

Capability Brief

A Summary of Core Capabilities and Work Methodology

CERP Labs seeks to build technology that helps the larger economic development process. We are a software firm housed inside of the Centre for Economic Research in Pakistan (CERP), which is founded and led by economists Asim Khwaja, Atif Mian, Tahir Andrabi, Ali Cheema and Adnan Khan. We look to marry their expertise and experience in research with the latest software development practices to create systems which have sustained impact over time. We do this by operating in tight iteration cycles in which we build, deploy, learn and repeat to maximize our impact - a fundamental idea that exists at the intersection of software and economic development.

We feel much of the opportunity lies in integrating digital components into existing workflows to both increase workflow efficiency as well as to capture critical data that is generated in the process. The captured data can in turn provide meaningful analytics to organizations and aid in decision making. It can also be more easily shared across different levels and roles in the organization, thereby increasing transparency and enabling productive network effects to emerge. As workflows are increasingly digitized, it also serves as a platform for more advanced technologies and integrations to play a role.

In the education sector, this has meant reducing the teachers' and owners' burden of administrative tasks such as writing and maintaining physical registers, freeing up significant amounts of time to focus on delivering education. In turn, this has also meant that school data is digitized and made available for analysis by the school administrators and teachers, to support data-based decision making. Supervisors of many schools can now have access to aggregated real-time views into each school's

performance, and parents are now being kept in the loop on their children's education through regular updates sent via SMS.

Work

MISchool

While conducting field work for several research projects in the education space, CERP researchers found that often the answer to the questions they were looking for with respect to schools attendances, enrollment, fee collection and grade performance, was contained within dozens of registers maintained by the school administrators and teachers. Data was being recorded in these low-cost private schools, but without the ability to access and share it easily, its value was lost. The recording and maintenance of this data was a pain point for school owners, teachers and admins - data often had to be copied multiple times in different books and formats to satisfy varying demands from officials who would inspect the schools. School owners were not aware of learnings outcomes, teacher performance or attendance rates -- and much of this information was not being passed along to parents either. Researchers saw an opportunity to strengthen the feedback loops critical to improving schools and education outcomes.

Over the next few years, CERP Labs worked with the CERP Education researchers to build an application specially designed to increase the management capacity of low-cost private schools. Labs worked in the field to iteratively design and prioritize various features with school owners, admins and teachers, ultimately building an application which synced data between different school devices in real-time when online, and queuing changes made offline on device until internet connectivity returned.

Labs formed and executed a sales strategy to sell the school management system in six districts of Punjab, managed a distributed sales team and housed a customer support center at CERP to reach over 300 schools in six months. School owners and parents were especially excited about the automatic SMS messages for attendance that began to be sent daily with the presence (or absence) of their children in school. Even illiterate parents learned that the shape of the P in “Present” meant their child had arrived, and the “A” in “Absent” meant their child was not there. Parents liked this feature so much that when the school didn’t send the messages out for just a few days, they began getting visits from the parents asking why the notifications had stopped. Children who had been bunking school were found out, and some schools reported a 10% increase in attendance rates. Parents of children who were out sick for days, or even weeks at a time, continued to receive text messages detailing their homework assignments. Parent visits to the school became significantly more productive when school owners were able to pull-up and show the child’s grades, attendance and fee records to discuss. The critical feedback loops between school owner, teacher, parent and child became more substantive and stronger.

ilmExchange

Labs partnered with researchers in the CERP Education program to create a marketplace connecting low-cost schools in Pakistan with Education Service Suppliers. School owners are often not exposed to several inputs that could be critical in improving education outcomes in their schools, such as loans, quality textbooks, and education innovations in the EdTech space. By creating a digital marketplace which school owners were comfortable browsing and ordering from, it could be possible to create a sustainable mechanism for bringing increased choice and awareness of these critical education inputs.

On its own, a single low-cost school is a small buyer, often in a far-flung area which is hard to reach and out of the way. However, CERP research showed that in the aggregate, low-cost private schools are a massive and thriving market in Pakistan (and deliver significantly better quality education than the public sector). By building a tool to aggregate demand from these schools, it could have the positive effect of crowding in more education service suppliers to help address this underserved market. There is significant value-add for suppliers at the cutting edge of education innovation - easy access to large numbers of schools significantly reduces the cost of distribution, which is one of the largest barriers to entry in the space.

Labs piloted a one-way, and then two-way marketplace between low-cost private schools and education service providers with the creation of ilmexchange.com. Schools were able to browse a catalog of products even when offline, and sales coordination was done through a call-masking solution which protects the privacy of the schools while still allowing contact to take place between buyers and sellers. This marketplace enabled over 150 transactions to take place and drove more than 4.4M Rs of exchange in just 6 months. When commercial activity was depressed because of forced school closures in light of the COVID crisis, Labs rapidly built a free distance learning solution for out of school children to watch educational lectures curated and aligned to the Punjab curriculum by the CERP Education program. The rapid development of this feature has led to the merging of the MISchool and IlmExchange systems in order to better serve schools in Punjab as they emerge from this health crisis.

Real-Time Mapping of Income Loss and Food Insecurity in Karachi - World Bank

The onset of COVID-19 and subsequent implementation of blanket lockdowns across Pakistan implied large disruptions to income for

workers in both the formal and informal sector. With many Pakistanis living at or near subsistence levels and dependent on daily wages, there were concerns that the lockdown would result in large-scale deprivation of basic necessities.

In a project led by the World Bank, CERP Labs rapidly designed and built a dashboard to visualize data coming from automatic phone surveys run in 34 neighborhoods of Karachi targeting Katchi Abadis. Indicators derived from waves of surveys and plotted on an interactive map showed hotspots in neighborhoods in which people had lost all their income, did not have money for a weeks worth of food supplies, did not have access to free rations in their neighbourhoods, and went to bed hungry last night. This dashboard was designed specifically to help the government allocate food resources to affected neighbourhoods as efficiently as possible, while also keeping an eye on inflation for necessities.

The dashboard featured both geospatial and temporal visualizations, allowing the government to pinpoint where hotspots were located and their trend. Labs built a map leveraging WebGL technologies, allowing for 3D visualisation of many thousands of data-points overlaid on a conventional map interface while maintaining smooth and natural interactivity. Data access was restricted and behind authentication, but once authenticated, users were able to cache data and use the application offline if needed.

The World Bank and CERP are looking to take these capabilities to more cities in Pakistan, and provide comprehensive disaster relief support wherever possible.

Economic Vulnerability Assessment

When the COVID-19 crisis struck, there was much discussion about the trade-off between locking down to slow the spread of the disease and the

associated economic costs that possibly could not be borne by large swaths of the Pakistani population. While case counts, testing numbers, and death charts were updated daily across newspapers and tv channels, there was little data presented with respect to the economic effects and hardships faced by people in lockdown. The Economic Vulnerability Assessment was initiated by CERP Labs to provide this information to the public.

Leveraging sample from ongoing CERP research projects as well as Random Digit Dialing, Labs was able to arrange and run a phone survey to determine the extent of income loss, consumption changes, loan and bill pay issues, food insecurity and attitudes towards lockdowns and COVID. The Economic Vulnerability Assessment has turned into a full-fledged research activity, directed by professors Basit Zafar, Javaeria Qureshi, and Saher Asad, with the same primary goal of informing the public with respect to the long-lasting economic cost of COVID in Punjab. Labs continues to aid in the management and development of an online dashboard to better convey the story to the wider public.

Cordoba Care: AirMed

Labs is working together with Cordoba Care to produce the AirMed suite of applications. Here Labs is building all of the technology for a socially responsible tech startup aimed at improving healthcare delivery in Pakistan by strengthening the connections between Nurses, Hospitals, and patients.

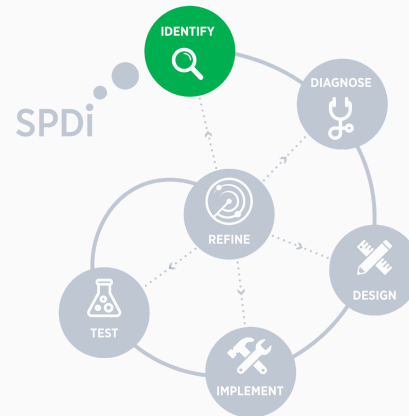
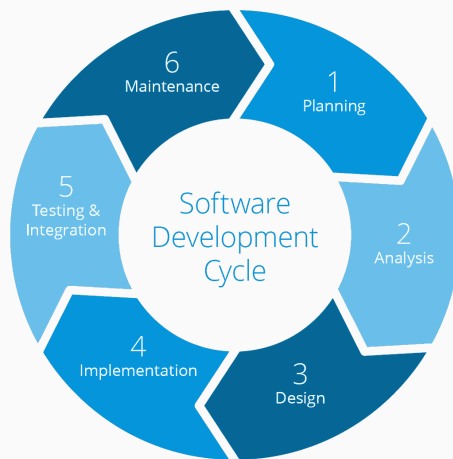
Methodology

It is important that Labs partner with clients to work in an agile, iterative way on system design and delivery. We firmly believe that this deep integration with our partners enables the user-driven design necessary for building an inclusive and effective system which can bring about change.

By working in this way with partners from the ground up, Labs is set to co-evolve the technology we are building with the understanding of the problem space. This is a fundamentally different approach from other software houses, and it is possible because impact is part of our bottom line.

We typically participate in the beginning phases of application design, working with the partner as well as going into the field to learn about our end-users and their problems. We then work to map these problems back to a solution which can be built. A minimal viable product is defined, constructed and then rolled out. From here we iterate in 2 week sprint cycles, balancing continuous feedback from the field with requirements from our partner. We firmly believe that this process will deliver, over time, a successful application that is genuinely appreciated and used by the target audience.

This belief in iterative methodologies to achieve outcomes is deeply rooted in both modern software development culture as well as economic development best practices. Harvard Evidence for Policy Design (EPoD) follows the Smart Policy Design & Implementation (SPDI) approach they developed, advocating for “embedded, self-correcting processes which produce and integrate evidence as it develops new processes”. This is because as development challenges are overcome, ever more complex issues are presented at the next frontier. Similarly, agile software development accepts that the best way to build technology that fits the users needs is to continuously deploy changes to users, gather feedback, and adapt plans to fit the new reality and your end goals. The key component is recognizing that the problem space is constantly shifting, and that flexibility and adaptability is key for lasting success. At CERP Labs, where our chief goal is positive sustainable impact, we take this lesson to heart and orient all our operations in service of continuous learning and iteration.



Technical Details

To accomplish our goals, we typically build offline-first progressive web applications. The app installs directly to the device through the browser and looks and feels exactly like a native application - but with much faster update cycles. These apps are designed to be responsive, so they can run on all phone, tablet and desktop devices. It is important to build offline-first, as in most development contexts connectivity is highly intermittent, of poor quality or entirely absent for months on end. Cutting edge web technologies allow us to design for this context without needing to build native applications, improving development efficiency.

We support real-time data syncing out of the box. Changes made while offline are queued up until the device comes online, and they are automatically synchronized with the rest of the system. We store the changes made to the system in a log to support audit trails, system state rollbacks (undo buttons) and to provide detailed analytics to data scientists and researchers alike.

Our system is deployed using Docker and Kubernetes, and is fully portable to support both cloud deployments and on-premise solutions. While cloud

deployment is preferable for scaling and consistency purposes, we are able to support special situations which require servers to be run on-premise on a case-by-case basis.

Our framework is built from the bottom-up to handle distributed computation and allows us to scale our backend horizontally to handle any traffic needs. The core of our framework provides the ability to both pull and push information across arbitrary servers and clients, and our implementation of the actor model allows us to maintain much of application state in-memory, without preventing the backend from scaling.

This ability to maximize server memory usage without compromising scalability gives us tremendous flexibility in being able to push and pull information across different kinds of clients and servers in response to arbitrary events, allowing us to quickly build unique features that can set us apart from other software houses.

Team

Maroof Syed: President & CEO, CERP

Maroof is the President & CEO of the Centre for Economic Research in Pakistan (CERP) and a Senior Fellow and Advisor at Harvard's Evidence for Policy Design (EPoD). He has over 20 years of entrepreneurship, investment and leadership experience in multiple sectors. He combines academic work in public policy, economics, and engineering with extensive experience in leading organisations and building institutions.

Taimur Shah: Head, CERP Labs

Taimur was previously a software architect at IBM Watson before moving to Lahore from New York City and starting CERP Labs. He has an intense interest in exploring the intersection of technology and economic development and creating systems that can have a sustained, positive

impact over time. Prior to working at IBM, he had started and sold his first company, Clossit, to Parrable in the retail and advertising recommendations space. Taimur studied machine learning and economics at Columbia University.

Ali Ahmad: Senior Developer

Ali is a full-stack developer with a passion for writing code. As a software engineering student at the University of the Punjab, he closely followed trends in software development online and taught himself new technologies such as React and React Native. You will never find him without a few side projects in development.

Mudassar Ali: Developer

Mudassar is a graduate of the Punjab University College of Information Technology, where he majored in Computer Science. He is a full-stack developer with a keen interest in design and user experience. Mudassar is an avid participant in several local and international open source projects on GitHub. He is always up to date on the latest Typescript and VSCode updates and releases.

Humna Aleem: Developer

Humna is a graduate of the Punjab University College of Information Technology. She joined CERP to excel in the carrier of software development with a vast experience of working with different tools and technologies. She is a true team member always ready to face challenging situations. She is a competent Full stack developer having expertise in Front-end frameworks (Reactjs and Vuejs). Eager to enhance her skills she keeps a keen eye on the latest developments in frontend frameworks.

Rahij Gilani: Developer

Rahij graduated with a Bachelor's degree in Computer Science from LUMS, and a Master's degree in Systems Design Engineering from the University of Waterloo, where he specialized in Machine Learning & AI. Rahij enjoys programming, and is always looking for a challenge. He is also very passionate about coming up with creative solutions to new and existing problems, especially in the novel application of software.