth of scientific research within the departments and the college. Stimulating the participation of undergraduate students in carrying out scientific research should be considered as a primary source for the growth of scientific research and innovation within the college. The resources and steps to assist students and faculty for research collaborations should be clearly identified.

Operational Steps:

1. Each academic department must implement different programs that focus on stimulating scientific research within the department in general.
2. Inclusion of general courses at the college level dedicated to scientific research methods and statistical design in various computer science disciplines.
3. Establishing competitions and conferences within the college focusing on scientific research for faculty members and students.

STRATEGIC ACTION 2:

Alignment Between Research & Innovation Strategies and Teaching Strategies and Curricula

Course work and curricula in each academic department should focus directly on research in the field of specialization. Updating these scientific curricula officially requires a lot of procedures. To solve this problem, faculty members must be motivated to adopt teaching methods that focus on scientific research within each subject.

Operational Steps:

1. The inclusion of a specific number of hours within each subject and syllabus dedicated to talking about the different fields of research within the subject.
2. The inclusion of a simple collaborative research project within each subject and curriculum, focusing on the latest research topics within the subject.
3. Establishing a track dedicated to research within the graduation project for undergraduate students.

STRATEGIC ACTION 3:

Encourage Interdisciplinary Collaboration between Academic Departments inside and outside the College

Interdisciplinary research and collaboration has become one of the most important sources of innovation within academic institutions and the private sector. To nurture innovation, researchers must step beyond the boundaries of their disciplines to provide innovative solutions. Within the college, academic departments must define the research areas for each faculty member, establish different research laboratories within the department, and introduce other departments inside and outside the college to current research projects.

Operational Steps:

1. Establishing different research labs within each academic department and introducing these labs and their research fields and principal researchers to the rest of the college.
2. Each academic department must create and share information about faculty members, their past and current research projects, and contact information.
3. Each academic department must create and share information about the conferences and scientific journals that are well-recognized in the various disciplines within the department.

STRATEGIC ACTION 4:

Identify Appropriate Incentivizes for Research & Innovation within the Collage for Faculty & Students

Providing various incentives is very important to motivate faculty members and students to conduct different research projects. These incentives must be presented at the college level with a clear and announced mechanism in order for all researchers to be aware of and benefit from them.

Operational Steps:

1. Using different motivational techniques, such as gamification, to encourage faculty and students to conduct more research.
2. Offering various awards to faculty members and students at the college level when publishing scientific research.
3. Raise awareness of the research achievements of faculty members and students at the college and university level by publishing them in various social media platforms.

STRATEGIC ACTION 5:

Ensure that the Environment Can Support Conducting Research in the Highest Standards Possible

The infrastructure of the college should support conducting research projects at the highest standards. The presence of specialized laboratories and the availability of new technologies can help motivate faculty members and students to conduct more research projects.

Operational Steps:

1. Establishing specialized labs within the college and making them available to all faculty members and students.
2. Ensuring that all faculty members have the equipment and technologies required to conduct their research projects.
3. Establishing cooperation programs between the college and the rest of the university's faculties and private sectors to have access to different resources for conducting research projects.

STRATEGIC ACTION 6:

Encouraging Research-Based Entrepreneurship Spirit within the College for Faculty & Students

The role of entrepreneurship in economic and social development has become very important. Research has a share of this development. Linking scientific research with applied research has a clear impact on the development of innovation. Faculty members and students should be motivated to transfer their research projects into business idea. Research and Development (R&D) should be encouraged and given a high priority within each academic department.

Operational Steps:

1. Implement college-wide programs that focus on stimulating research-based entrepreneurship in general.
2. Establishing a unit within the college for business acceleration and transforming research ideas into business idea.

R&I Domains and Areas

The various CCSE departments will be a main factor in achieving the R&I strategies and plans. Within each department, faculty and students will be encouraged to engage in different research and innovation activities that covers various domains and areas.

1. Computer Science and Artificial Intelligence

- 1.1. Computer Vision
- 1.2. Natural Language Processing
- 1.3. Computational Linguistics
- 1.4. Optimizations

2. Data Science

- 2.1. Environmental Data Analytics
- 2.2. Decision Support Systems
- 2.3. Blockchain
- 2.4. Cloud Computing

3. Cybersecurity

- 3.1. Mobile Device Forensic
- 3.2. Digital Rights Protection
- 3.3. URL Filtering
- 3.4. Intrusion Detection and Prevention

4. Computer and Network Engineering

- 4.1. Robots
- 4.2. Autonomous Vehicle
- 4.3. Wireless Communication
- 4.4. Computer Hardware and Architecture

5. Software Engineering

- 5.1. Software Quality
- 5.2. Human-Computer Interaction
- 5.3. Resources Allocation
- 5.4. Software repository

Academic Departments Expected Contributions

Each department within the CCSE is expected to contribute tremendously to different trending and pressing research and innovation topics, including the development of intelligent systems, supply chain management, robotics, smart cities, and cyber-physical systems.

Academic Departments	Intelligent Systems	Supply Chain Management	Robotics	Smart Cities	Cyber-Physical Systems
Computer Science and AI	X		X	X	X
Cybersecurity		X		X	X
Information Systems and Technology	X	X			X
Computer and Network Engineering	X		X	X	X
Software Engineering		X	X	X	X

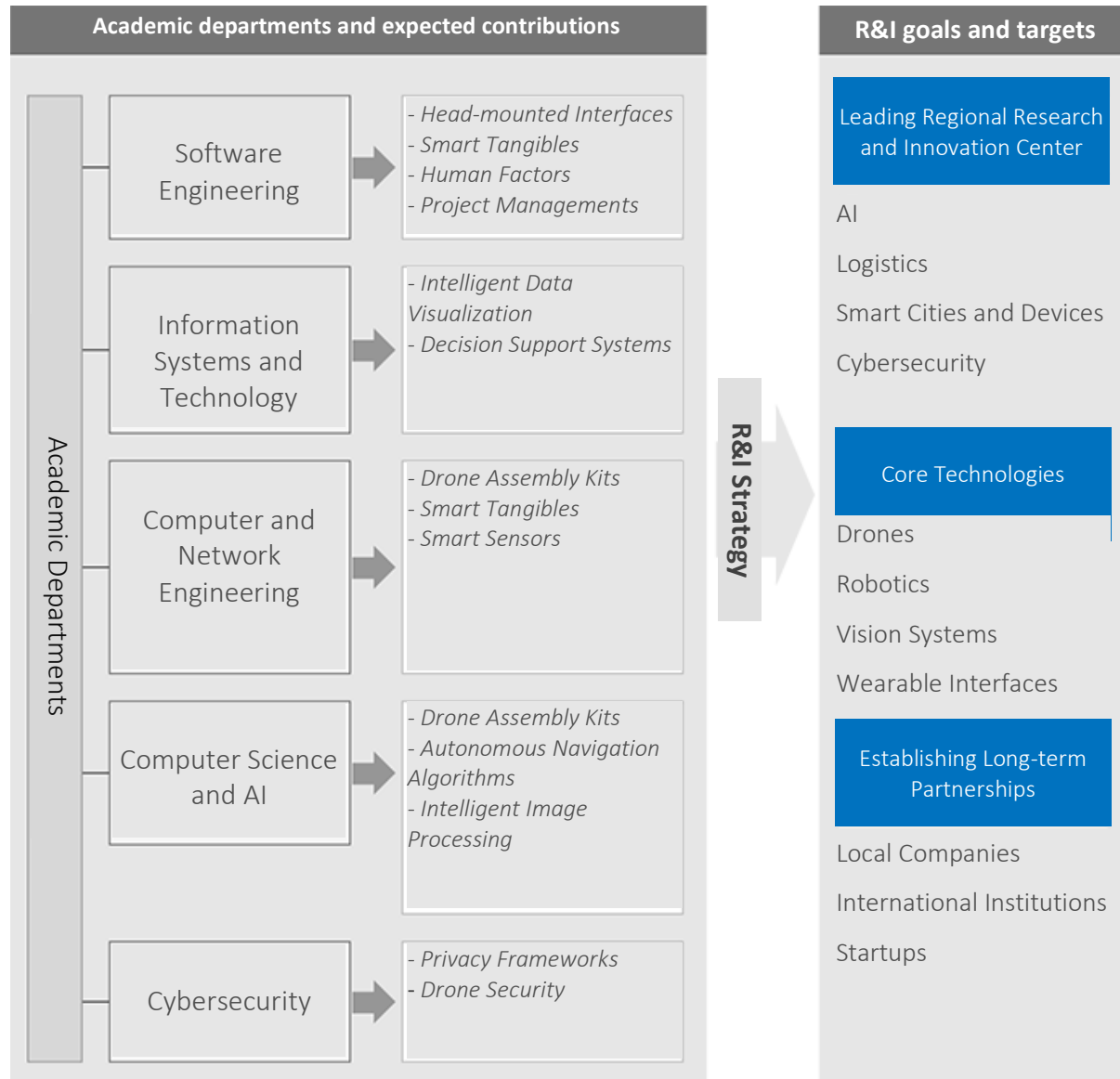
Core Technologies & Alliances

CCSE aims at contributing a verity of products and technologies that will be designed and built by its students and faculty, strengthening our innovation efforts and profitability to overcome local and global challenges. Furthermore, as we strive to achieve our goals and objectives, we will actively acquire new technologies and collaborate with different companies, organizations, and research institutes to gain immediate access to technologies that are not available in-house. The following table showcase a number of core technologies and potential products.

Core Technologies	Potential Products
<i>Drones</i>	<i>Drone Assembly Kits, Autonomous Navigation Algorithms</i>
<i>Robotics</i>	<i>Autonomous Robots, Smart Tangibles, Teleoperated Robots</i>
<i>Vision Systems</i>	<i>Vision Detectors, Smart Sensors, Intelligent Image Processing</i>
<i>Wearable Interfaces</i>	<i>Electronic Textiles, Body Sensors, Head-mounted Interfaces</i>

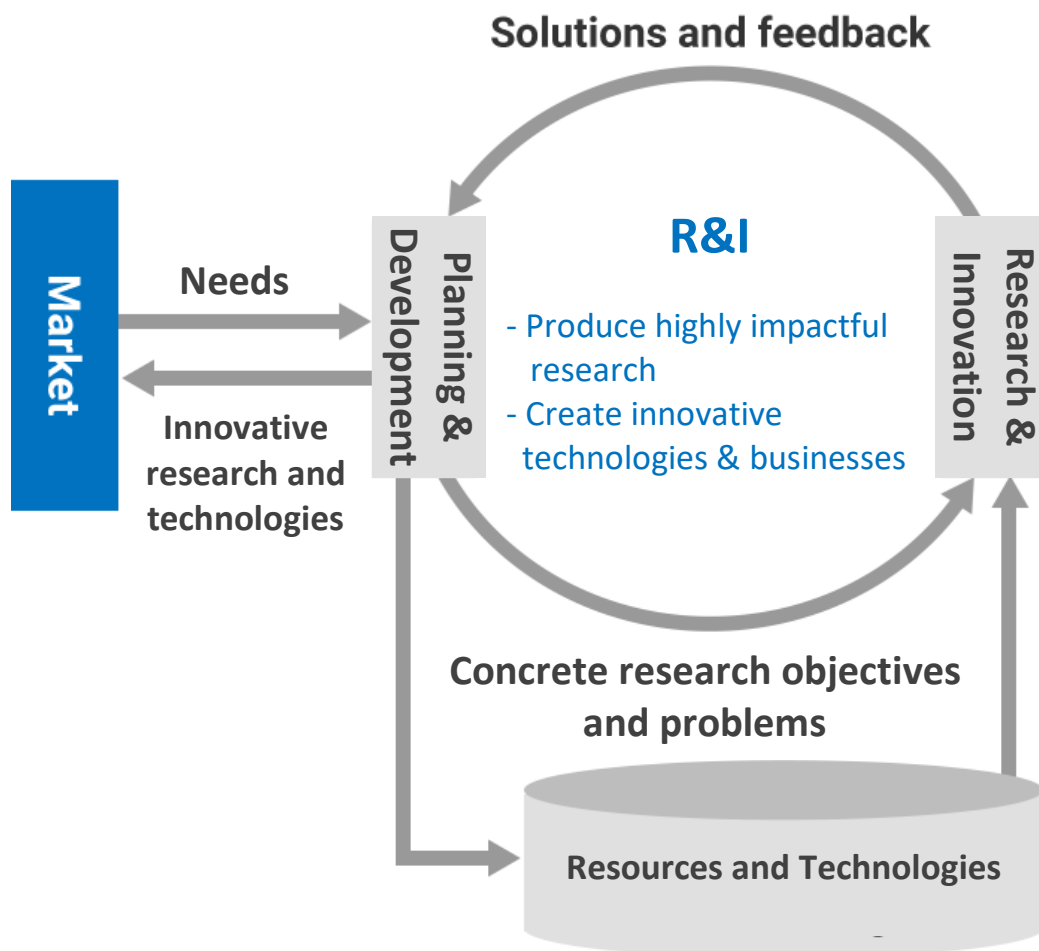
Technologies and Products

A variety of products and technologies will be designed and built by CCSE. The following figure shows how such technologies would be used to produce these different products and how they will contribute to the overall R&I's strategies.



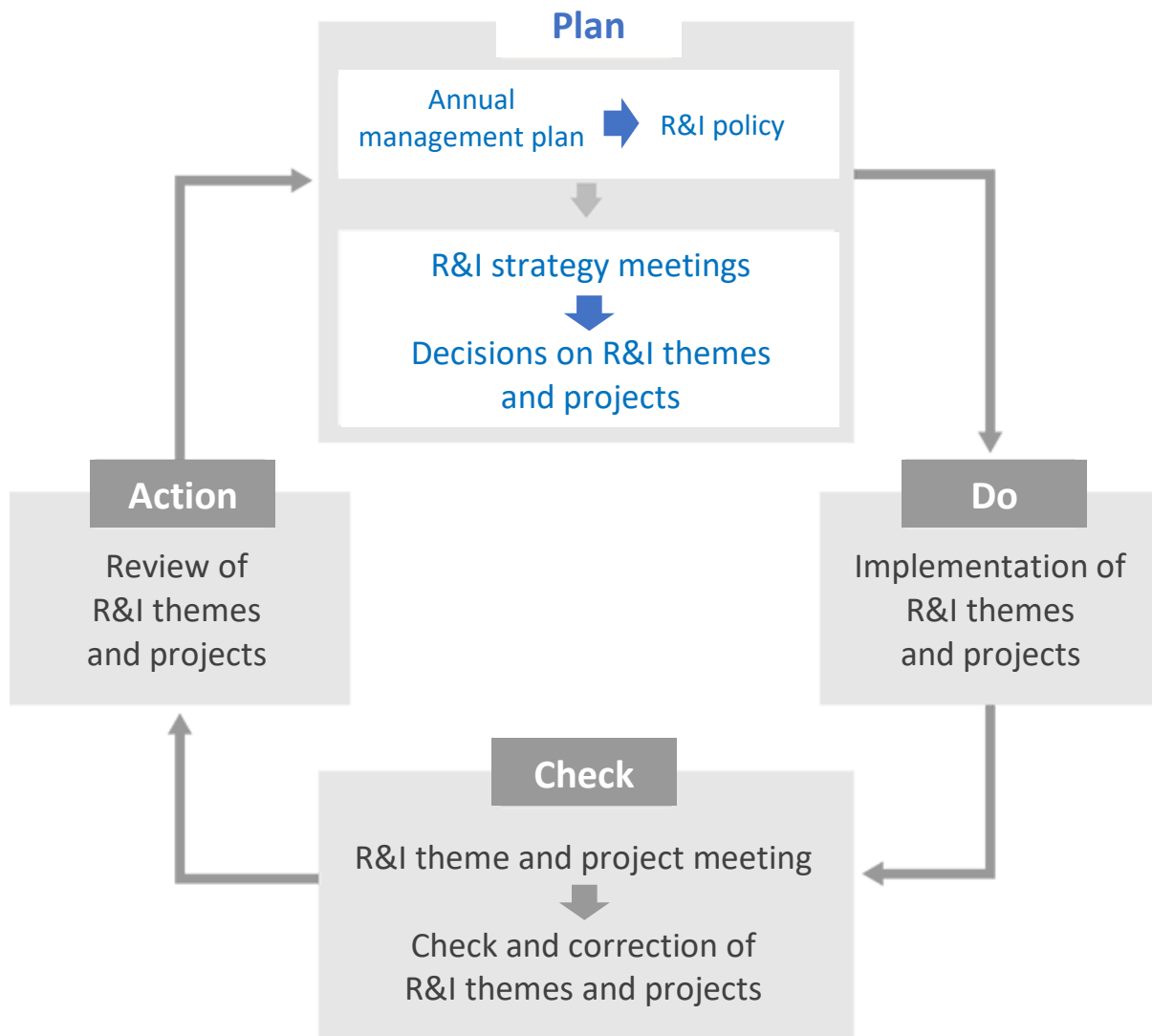
Research and Innovation Lifecycle

To realize our R&I strategies, CCSE makes its R&I committee select appropriate themes and review them annually according to market needs and the available resources and technologies within the college and the established R&I collaborations with different local and international research laboratories to effectively produce innovative research and technologies.



Research and Innovation Review Plan

To increase the efficiency of college-wide research and innovation activities, our R&I strategies are project-oriented and are annually reviewed the R&I committee as shown below.



Research and Innovation Laboratories

CCSE will establish 4 research laboratories, as an initial step to achieve our R&I objectives. These laboratories will directly report to the R&I committee. Each laboratory has its own R&I responsibilities that contribute to designing and building different technologies and conduct a variety of applied and academic research. All of these research laboratories will primarily focus on achieving CCSE's R&I goals and targets.

R&I Laboratories	
	CCSE Departments
Artificial Intelligence Laboratory	Computer Science and AI
	Information Systems and Technology
Robotics and Drones Laboratory	Computer Science and AI
	Computer and Network Engineering
Smart Logistics Laboratory	Computer Science and AI
	Computer and Network Engineering
	Information Systems and Technology
	Software Engineering
	Cybersecurity
Software & Human Laboratory	Software Engineering

Research and Innovation Data

In order for CCSE to continue to develop as a highly competitive and widely recognized R&I college, we will make strong efforts in increasing our research and innovation projects. The number of faculty currently engaged in R&I activities are a total of ##, and the number of undergraduate and graduate students engaged in R&I activities are approximately ####. These numbers encourage us to continue building our human and technology infrastructure to be able to achieve our R&I goals and objectives.

Current Research & Innovation Efforts

CCSE has, and continues to, contribute to research and innovation projects all over the world with its rich experience as a young R&I hub. The following figure shows the amount of scientific research papers and innovative projects that has been published in conferences and journals by CCSE students and faculty in the past 5 years. This increasing number prove that our CCSE college is capable of contributing to local and global R&I efforts and is in the process of becoming one of the highly competitive and widely recognized R&I colleges in the region.





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