OFFICE OF RESEARCH, INNOVATION & COMMERCIALIZATION (ORIC)

NU FAST ORIC HANDBOOK

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Preface

It is given me immense pleasure to share the first cut of ORIC Handbook. The motif is to provide a ready reckoner that shall facilitate the researchers.

Your inputs would be appreciated to improve the content and usability. Wish you a fruitful journey into result oriented research.

Dr Ataul Aziz Ikram

Director ORIC

CHAPTER 1

Office of Research, Innovation & Commercialization (ORIC)

HEC aims to develop and sustain a dynamic and internationally competitive research sector in Pakistan that makes a major contribution to economic prosperity, national wellbeing and the expansion and dissemination of knowledge. Promotion of Research is one of the core strategic aims of HEC. Through the program and initiatives launched by HEC for strengthening research and the process of knowledge creation, the quality and research output emanating from the universities and institutes in the country have shown tremendous improvements.

Office of Research, Innovation and Commercialization (ORIC) has been established at FAST NU in line with the guidelines of the Higher Education Commission (HEC). ORIC is very actively working to promote research and commercialization activities and academia industry collaboration at FAST NU. ORIC a provides services related to research and development, innovation, industrialization, commercialization, collaborations, seminars, workshops, submission and approval of research projects/proposals/ grants/funding/awards.

VISION

The vision of ORIC (Office of Research Innovation and Commercialization) at FAST-NUCES is to promote and support research, and innovation keeping in view local context. We want to take Pakistan forward by continuously improving quality of education, building partnerships with the industry, and being able to capitalize on outcomes that result from R&D activities.

ORIC ROLE

ORIC consist upon three important wings

1. Research Development and operation
2. Innovation
3. Research Commercialization/entrepreneurship

ORIC activities will revolve around the following research cycle to ensure research impact on economy and society.

Research Innovation Commercialization Cycle

FAST NU ORIC POLICIES

1. CONFLICT OF INTEREST (COI) POLICY

This policy addresses conflict of interest (COI) so as to ensure highest standards of ethics and integrity and to protect organizational interests and reputation and to prevent its work and protect Board members and its employees from potentially damaging instances of impropriety arising from conflict of interest issues. The objective is that members must carry out their work in an environment that is free from any suggestion of improper influence and take all reasonable steps to avoid being in an actual, apparent or potential conflict of interest. The conflict of interest may arise in a situation where financial or other personal or professional considerations compromise an individual's objectivity, professional judgment and ability to perform his or her professional responsibilities to the University.

System of Monitoring Ethical Standards in Research and Scholarly Work

This policy aims to ensure that research conducted at the University is of the highest ethical standard and applies to all University staff and students, full time, part time, casual or adjunct faculty.

Policy Statement

As an educational institution, the University recognizes its responsibility to ensure that all research activities are conducted in accordance with the highest ethical standards and complies with relevant legal, regulatory, professional and ethical requirements and standards. The University is also committed to promoting research culture and conducive environment.

Core principles

The University expects its employees, or any other person conducting research on University premises, to abide by the University's normal expectations of good practice in research and to take all reasonable steps to ensure that ethical conduct of research is observed at all times. The University is committed to conducting research based on the following core principles:

High Standards: Researchers are expected to strive for excellence and the highest ethical standards when conducting research.

Honesty: Researchers are expected to be honest in respect of their own actions in research. Honesty must be ensured in all aspects of research, in presentation of findings, reporting on research methods and procedures, gathering data, using and acknowledging the work of other researchers and conveying valid interpretations and making justifiable claims based on research findings.

Openness and transparency: The University encourages researchers to be as open as possible in discussing their work with other researchers. Transparency and open communication is to be observed in the reporting of research, data collection methods, analysis and interpretation of data, research findings and in presenting the work to other researchers.

Accountability: Researchers are expected to ensure that the work they undertake is consistent with the expectations of the University and funders of research.

Integrity: All individuals involved in research are expected to observe the highest standards of integrity, honesty and professionalism in respect of their own actions in research. This applies to the conducted of research exercise in designing studies and experiments;

generating, recording, analyzing and interpreting data, sharing data, applying for funding; presenting and publishing results and acknowledging the contribution of others.

Equal opportunity: The University aims to promote and provide equality of opportunity for all who are part of its research community. Researchers are expected to treat individuals with dignity and respect and respond positively to different needs and circumstances in carrying out their research.

Safety: The University and its researchers will ensure the dignity, rights, safety and well–being of all involved in its research, and avoid unreasonable risk or harm to its research subjects, participants, researchers and others.

Confidentiality of information given by participants, and the anonymity of subjects, must be respected at all times and documentation protected accordingly.

In addition to these core principles, researchers should ensure that their research is conducted according to appropriate ethical, legal and professional frameworks, obligations and standards. This includes seeking ethical approval for research where appropriate. Researchers are also expected to treat colleagues with integrity, honesty and collegiality, including the fair provision of references and peer review.

2. INTELLECTUAL PROPERTY RIGHTS (IP) POLICY

➤ Intellectual Property laws of Pakistan include the copyright laws, patent laws and trademark laws. This area of law protects the work of creative individuals and businesses from unauthorized use or exploitation by third parties. By utilizing Intellectual Property laws, creators and innovators can fully protect and benefit from their creations.

➤ Pakistan is a signatory to World Trade Organization (WTO), which aims to increase international trade. Under the provisions of this agreement all states which subscribe to WTO become bound to a mutual recognition of intellectual property rights at a higher level of protection that the older conventions could offer. Pakistani intellectual property laws take into account the provisions of WTO.

➤ Further, Pakistan is a signatory to the Berne Convention for the Protection of Literary and Artistic Work of 1886 and the Universal Copyright Convention of 1952 and Agreement on Trade Related Aspects of Intellectual Property Rights, 1995 (the "TRIPs"). The Berne Convention's basic requirement is that each member state must follow the principle of national treatment where, in case, the country of origin of a

work is a Berne state, other members must accord to the work the same treatment as they offer to their own national.

➢ The TRIPs is an international treaty administered by the WTO which sets down minimum standards for most forms of intellectual property (the "IP") regulation within all member countries of the WTO. TRIPs deals with: copyright and related rights, such as rights of performers, producers of sound recordings and broadcasting organizations; geographical indications, including appellations of origin; industrial designs; integrated circuit layout-designs; patents, including the protection of new varieties of plants; trademarks; trade dress; and undisclosed or confidential information, including trade secrets and test data.

➢ Pakistan Penal Code provides punishment under sections 478 to 489 against infringement of trade, property and other marks. This shows both international and national ramification of IP laws. Owner of the exclusive licensee of copyrights in case of an infringement, are entitled to all such remedies by way of injunction, damages, accounts and otherwise as are conferred by law for the infringement of a right. Similarly, the holder of a valid Patent in Pakistan shall have the right to prevent the third parties, not having owner's consent, from the acts of making, using, offering for sale, selling, or importing and having the right to assign, or transfer by succession, the patent and to conclude licensing contracts.

➢ The proprietor of a registered trade mark shall also have exclusive rights in the trade mark. The infringement of the registered trade mark shall entitle its proprietor without prejudice to the rights to obtain any relief, by way of damages, injunctions, accounts or otherwise as is available in respect of the infringement of any other property right, under any law for the time being in force, the proprietor shall also have the right to obtain relief under the Ordinance if the trade mark is infringed.

3. JOURNAL RANKING AND REWARD POLICY FOR RESEARCHERS

The University has adopted excellence measures for publishing research into the journals that not only uphold publishing requirements in prestigious venues but also rationalizes "recognition and reward" atmosphere. It shall help the University in improving pedestal of research output from its platform in due course of time.

Key envisaged objectives are as under:

- To curb unethical practices of some publishers who artificially inflate IF (impact Factor) of their journals to make money and to adopt quality criteria for publications in quality journals.
- The quality criteria should consist of a number of publically available measures.
- The quality criteria should be (as much as possible) subject or domain independent.
- Minor deviations from one knowledge domain to another are to be allowed.
- Support research publication in top ranked journals (international and local).
- Be an active participant in global research.
- Encourage networking with world-wide researchers.
- Motivate diversification of academic outcomes

CHAPTER 2

Research

FUNDING ORGANIZATIONS

This section presents selective list comprises funding agencies, which sponsored research actives in universities.

1. Higher Education Commission

The HEC also facilitated the development of higher educational system in the country with main purpose of upgrading the universities and colleges in the country to be focal point of the high learning of education, research, and development. Over the several years, the HEC plays an important and leading role towards building a knowledge based economy in Pakistan by giving out hundreds of doctoral scholarships for education abroad every year. Following are the grants offer by HEC

Services	Grant	URL
Students	Technology Development Fund	http://hec.gov.pk/english/services/students/TDF/Pages/Intro.aspx
Faculty	HEC Research Travel Grant	http://hec.gov.pk/english/services/faculty/HEC%20Research%20Travel%20Grant/Pages/HEC-Research-Travel-Grant.aspx
	Start-Up Research Grant for fresh PhD holder	http://hec.gov.pk/english/services/faculty/Start-Up%20Research%20Grant%20Program/Pages/Introduction.aspx
	University - Industry Technology Support for Researchers	http://hec.gov.pk/english/services/faculty/University%20Industry%20Technological%20Support%20Program/Pages/Introduction.aspx
	Thematic Research Grants Program	http://hec.gov.pk/english/services/faculty/trgp/Pages/default.aspx
	National Awards for Outstanding Researchers	http://hec.gov.pk/english/services/faculty/HEC%20Outstanding%20Research%20Awards/Pages/Introduction.aspx
University	Offices of Research, Innovation and Commercialization (ORICs)	http://hec.gov.pk/english/services/universities/ORICs/Pages/default.aspx
	Grant for Repair and Maintenance of Scientific Equipment	http://hec.gov.pk/english/services/universities/gspme/Pages/default.aspx
	Grant to Organize Seminar, Conference and Training Workshop	http://hec.gov.pk/english/services/universities/GrantsforSeminarConferenceTraining/Pages/Introduction.aspx

	Institutional Strengthening Grant for Upgrading Laboratories and Libraries	http://hec.gov.pk/english/services/universities/InstitutionalStrengthening-GrantUpgradingLaboratoriesLibraries/Pages/ISULL.aspx
	National Research Program for Universities	http://hec.gov.pk/english/services/universities/nrpu/Pages/Introduction.aspx

2. Pakistan Academy of Sciences

The aim of Pakistan Academy of (PAS) is to promote higher studies and research on pure and applied sciences in Pakistan and to disseminate scientific knowledge; to formulate standards of scientific effort and achievement in Pakistan and to recognize outstanding contributions to the advancement of science.

Grant	URL
Research Grant	http://www.paspk.org/research-grants/
Travel Grant	http://www.paspk.org/travel-grants/
Financial Support for Conferences	http://www.paspk.org/financial-support-for-conferences/

3. National ICT R&D Fund

The goal of National ICT R&D is to create industry-academia partnership by funding concrete development and research initiatives. Enhance the national ICT related human resource development capacity manifolds by facilitating industrial demand focused human resource capacity building and R&D capabilities in the country and promoting ICT related educational programs and activities

Grant	URL
Technical Development and Research Project	http://www.ictrdf.org.pk/index.php/proposal-statuswwww/submit
Human Resource Development Project and Scientific Event	http://www.ictrdf.org.pk/index.php/proposal-statuswwww/submit

4. WWF-Pakistan

WWF-Pakistan aims to conserve nature and ecological processes by: Preserving genetic, species, and ecosystem diversity. Ensuring that the use of renewable natural resources is sustainable, both now and in the longer term. Promoting action to reduce pollution and the wasteful exploitation and consumption of resources and energy.

Grant	URL
Small Grants Programme	http://www.wwfpak.org/sgp/index.php

5. Science Foundation

The aim of Pakistan Science Foundation is promoting and popularizing science for socio-economic development Create culture of inventions and innovations. Advance science and technology to accelerate socio-economic development. Motivate youth towards career in science through a variety of viable science popularization programs

Grant	URL
Small Grants Programme	http://www.wwfpak.org/sgp/index.php
Institutional Support	http://www.psf.gov.pk/institutionalSupport.aspx
Support to Scientific Societies	http://www.psf.gov.pk/scientificSocietySupport.aspx
Grants for Publication of Journals	http://www.psf.gov.pk/publicationSupport.aspx
Grants for Awards and Fellowships	http://www.psf.gov.pk/awardsAndFellowshipsSupport.aspx
Grants to Science Conferences, Seminars and Workshops	http://www.psf.gov.pk/scienceConferenceSupport.aspx
Travel Grant	http://psf.gov.pk/travelgrant-notice-2016.aspx

6. Pakistan Scientific and Technological Information Center (PASTIC)

The aim of Pakistan Scientific and Technological Information Center (PASTIC) is to serve as an Information Provider for Research & Development enhancing access to and delivery of information by catering to the information needs of Researchers, Entrepreneurs, Industry, Educationists, Policy Makers and Planners through anticipatory and responsive Information Services.

Funding Agency	URL
Pakistan Scientific and Technological Information Center (PASTIC)	http://pastic.gov.pk/

RESEARCH LABS

Several independent research labs engage FAST NU faculty and students from across the university. Multiple funding agencies and university department sponsor these labs. Following is the brief overview of multiple research labs running in FAST NU.

1. NU FAST Islamabad Campus

i. Software Quality Engineering and Testing (QUEST) Center

The Software Quality Engineering and Testing Center (QUEST) focuses on engineering of reliable and dependable software systems. Quality Engineering and Testing of software systems is an active research area and is receiving a lot of attention worldwide. However, catastrophic software failures are still reported frequently. There is an ever-increasing need to develop better quality software by using systematic engineering techniques. For this purpose, the center will investigate the use of model-driven approaches for developing high quality software.

Almost all professionals in software industry agree on the need to thoroughly test the developed software. However, the actual testing process is severely hindered by lack of automation. Software testing is a time-consuming process that requires specific expertise and automation to be cost-effective, which are often not available in industry.

Current Projects

➢ Integrated Toolset for automated model-based testing – MBT-Toolset (National ICT R&D Funded) Collaboration: Simula Labs, Norway.

➢ Automated model based constraint solver. Collaboration: SnT, Luxumbourg

➢ Automated Re-factoring of UML Models. Collaboration: Cisco Systems Inc.

➢ Automated testing of model transformations

➢ Model based development of dependable mobile applications

Impact Factor International Journal publications from QUEST in 2013/2014

➢ Muhammad Zohaib Iqbal, Shaukat Ali, Tao Yue, Lionel Briand, Applying UML/MARTE on Industrial Projects: Challenges, Experiences, and Guidelines, Accepted for publication in Software and Systems Modeling Journal (SoSyM), 2014

- Shaukat Ali, Muhammad Zohaib Iqbal, Andrea Arcuri, Lionel Briand, Generating Test Data from OCL Constraints with Search Techniques, in IEEE Transactions on Software Engineering, 39(10): 1376-1402, 2013.
- Muhammad Zohaib Iqbal, Andrea Arcuri, Lionel Briand, "Environment Modeling and Simulation for Automated Testing of Soft Real-Time Embedded Software", in Software and Systems Modeling Journal (SoSyM), 2013.

ii.   Software Engineering Research Center (SERC)

The objectives of this centre are to carry out research and development in software engineering and allied application areas. The centre promotes theoretical research in the software engineering area, resolve problems faced by the software industry, and helps establish software engineering practices in the industry. Through SERC, the University seeks to help and support the local software industry in establishing and improving their processes and practices through continuous feedback and training. SERC aims to achieve these objectives by collecting the industry data to understand productivity, cost, and quality parameters. This will hopefully also help in developing more suitable process and lifecycle models for different types of projects being undertaken by our local industry in the offshore and distributed environment. Software Architecture, Software Project Management, Software Quality and Process Improvement are main areas of research.

Sample Projects Completed
- Software Maintenance Prediction: An Architecture Perspective.
- Coverage Analysis for GUI Testing.
- Intelligent Requirement Prioritization using Fuzzy Logic.
- Proposing Architecture for Grid Monitoring Tools.
- Tracing Architecture Decisions to Requirements.
- Proposing Software Project Management Methodology.
- Integrated service-oriented architecture (SOA) environment.
- Software Architecture for 2D Mobile Game Development.
- Sense Me (A virtual interface).
- Authenticated identification system.

On-going Projects
- Framework and Software Architecture for Information Assurance and Regulatory Compliance ("FAIR")

- A Generic Model for Testing Agent based Applications
- Software Effort Estimation using Evolutionary Computation Techniques
- Widget-Based Application Composition Framework

iii.   Management Advancement Research Centre - MARC

The Management Advancement Research Centre (MARC) was established at FAST_NUCES Islamabad to conduct leading edge research in management sciences with the aim to enhance knowledge and find solutions for industry challenges. Various Special Interest Groups (SIGs) work under MARC, all committed to taking up projects which contribute to the body of knowledge, yet at the same time provide a bridge between academia and practice. The Leadership and Management SIG has carried out various projects on leadership, cross-cultural HRM and performance management over the past few years. International projects and partnerships include work with the Cross-Cultural Management Network (CCMN) under which the main past project covered trust and leadership across cultures, while the current project is based on leadership behaviors, trust and job embeddedness across cultures. Another landmark project of the SIG includes collection of data on GLOBE's cultural dimension in Pakistan and comparison of Pakistan with 61 GLOBE countries in collaboration with the GLOBE team and the Thunderbird University. The lead researcher has also been involved in various projects on performance management to improve industry practices, and has a special interest in using data to improve HR practices.The Project Management and the Organizational Behavior SIGs are recent additions to expand the scope of MARC. The team's expertise includes behavioral decision making in project management, justice, creativity, organizational politics, workplace stressors and psychological stressors. The SIG researchers have various publications in the above-mentioned areas and are interested in working with industry to improve organizational practices. Extensive research has been carried out on Islamic Finance under the Islamic Finance SIG. The lead researcher has published two books on Islamic Finance and has published numerous articles on the subject. The SIG is interested in working closely with the Islamic banks and the Islamic finance industry to refine practices.Extensive research has been carried out on Islamic Finance under the Islamic Finance SIG. The lead researcher has published two books on Islamic Finance and has published numerous articles on the subject.

iv.   ReVeaL (Recognition, Vision and Learning) Research Group

ReVeaL is a research group that focuses on applied research in Visual Recognition, Computer Vision and Machine Learning for solving real-world large-scale complex problems.

In ReVeaL the goal is to conceive, design and develop recognition systems that can recognize and understand the content of an image (or video) and then make informed decisions or recommendations. Building such systems not only demands solutions for complex recognition and inference problems but also requires answers to challenging computational questions.

v.   Artificial Intelligence & Machine Leaning [AIM]

The primary motivation for the creation of this group is to encourage the development and understanding of Artificial Intelligence (AI) and its applications in our students and faculty members. It promotes inter-disciplinary exchanges between AI and other fields such as information processing, energy management etc. Its principal focus is to maintain a sustainable research base aimed for graduate and post-graduate students within relevant research areas. This research group emphasizes on the areas of Computational Intelligence, Machine Learning and Data Mining. We explore the applications of the algorithms and techniques from these areas, in real life scenarios. The group has ongoing research work that investigates the creation of automated and independent learning within machines. Some areas where our research work is applied include Game AI, Social Computing, Knowledge Management, as well as other classical areas of research such as function optimization in dynamic or time variant environments.

vi.   EPIC (Embedded Systems & Pervasive Computing) Lab

Electrical Engineering Department hosts the Embedded Systems & Pervasive Computing (EPIC) Lab that as the name suggests, encompasses research and development activities in the broad areas of Embedded Systems, Internet of Things (IOT), Cloud Computing and integration of software and hardware systems. It is headed by Dr. Ataul Aziz Ikram, Professor, Department of Electrical Engineering. Currently, a Higher Education Commission (HEC) funded National Research Program for Universities (NRPU) project is being executed by Dr. Ataul Aziz Ikram, Principal Investigator. The title of the project is "Implementation of a multi-device multi technology cloud, performance evaluation and customization for commercial applications". The project is in collaboration with the University of Gujrat, Hafiz Hayat Campus, and the Co-Principal Investigator, Dr. Zia- Ul Qayyum, who is also the Vice Chancellor there.

vii. HALP (Huawei Authorized Learning Partner)

To bridge the gap between academia and industry, the University has joined hands with Huawei Technologies to establish a training center at its Islamabad campus. It is now a "Huawei Authorized Learning Partner (HALP)" and is able to deliver Huawei Certified Network Associate training program. The three programs currently offered include HCNA Unified Communications and HCNA Storage and HCNA Routers and Switches. Six batches that constituted Industry Professionals and University Alumni have successfully completed HCNA training from HALP.

2. NU FAST Karachi Campus

i. LLC Language Learning Centre

FAST-National University lays special emphasis on the ability of the students to effectively communicate their professional abilities. In order to augment their soft skills—communication adeptness, leadership talent, and managerial capacity—LLC, established at the Karachi campus is equipped with twenty-five work stations, provided for by state of the art hardware and most modern Interactive Language Software, and other allied pedagogical tools and techniques. The exquisitely furnished Centre affords students an opportunity to polish their language and communication skills both in English as well as foreign languages. Apart from offering lab sessions as course components of regular courses, i.e., English Language, the Centre also holds workshops, training courses, and activities in other Foreign Languages as well. The Centre also offers short courses for professionals from industry and students within in English and foreign languages like Arabic, Chinese, French, German and Korean. This computer assisted language learning centre with video camera recording and discussion arenas, trains students in basic presentational skills, group discussions, interviews, communication and perception, creative and innovative thinking skills, etiquettes, public speaking, model speaking through movie sessions and live television programs, spoken English, phonetics and phonology, pronunciation, sound and spelling, stress and intonation, word focus, and Language Varieties(British and American).

ii. Centre for Research in Ubiquitous Computing

Ubiquitous Computing (computing everywhere for everyone) promotes the idea of integrating computation into the environment, rather than having computers in daily life. The idea will enable people and machines to move around and interact with information and computing in informal way, to sense changes in their environment and to automatically adapt and act based on these changes

CRUC was established in March 2006 and has several faculty and student members including 10 Ph.D. fellows working on diverse projects and ideas within this domain. More than 40 research papers are published in International conferences and Journals by the Centre in last 2 years. The Centre has active collaboration with researchers and faculty members of universities of Australia, China, USA, UK and UAE. The Centre has funding by Microsoft and support from European Union, ICT R&D and HEC.

The CRUC has also offered several Doctoral and Graduate level courses to equip students with latest challenges of computer science. It is regularly arranging seminars and workshops on different areas where researchers present their ideas. At least one research conference is arranged at each year where graduating students present their findings.

Under the umbrella of Ubiquitous Computing, we are working in the areas of Augmented and Virtual Reality, Human Computer Interaction, Multi Agent Systems, Grid and Cloud Computing, Robotics & Sensor Networks, Workflow Systems, Provenance Systems and Agri Informatics.

iii. Management Science Research Centre

Karachi is the hub of major business and economic activities in Pakistan. A large number of business centres and industries are spread all around the city. Karachi port, stock exchange and a cluster of multinational companies are providing unique opportunities of international trade and business here. Management Science Research Centre aims at providing a platform to offer research-based academic solutions of business and economics problems prevailing in today's organizations. The centre has collaborations with local entrepreneurs and international companies.

iv. Systems Research Laboratory

URL: syslab.khi.nu.edu.pk

SysLab focuses on research and development of Cloud Systems, Internet-based distributed systems, and mobile applications. Research at SysLab is inspired by many considerations related to Security, Scalability, Quality of Service, Performance Enhancement, and Usability of these systems.

Motivated by recent advancements and popularity of Cloud Computing and High Performance Computing systems, SysLab also focuses on research and development of these two different but related domains. Cloud Computing can yield enhanced performance and usability for different mobile and Internet-based applications. Similarly, High Performance Computing can catalyze solution for many computational problems and yield increased performance for various applications. Further, technological advancements related

to Smart city and Internet of Things, emergence of smart grid, and integration of mobile and cloud, has open new opportunities for research. SysLab team is concentrated on architecture and design of these systems and development of various applications which can benefit from emerging research technologies.

A few of the ongoing projects are listed below:

A few of the ongoing projects include volunteer Computing on heterogeneous platforms, Smart City and Smart grid, GPGPU Computing, Internet of Things, Bio Informatics over Cloud, Heterogeneous Parallel Computing, Cyber Security for Smart City, Multimedia Wireless Sensor Networks, Security in Smart phones, and Botnet detection and Mitigation. SysLab has received research grants from NVIDIA and IEEE TCPP. It is also Pakistan's first and only NVIDIA Research Centre.

V.   The Machine Intelligence Group

The group focuses on multiple aspects related to machine learning, computer vision, data and text mining, and information retrieval.

Computer Vision focuses on giving machines the ability to understand visual input. The ability to automatically extract information from visual input finds its applications in video surveillance at airports, streets, banks, old homes, schools, in medical imaging to assist in diagnosis and surgeries, in human computer interaction (playing games, controlling computers with gestures, etc), in exploration of outer-space, and other areas of scientific research. Machine Learning provides exciting aspects for enhancement and automation.

The group also focuses on knowledge discovery from textual data. It is involved in extracting unstructured text, processing of information, converting into structural form for meta representation, associating semantics information, and performing innovative task specific processing. Some of the ongoing projects of the group include video surveillance, object classification and search, action activity recognition, and the analysis of crowded scenes. On the information retrieval side, the group is currently focused on Document clustering, Text summarization, Sentiment analysis, Named entity/event information mining, and web search and ranking. The algorithms and techniques proposed during last five years from the group received excellent citation from the research community.

3. NU FAST Lahore Campus

i. Big Data Lab Establishment

A Big Data lab has been established in Lahore campus. The use of Big Data is becoming a crucial way for leading companies to outperform their peers. In most industries, established competitors and new entrants alike, leverage data-driven strategies to innovate, compete, and capture value. Big Data will help to create new growth opportunities, and also entirely new categories of companies, such as those that aggregate and analyze industry data.

ii. Centre for Information Visualization and Intelligent Computing (Civic)

Centre for Information Visualization and Intelligent Computing (CIVIC) has been established at the Lahore campus with the aim of conducting research in various areas of Intelligent Computing, Knowledge Engineering, Image Processing and Computer Graphics. Many groups are actively participating in research and development under the umbrella of CIVIC.

Projects

Following is a list of the current research projects undertaken by CIVIC:

➢ Surveillance Eye: The system provides the user with Automated Intelligent Surveillance in order to monitor malicious activities at entry points in various buildings.

➢ Needle 1.0: Construction of a 3D dynamic scene using the least number of cameras possible.

➢ The lounge: Creation of an effective and easy graphical interface for new users of the Windows XP operating system.

➢ MB 1.02: The system enables content based image and video re-ranking and prioritization capabilities using novel clustering techniques.

➢ AELTS: Adaptive English language teaching tool (proposal submitted for funding).

➢ Development of intelligent tutoring system using techniques in user and cognitive modeling.

➢ Mixture modeling for causal feature selection.

➢ Development of novel and improved algorithms for unsupervised clustering.

➢ Fair path planning using Pythagorean hodograph quintic spiral functions.

➢ Energy efficient motion planning for nonholonomic (car like) mobile robots using cubic spirals.

➢ An evolutionary fair path planning for mobile robots with obstacle avoiding.

➢ Capturing outlines of planar images.

- Surface reconstruction with spline functions using evolutionary heuristics.
- Psyche Mining using automated psyche features extraction from text documents.
- DSD Studio: Construction of Database Schema Designer Studio using database design theory and methodology.

iii. Multi-Media Lab (MML)

This lab is developing innovate techniques for efficient communication of voice, video and data, especially in the internet connected world. Limited bandwidth of transmission medium (wire-line and wireless) and user's demand for good quality of service pose interesting challenges for the researchers.

Specific areas of work in Computer Networks include providing QoS in the WLANs for real-time multimedia communication, Statistical modelling of the MAC layer for delay and throughput analysis, cross-layer design for improving performance over wireless networks, and joint source-channel encoding for image and video. In wireless communication, the research focuses on exploiting MIMO technology in order to develop algorithms to achieve higher data rates at low errors. This includes analysing system performance under various channel conditions and designing coding schemes to mitigate the effects of channel impairment.

One of the projects, entitled, "Dynamic Scheduling and Call Admission Control for Quality of Service (QoS) Provision in Real-time Multimedia Application over IEEE 802.11e Wireless Local Area Networks (WLANs)" was funded by the PTCL R&D Fund for Thematic Research Grant. The goal of this research was to develop novel scheduling and call admission control (CAC) mechanisms for IEEE 802.11e WLANs. Outcome of this research was development of a novel scheduler, named Proportional Increase and Multiplicative Decrease (PIMD), and a measurement based CAC algorithms. Both algorithms have been published in the proceedings of International refereed conferences. As an extension to this project, modelling and delay analysis of real time multimedia streams (voice and video) over WLAN is being done with an aim to achieve optimal admission control that adapts to dynamic network conditions. Mathematical analysis of PIMD for its suability in various network configurations is being investigated.

In MIMO wireless communication systems, analytical modelling under various fading channels and employing hybrid system (BLAST vs. STBC) are current areas of research. Work is also being done on enhancing combating capabilities of system against variations and inherent interference present in fading. The MIMO systems are being analysed by including pre-coder and multi-user detection. The future direction of the research

is towards developing communication and network algorithms for implementation for the upcoming 4G –LTE and mobile wi-max systems.

iv.   **Centre for Research on Management and Governance (CRMG)**

CRMG is established by the FAST School of Management, Lahore Campus ("FSM") to motivate research on the impact of management and governance philosophies on the art and practice of these disciplines. The centre is jointly run by Dr Hamid Hassan, Dr Zia Khan and Dr Akbar Azam. Dr Hamid Hassan was Visiting Research Fellow at the Institute of International Affairs, Aichi University, Nagoya campus, Aichi, Japan working in coordination with Prof. Yasuo Hoshino of Aichi University, on "Role of Leadership in the Organizational Success". Some of the recent results of research endeavors at CRMG are as following.

➢ Hussain, M and Hassan, H (2015). Military Leadership and implications of business leaders in the light of alternative theories. Pakistan journal of Science, Vol. 67 No. 1

➢ Idrees, F. ,Hassan, H. and Ghauri, T. K. (2015). "Study on Brand Relevance: Cross Category and Cross Gender Comparison, the Case of Pakistan." International Journal of Economics and Empirical Research. 3 (5), 211-223.

➢ Hassan, H. Asad, S. and Hoshino, Y (2015). "Sketching the leadership-personality link by using representative leadership styles and big five personality dimensions." Annual Tokyo Business Research Conference, held at Shinjuku Washington Hotel, Tokyo, Japan. (November 9-10, 2015)

➢ Hassan, H., Omar, F. and Hoshino, Y (2015). "Relationship between negative perceptions of organizational politics, job satisfaction, organizational commitment and creative propensity in employees." The 18th Annual Meeting of Japanese Association of Administrative Science, held at the Nagoya Campus of Aichi University, Nagoya Shi, Japan. (November 14-15, 2015)

➢ Hassan, H. Asad, S. and Hoshino, Y (2015). "Gauging the effect of elements of training and trainees' characteristics on task and contextual performance." The 18th Annual Meeting of Japanese Association of Administrative Science, held at the Nagoya Campus of Aichi University, Nagoya Shi, Japan. (November 14-15, 2015)

➢ Hassan, H (2015). Seminar on "Trust and Economic Performance; Evidence from Cross Country Panel Data Analysis" at Institute of International Affairs, Aichi University Nagoya Campus, Nagoya Shi, Japan (November, 11 2015)

- Khan, Z. and Ferguson, D. (2015). Understanding the complexity of customer advocacy intentions resulting from continuance commitment and its antecedents. 20th Corporate Marketing Communications Conference, Izmir, Turkey, 2015. (associated with Journal of Marketing Communications) Published in its proceedings available at iletisim.ieu.edu.tr/wp-content/uploads/CMC2015_Proceedings_Book.pdf

v. **Software Engineering Research Centre (SERC)**

URL: www.serc.org.pk

Software Research Engineering Centre is dedicated to conducting research and development in various facets of software engineering. The center has been established to promote theoretical research in the software engineering area, resolve problems faced by the software industry, and help establish software engineering practices in the industry. Through the establishment of the SERC, the University seeks to help and support the local software industry in establishing and improving their processes and practices through continuous feedback and training. SERC aims to achieve these objectives by collecting the industry data to understand productivity, cost, and quality parameters.

Past Projects

- DISC – Design using integrated software chips.
- Development and analysis of a new Object to Relational Mapping technique.
- Mining code repositories for automatic detection of bad smells in the code.
- An Empirical Study to Analyze the Impact of Testing and Code Inspections on Overall Productivity.
- Small - Separated Modelling and Language for meta-modelling

Recent Publications

- Sadia Khalid and Ali Malik, "Impact of Team Structure on Software Development Productivity and Quality in Pakistani Software Houses", FAST-NU Research Journal, Volume 1, Issue 1, January 2015
- Raza Rasool and Ali Malik, "Effort Estimation of ETL Projects Using Forward Stepwise Regression", International Conference on Emerging Technologies (ICET 2015), December 2015, Peshawar – Pakistan
- Nosheen Sabahat and Ali Malik, "Size Estimation of Open Source Board-Based Software Games", International Conference on Open Source Systems and Technologies (ICOSST 2015), December 2015, Lahore – Pakistan

SCHOLARSHIP OPPORTUNTIES

Here we provide a list of those scholarships those are available for Pakistani students who want to continue their higher studies in the foreign countries. Students can get information of all the posted scholarships and also can apply online.

Scholarship	URL	Deadline	Course Level
International Welcome Scholarships (IWS) at Murdoch University in Australia, 2017	http://our.mur-doch.edu.au/Student-life/Finances/Browse-scholarships/INTL_IWS-Scholarship/	Deadline varies according to courses.	International Welcome Scholarships are open to eligible international students who choose to study a Murdoch University Bachelor, Honours or Postgraduate Coursework degree programme.
International Merit Undergraduate Scholarships at University of Sheffield in UK, 2017	https://www.shef-field.ac.uk/interna-tional/en-quiry/money/ugmerit	April 21, 2017.	Scholarships are available for pursuing undergraduate programme.
International Scholarships for Masters Programme at University of Essex in UK, 2017-2018	http://www.es-sex.ac.uk/fees-and-fund-ing/masters/scholar-ships/academic-excel-lence.aspx	September 30, 2017.	Scholarships are available for pursuing the full-time master programme.
International Full Scholarship for Postgraduate Degree Programme at University of Brighton in UK, 2017	https://www.brighton.ac.uk/studying-here/fees-and-finance/postgradu-ate/international-stu-dents/scholarships/inter-national-full-scholar-ships.aspx	May 31, 2017.	Scholarships are available for pursuing a postgraduate taught degree programme at the University of Brighton.
Science & Engineering Merit Extension Undergraduate Scholarships at Curtin University in Australia, 2017	http://scholarships.cur-tin.edu.au/scholar-ships/scholar-ship.cfm?id=2693.0	December 31, 2017.	Scholarships are available to pursue undergraduate degree programme.
Undergraduate Scholarships for Pakistani Students at University of Nottingham in UK, 2017	http://www.notting-ham.ac.uk/studywithus/international-appli-cants/scholarships-fees-and-finance/scholar-ships/undergraduate-scholarships/pakistan-colleges-ug.aspx	April 21, 2017.	Scholarships are available for pursuing undergraduate programme.
University of Manchester PhD Scholarships for International Students in UK, 2017-2018	http://www.mbs.ac.uk/phd/programme-over-view/funding.aspx	Varies	Scholarships are available for pursuing PhD programme.
Scholarships for International Students at HAN University of Applied Sciences in Netherlands, 2017	https://www.han.nl/inter-national/english/admis-sions/scholarships/	May 1, 2017.	Scholarships are available for pursuing bachelor's programme.
Glasgow Caledonian University Scholarships for International Students in UK, 2017	http://www.gcu.ac.uk/study/scholarships/interna-tional/	June 1, 2017.	Scholarships are available for pursuing undergraduate and postgraduate programme.

Undergraduate Scholarships for Pakistani Students at University of Nottingham in UK, 2017	http://www.nottingham.ac.uk/studywithus/international-applicants/scholarships-fees-and-finance/scholarships/undergraduate-scholarships/pakistan-colleges-ug.aspx	April 21, 2017.	Scholarships are available for pursuing undergraduate programme.
10 Undergraduate Scholarships for International Students at University of Brighton in UK, 2017	https://www.brighton.ac.uk/studying-here/fees-and-finance/undergraduate/international-students/scholarships.aspx	Throughout the year	Scholarships are available for pursuing undergraduate degree level at the University of Brighton.
10 MSC/MBA International Student Scholarships in Australia, 2017	https://scholarships.curtin.edu.au/scholarships/scholarship.cfm?id=2875.0	August 25, 2017.	Sch0larships are available for postgraduate programme.
MSc Scholarships for International Students at University of Strathclyde in UK, 2017	https://www.strath.ac.uk/studywithus/scholarships/humanitiessocialsciencesscholarships/mscbusinesstranslationandinterpreting-scholarship/	June 30, 2017.	Scholarships are available for pursuing MSc programme.
Postdoctoral Research Fellowship in Plate Tectonic at University of Oslo in Norway, 2017	http://uio.easycruit.com/vacancy/1733827/97031?iso=no	June 1, 2017.	Fellowship is provided for pursuing the postdoctoral programme.
Zhejiang University Doctoral and Postdoctoral Positions in China, 2017	http://www.zju.edu.cn/english/	These positions are open until they are filled.	Fellowships are available to pursue doctoral and postdoctoral programme.
University of Dundee Global Excellence Master's Scholarships in UK, 2017	http://www.dundee.ac.uk/study/scholarships/uod-global-excellence/	October 1, 2017.	Scholarships are available for pursuing Master degree programme.
60 Postgraduate Scholarships at University of Bath in UK, 2017-2018	http://www.bath.ac.uk/study/pg/funding/taught/scholarships#	June 1, 2017.	Scholarships are available for pursuing full-time taught masters at the University of Bath.
International Awards at Queen Mary University of London in UK, 2017-2018	http://www.qmul.ac.uk/international/international-students/feesfinance/ugbursaries/sciengexcellence/	Applications are open	Awards are available for pursuing the undergraduate programme.
Four-Year Fully Funded PhD Studentship at University College London in UK	https://www.epsrc.ac.uk/skills/students/	Contact Employer	Fellowships are available for the Ph.D. program.

LIST OF HEC RECOGNIZED JOURNALS

Here we provide list of HEC recognized journals.

Source: http://www.hec.gov.pk/english/services/faculty/Pages/HEC-recognized-Journals.aspx

Journal Title	Category	Editor Contact	Email	Website
Proceeding of Pakistan Academy of Science	X	Dr. Abdul Rashid 051-9207140; 0308-5203032	Pas.editor@gmail.com; pasisb@yahoo.com	www.paspk.org
Sindh University Research Journal	Z	Prof. Dr. M.Y Khuhawar (S.I) 0333-2751831	mykhuhawar@usindh.edu.pk; surj@usindh.edu.pk	www.usindh.edu.pk
Pakistan Journal of Science	X	rof. Dr. Muhammad Saleem Chaudhry 03009424904; 03219424904	Cm_salim@hotmail.com; editorinchief@pass.com.pk	www.paas.com.pk
The Nucleus	Y	Dr. Jamshed H. Zaidi 3008525955	jamshedzaidi@yahoo.com; Zulfiqar498@pinstech.org.pk	www.thenucleus.org.pk
Journal of Basic and Applied Sciences	Y	Dr. Rafeeq Alam Khan 3218258742	rkhan1959@gmail.com; rafkhan@uok.edu.pk	www.lifescienceglobal.com/jbas
Advancements in Life Sciences	Y	Dr. Idrees Ahmad Nasir 03035961316; 04235293152	editor@als-journal.com; dr.idrees@gmail.com	www.als-journal.com
Science International (Lahore)	Y	Dr. Muhammad Azam Sheikh 03035961316; 04235293152	Sciint15@yahoo.com; sciint@gmail.com; Sciint15@hotmail.com	www.sci-nt.com
Gomal University Journal of Research	Y	Dr. Allah Nawaz 03005790721; 0966-750213	gomalujr@gmail.com; drallahnawaz@yahoo.com	www.gu.edu.pk/gujr/gujr.html
Journal of Science & Technology	Z	Dr. Amir Nawaz 091-9216683; 03005904839	nawaz57@yahoo.com	no website
Science, Technology & Development	Z	Prof. Dr. Mudassir Asrar 051-9204860; 0519208736; 05192051157	Editor.pcst@gmail.com; mudassirisrar@hotmail.com	www.pcst.org.pk/journals
Journals of the College of Physicians and Surgeons Pakistan (JCPSP)	W	Prof. Zafar Ullah Chaudhry 03009251497; 021-99207100-10, Ext: 224; 021-99266439	publications@cpsp.edu.pk; jamjim88@yahoo.com	www.jcpsp.pk
Pakistan Journal of Medical Sciences (PJMS)	Y	Dr. Shaukat Ali Jawaid 03008262057; 021-35688791; 021-	pjms@pjms.com.pk; shaukat@pjms.com.pk	www.pjms.com

		35689285Fax: (021) 3568986		
Pakistan Journal of Medical Association (PJMA)	Z	Dr.Fatema Jawad 03009371024; +92 (021) - 32226443	jpmaofficial@gmail.com; submissions@jpma.org.pk	http://jpma.org.pk/
Journal of Post-graduate Medical Institute (JPMI)	X	Prof. Arshad Javaid 03005949509; 03339123625	arshadj34@gmail.com; editorjpmi@yahoo.co.uk	www.jpmi.org.pk
Pakistan Heart Journal	X	Dr. Adnan Mahmood Gul 03469169760; 0333-9103382; 091-9211431	pheartjlrh@gmail.com; adnangulmd60@yahoo.com	www.pakheartjournal.com

CHAPTER 3

Entrepreneurship & Innovation

The Business Incubation Centre (BIC) at FAST NU HQ under ORIC department offers venue for the pioneering ideas of the faculty, students and alumnus. FAST NU reserves the right to modify, change, amend or annul the incubator related policy guidelines at its sole and absolute discretion.

Objectives

The key objectives are as enumerated below:

- ➤ Nurture entrepreneurial atmosphere by supporting Students, Faculty and Alumnus in their pursuit of technological or social innovations.
- ➤ Supporting the promising start-ups during initial period when they are most susceptible.
- ➤ Offer resources (mentorship, equipment, etc.) as measured viable on case to case basis.
- ➤ Establish academia-industry linkages to evolve mutually beneficial solutions.
- ➤ Encourage disruptive innovations and partner in knowledge based economy.
- ➤ Hand-holding in commercialization of market ready products.
- ➤ Harvest organisations that graduate as a gainful business concerns.

Facilities Offered by the University

The University offers *(Free of Cost)* following services:

- ➤ Work space with furniture
- ➤ Internet access
- ➤ Shared printing
- ➤ Heating / Cooling arrangements
- ➤ Electricity with generator backup
- ➤ Kitchenette with dispenser, refrigerator, electric kettle, microwave
- ➤ Networking Services
- ➤ Professional mailing address
- ➤ Office working hours from 9 am to 5 pm (5 days a week)

Expected Good Will from the Start-up Entrepreneurs

Expected good will is itemized as under:

- ➢ Workshop / Seminars / Lectures for FAST NU students
- ➢ Supervising / mentoring of FYPs
- ➢ Inspiring other start-ups through sharing of distinctive skills and experience
- ➢ Sharing ideas
- ➢ Access to Investors

Criteria for Start-up Selection

The University Students, Alumnus or Faculty, shall be selected through selection process. having well-defined product, service ideas and / or running a business that can do handholding / mentoring of the start-ups in the FAST NU. Selection shall be subject to recommendations of the 'Selection Committee'. Following shall be the *minimum criteria* before applying for the tenancy request:

- ➢ Feasible product or / and service idea(s)
- ➢ Documentary proof of owner's credentials
- ➢ Team structure disclosure
- ➢ The primary place of the business is to be physically located in the Incubator facility.
- ➢ The applicant has good repute and reasonable experience in the relevant sector.
- ➢ The entrant is neither nonpayer of any financial institution nor any government duties / taxes.
- ➢ The applicant has no civil or criminal case ever registered against him.
- ➢ May have registered company / legal status
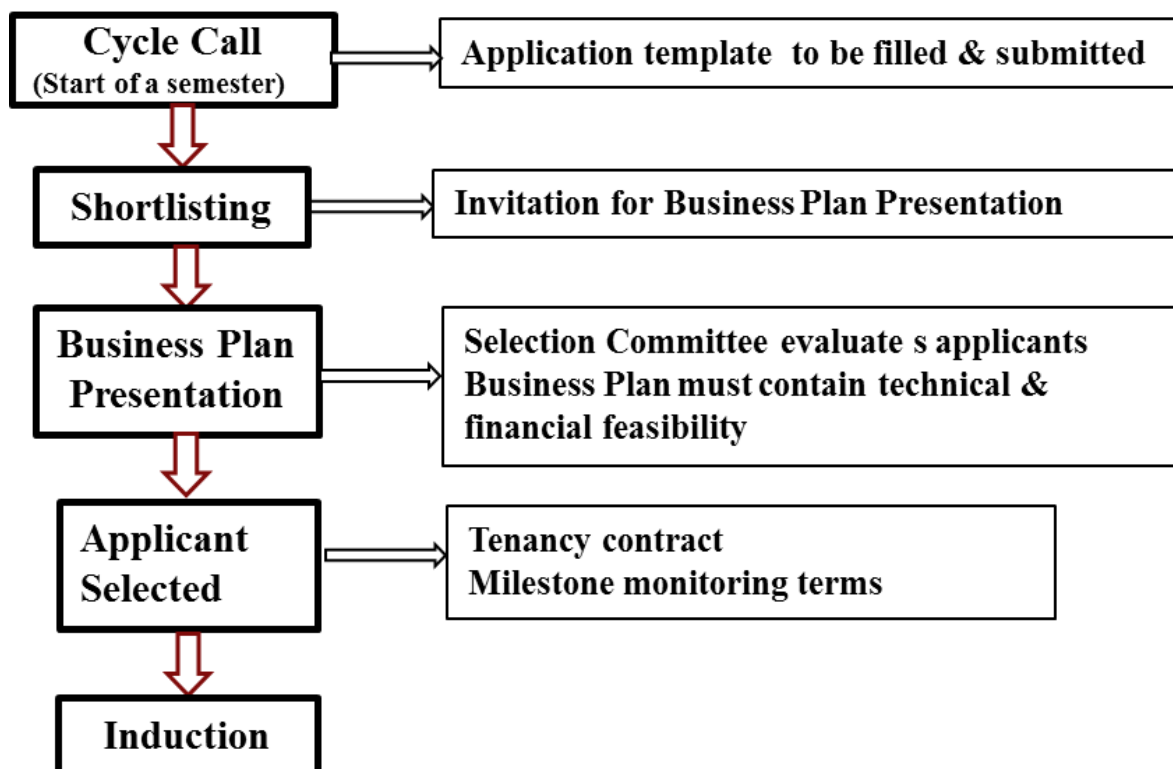
Composition of the Selection Committee

The Selection Committee will assist Director ORIC FAST NU in the selection process. The composition will be as under:

1.	Rector	(Chairman)
2.	Director ORIC	Member
3.	Relevant Head of Department	Member
4.	One Industry Representative	Member
5.	One established Incubator Representative	Member

Selection Process

The selection process comprises of the succeeding distinct steps that shall be carefully followed by the prospective entrants to the BIC facility. The steps have been visually depicted for understanding as under:

```
┌──────────────────────┐      ┌─────────────────────────────────────────┐
│     Cycle Call       │─────▶│ Application template to be filled & submitted │
│ (Start of a semester)│      └─────────────────────────────────────────┘
└──────────────────────┘
          │
          ▼
┌──────────────────────┐      ┌─────────────────────────────────────────┐
│     Shortlisting     │─────▶│ Invitation for Business Plan Presentation │
└──────────────────────┘      └─────────────────────────────────────────┘
          │
          ▼
┌──────────────────────┐      ┌─────────────────────────────────────────┐
│    Business Plan     │      │ Selection Committee evaluate s applicants │
│    Presentation      │─────▶│ Business Plan must contain technical &     │
│                      │      │ financial feasibility                      │
└──────────────────────┘      └─────────────────────────────────────────┘
          │
          ▼
┌──────────────────────┐      ┌─────────────────────────────────────────┐
│     Applicant        │─────▶│ Tenancy contract                          │
│     Selected         │      │ Milestone monitoring terms                │
└──────────────────────┘      └─────────────────────────────────────────┘
          │
          ▼
┌──────────────────────┐
│      Induction       │
└──────────────────────┘
```

Tenancy Rates

FAST NU will offer '*FREE'* incubator services without any tenancy charges. However, the final decision for waiver or exact monetary reimbursement to the FAST NU will be mutually discussed at the time of selection and issuance of terms & conditions offer:

➢ *Final Year Students* shall be offered space without any security deposit for an initial period of 6 months. It is to be reviewed after 3 months based on their progress made on the given project time line.

➢ *Faculty* shall be offered space with a token money of PKR 15,000/- as a security.

➢ *Alumnus* shall be given due recognition at the time of negotiations. They shall be charged nominal security of PKR 25,000/-

➢ *Security* money shall be returned upon graduation or termination subject to clearance by the administrative staff for the health of furniture and equipment provided by the University.

Graduation or Exit Policy

Start-up business employees will have to abide by undermentioned occupancy periods:

- A start-up may remain in the facility for a period of *upto 12 months; subject to progress made*.
- If a start-up meets or exceeds the milestones set at the induction before stipulated time of 12 months, they may be graduated in earlier timeline.
- *3 Monthly Reviews* on progress of a start-up shall define next three months' tenancy.
- Requests for *extra time of tenancy* may be granted on rare cases with advanced notice and compelling justification at the University's sole and absolute discretion.

Signing of Contract

After selection, start-up entrepreneurs shall sign contract with the University in a time period of 14 working days. Failing to do so, shall leave no obligation on the University's part to wait any further and may extend offer to any other party.

Templates

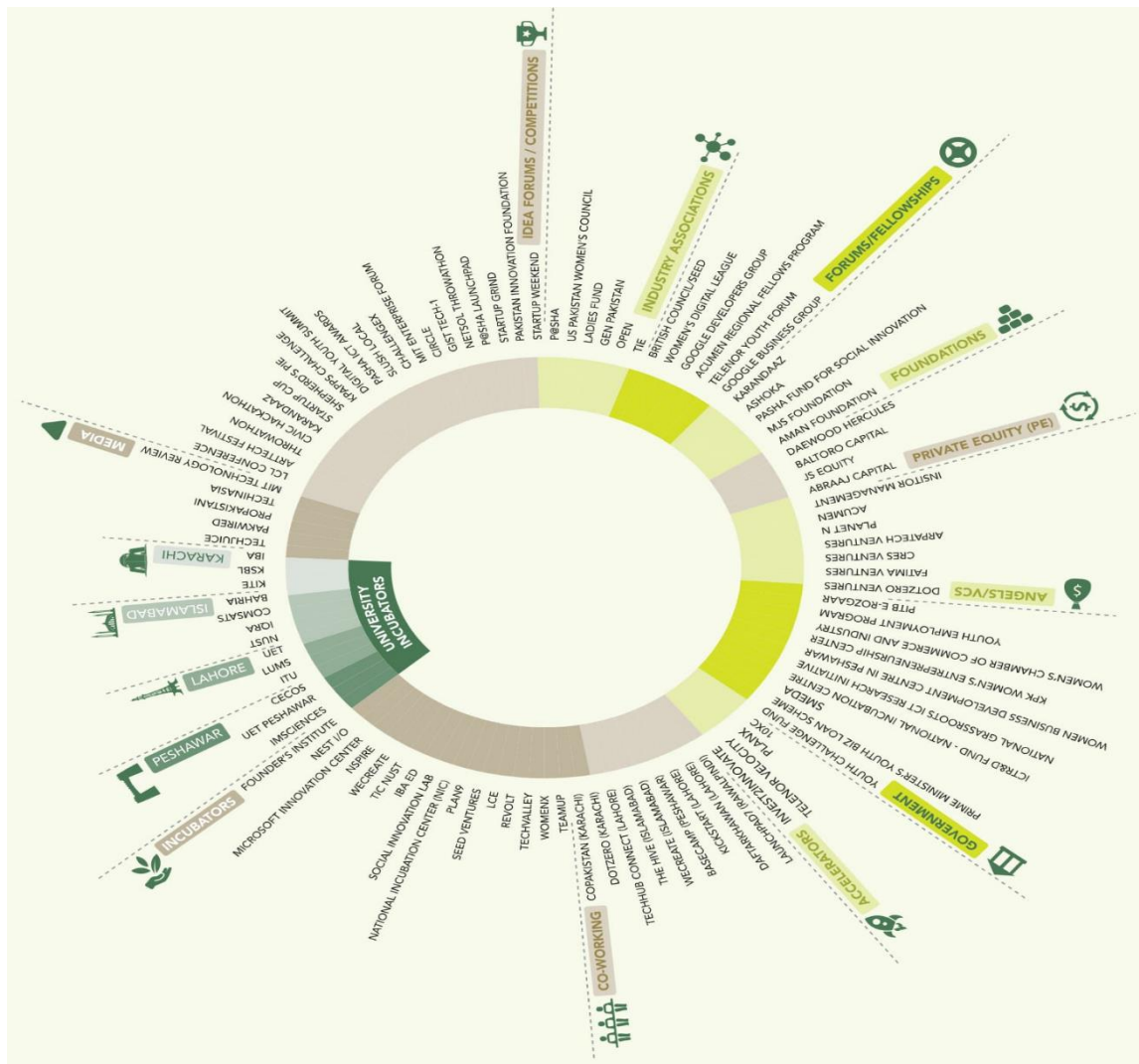Following templates are annexed to the guidelines for reference:

- Application Proforma for the Applicants (ANNEX-I)
- Outline of Business Plan (ANNEX-II)

Note: Real time information about incubation cycle and relevant process can be seen from website: www.nu.edu.pk/oric/IncubationFacilities

PAKISTAN'S ENTREPRENEURIAL LANDSCAPE AND FUNDING OPPORTUNITIES

The landscape of Pakistan's emerging entrepreneurship eco-system is being shared to educate prospective & current startups and their mentors

Source: http://invest2innovate.com/insights/peer/

1. Government

Government based opportunities are as under:

i. Prime Minister's Youth Business Loan

It is an initiative by the National Bank of Pakistan to provide small business loans for youth (21 to 45 years of age) looking to launch enterprises in the country. 50% of all loans will go to women borrowers, with the aim to provide 100,000 loans with an average size of about PKR 2,000,000.

ii. National ICT R&D Fund

Under the umbrella of the Ministry of Information Technology, it provides grant funding to information & communication technology (ICT) projects as well as research collaborations between industry and academia in Pakistan. It is currently

raising National Incubation Centre with funding of US$ 5.5 million. It shall house 40 start-ups per year.

iii.   Small and Medium Enterprises Authority (SMEDA)

It is meant to encourage and facilitate the development and growth of SMEs in Pakistan.

2. Foundations and Fellowships

Non-profit organizations, international agencies, and microfinance institutions provide grants and entrepreneurial trainings to low-income communities as under:

i.   MJS Foundation

Mahvash & Jahangir Siddiqui Foundation (MJS) provides grants to support healthcare, education and social enterprise with a special focus on women, minorities, children and disabled individuals in Pakistan. It has offices in Karachi.

ii.   AMAN Foundation

It is a non-profit foundation. It focuses its grant-making activities mainly in Karachi and supports healthcare, nutrition and education.

iii.   P@SHA Fund for Social Innovation

It was seeded by Google Pakistan and implemented by the Pakistan Software Houses Association for IT & ITES (P@SHA) to provide small grants to innovative ideas that use technology either as a development platform or as a platform for delivery. The P@SHA Fund launched in 2011 and the total funding allocation is up to $10,000. However, the funding has dried and future funding will be subject to availability of funds from the donors (Google, Samsung, etc.).

3. Angel Investors

In Pakistan, angel investors are scarce for the entrepreneurial pursuits. Few noticeable are enumerated below:

i. DotZero Ventures

It is a seed and angel investment fund invest in startups. It is based in Karachi. Key focus areas are fashion / retail, e-commerce / internet and technology.

ii.   Crest Ventures

It is a Lahore based angel capital firm and is an initiative of the Crescent Group. The fund is interested in four major areas – travel & logistics, home & office, financial technology, and artificial intelligence.

iii.   Fatima Ventures

It is an angel investment initiative by the Fatima Group in Lahore. In the past, they have given funding for the beauty industry and technological sectors.

iv.   Planet N

It is an angel fund and accelerator launched by Nadeem Hussain, the founder of Tameer Bank. Since 2015, Planet N has invested in 14 start-ups across e-commerce, fintech, edutech, super food agriculture, retail and renewables sectors.

v.   Venture Capital

Only a handful of venture capitalists operate in Pakistan as under:

a. **Acumen**

It is a global impact investment fund functioning in Pakistan since 2002. Acumen's investment sectors include agriculture, education, energy, water, health, and housing.

b. **Insitor Management**

Insitor (Phnom Penh, Cambodia) recently hired a team in Pakistan to begin deploying capital in the country, but have not yet announced any investments.

ANNEX I

Application Proforma for the Applicants

National University of Computer and Emerging Sciences, Islamabad

Reference No: _____   Date: _____

Business Incubation Centre
Application

(Information submitted will be held in confidence)

Section I: Basic Information
1. Name of Principal Applicant:
2. Date of Birth:
3. CNIC:
4. NTN (if available):
5. Cell Number:
6. Email ID:
7. Last Academic Degree:
8. Specialization:
9. Current/Last Job Title:
10. Postal Address:
11. Permanent Address (Parental Residence - if different from above):
12. Guarantor's Name:
13. Guarantor's CNIC:
14. Guarantor's Contact number:
15. Guarantor's Postal Address:

Section II: Venture Snapshot
16. Project / Business Title:
17. Project Domain
    (1) Education   (2) Health   (3) IT Services   (4) Telecommunications

    (5) Agriculture   (6) Renewable Energy   (7) Other (Mention)
18. Legal Status: (1) Sole Proprietorship   (2) Limited Company   (3) Partnership
19. If Registered, please enter details below: (If only business idea, mark NA)
    a. Date of Registration & Statutory Body with whom registered:
    b. Registered Office Address:
    c. Registered Number:
    d. Website Address and Business Email:
20. Team Members (not more than four, also attach CVs with CNIC copy):

Name	**Title**	**Organization**
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

21. Affiliation with FAST NU: (1) Faculty (2) Student (4) Alumni (4) NA

22. Explain your Product or Service:

23. Current development status of product or service (Idea / Prototype / Patent):

24. Anticipated / planned timeline of product service development (6/12/18 months):

25. Describe the target market segment or segments:

26. Financial Planning
    a. Total funds needed for:
       (1) Prototype development
       (2) Product launch (with marketing)
    b. Funds held:
    c. Any funding avenues explored / approached?

Section III: **Incubator Requirements**

27. Will there be some swap / changeover of employees working in the Incubator?

28. Do you anticipate having any equipment other than standard office equipment in the incubator in support of your business? Please explain.

Section IV: **Declaration by Principal Applicant**

I, hereby declare that the information provided in this application form is true and correct to the best of my knowledge.

Signature: _____   Date: _____
(Principal Applicant)

NOTE: Please attach or mail application with business plan and summary, company and / or project literature, and management team biographies to:

Director
ORIC
4rd Floor (Incubator), FAST House,
Rohtas Road, G-9/4
Islamabad (44000) Pakistan.

ANNEX II

Outline of Business Plan

1. **Cover Page**. The first page of the written entry is the title page. It must include in any order, but is not limited to, the following:

Reference No: _____   Date: _____

Start-Up Business Plan
FAST NU, Name of Campus

Company Business Name
Name of Principal Applicant
Date of Submission

2. **Declaration by the Principal Applicant**. It shall be on a separate page as under:
   I, (Name) hereby declare that the information provided in this business plan of our company (legal name of company) is true and correct to the best of my knowledge.

Signature: _____   Date: _____
_____
(Principal Applicant)

3. **Table of Contents**. The table of contents page(s) shall be given Roman numbering.

4. **Body of the Written Entry**. The body of the written entry starts with Section I, i.e. Executive Summary. The first page of the body to be numbered "1". Page numbers continue through the bibliography (required) and the annex (optional).

   I.   Executive Summary
   Keep it to one page, do not forget to include the Mission Statement.

   II.   Company Description
   Remember to write on the "third person". Must include:
   (1)   Legal name and Legal Form of business entity
   (2)   Mission Statement and Objectives
   (3)   History behind the idea or current business
   (4)   Product/Service Description (features and benefits)
   (5)   Intellectual Property Description
   (6)   Location and Geographical Information
   (7)   Company's Development stage
   (8)   Current financial position
   (9)   Achievements to date

   III.   Industry Analysis and Trends
   (1) Description of the industry
   (2) Industry current size (# of firms, employment, aggregate sales)
   (3) Growth potential
   (4) Factors that affect the industry including:

        (a) seasonality,
        (b) technological and regulatory challenges
        (c) Supply and Distribution Characteristics
    (5) Trends
    (6) Barriers to entry

IV. Target Market Analysis
    (1) Target Market Size
    (2) Target Market Trends
    (3) Demographics
    (4) Psychographics
    (5) Purchasing Patterns

V. Competitive Position
    (1) Market Share and Distribution
    (2) Barriers to Entry
    (3) Potential / Future Competitive Challenges

VI. Strategic Position & Risk Assessment
    (1) Company Strengths
    (2) Market/Industry Opportunities
    (3) Risks Assessment/ Risk Evaluation
    (4) Definition of Strategic Position
    (5) SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats)

VII. Marketing Plan and Sales Strategy
    (1) Company Marketing Strategy
    (2) Marketing Vehicles
    (3) Strategic Partnerships
    (4) Marketing Tactics and How They Create Sales
    (5) Sales Force & Structure
    (6) Sales Assumptions

VIII. Operations
    (1) Development Plan
    (2) Equipment and Technology
    (3) Variable Labour Requirement
    (4) Inventory Management
    (5) Supply and Distribution
    (6) Order Fulfilment and Customer Service
    (7) Research and Development
    (8) Capacity Utilization
    (9) Quality Plan
   (10) Safety, Health, and Environmental Concerns
   (11) Operational Concerns

IX. Management with Roles
    (1) Principals/Key Employees inclusive of
        (a) Title
        (b) Primary Responsibilities

    (c) Background, Relevant Work Experience and Expertise
    (d) Education
  (2) Organizational Chart
  (3) Board of Directors/Advisors
  (4) Consultants/Specialists
  (5) Management to Be Added
  (6) Management Style/Corporate Culture

X. Development, Milestones & Exit Plan
  (1) Past and Future Milestones
  (2) Long-Term Company Goals
  (3) Growth Strategy
  (4) Exit Plan

XI. The Financials
Sketch a high-level financial plan that defines your financial model and pricing assumptions.
This plan should include:
  (1) Start Up Cost
  (2) Classify your risks. (calculate future forecast figures)
  (3) Identify your potential expenses and capital requirements
  (4) Create your financial statements - cash flow, income and balance sheet
  (5) Break-Even Analysis
  (6) Proposed Sources & likely funding avenues (seed funding, angel investors, etc.)

XII. Appendix
  (1) Company logo, advertising plan, flyers, brochures
  (2) Letter(s) of Intent from prospective customers
  (3) Resume(s) of Key Team Members
  (4) Market Research Results
  (5) Quotes or estimates
  (6) Supplier information
  (7) Key Contracts / MoUs with industry
  (8) Letters of Endorsements
  (9) Legal Documentation pertinent to the business
 (10) Intellectual Property – Patents, Copyrights, Trademarks

NOTE:
Business Plan outline template has been provided as a reference only. The applicants are encouraged to follow any template for 'Business Plan' preparation as they feel comfortable.