

# Driving Digital Comfort for the Next Billion Internet Users

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**Abstract.** With the proliferation of digital mediums in the last decade also came a fundamental digital divide in the reach of these services. Those who lack access to or are uninformed of the digital world may suffer various negative consequences due to the digital gap. For example, they may be disadvantaged regarding education, job opportunities, and other areas of life. This study thoroughly examines the Great Indian Digital Ecosystem to understand how and why these gaps develop by analysing the big picture from the lens of an Indian farmer. It then offers a framework for a unified GUI that fosters digital comfort, which in turn develops digital confidence.

**Keywords:** Human-computer Interaction, Digital Mediums, Digital Literacy, Digital Divide, Graphical User Interfaces, Unified Inclusive Framework, Accessibility

## 1 Introduction

The reach and influence of big tech are widening outside of developed nations, and companies are eyeing countries outside of the Global West for their next source of growth. Google calls these soon-to-be first-time internet users 'The Next Billion'. India being at the very forefront of the digital revolution, owing to ubiquitous cheap phones and increasingly affordable connectivity plans makes one thing clear: as of now, a large portion of the Next Billion Users (NBUs) will be Indian. It is therefore worth investigating what these users expect and desire out of the digital ecosystem that they will soon be an indispensable part of.

In terms of designing apps and digital services to accommodate the NBUs, there are two broad directions that HCI research has taken in recent years. There has been a significant amount of work done towards designing for NBU accessibility. A considerable amount of effort has also been put into exploring the manifestations of this problem in uniquely Indian contexts. Despite all of this, a broad scan of the technological landscape in India reveals a rather dire state of affairs when it comes to making the NBU feel comfortable in the digital world. It is therefore imperative to take a deep look into how and why these gaps arise in the Great Indian Digital Ecosystem, and what can be done to eventually work towards bridging across them.

## 2 Research Questions

The long-term goal of the research is to develop a formalised approach to building technology for the NBUs, who tend to be Novice Internet Users, also known as the Digitally Illiterate. Digital Illiteracy is the inability to use digital tools daily for utilitarian or leisure purposes. The objective of the current study is to provide a comprehensive review of the literature and industry practices concerning the development of user interfaces for the NBUs and outline a conceptual framework for interface-interaction systems. Specifically, the current study poses the following research questions:

1. What does digital comfort for NBUs entail in the Indian context?
2. What are the systemic gaps responsible for a lack of digital comfort for the NBUs?
3. How do these gaps translate into interface-level roadblocks and how do we overcome them?

Answering these questions is crucial to ensure everyone, independent of literacy levels, can use technology for their benefit. The result of this study will be valuable to industry practitioners, governments and related software providers in developing better applications and tools to make the NBUs feel at home in their newly-adopted digital ecosystems.

## 3 Methodology

Given how vast the problem is in general terms, the current study will target the specific case of Indian rural farmers in order to provide satisfactory and in-depth insights with regard to the aforementioned research questions. In order to systematically analyse the factors at play and provide specific interface-level guidelines, the following methodology has been adopted:

1. **Document and Report** the real-life inequities and systemic failures that contribute to usability gaps in digital ecosystems, in the specific context of rural India. This is achieved by means of a literature review.
2. **Interview** the users with low literacy to understand the ground truth of how these gaps in the ecosystem affect the NBU. Also interview individuals in corporate sectors who work with Indian farmers, using this added perspective to deepen our understanding.
3. **Audit** farmer-facing digital systems, and refer to existing NBU HCI research literature, to identify how systemic gaps create interface-level roadblocks.
4. **Design and Develop** a proof of concept experimental design framework that caters to varying levels of digital literacy without compromising on the existing ecosystem of users and services.

## 4 Literature Review - Digital Inequities in Indian Society

As discussed above, 'interface-level roadblocks' do not exist in isolation. Several other contexts contribute to the more significant issue at hand, "Inequities in the reach of digital literacy".

Being digitally literate has become essential for establishing your presence and creating an identity in today's world. Digital literacy improves your quality of life by making things more accessible and efficient.

Technology as a whole is critical to establishing gender equality. The modern world is progressively going online, and it is equally necessary for men and women to adapt and rely on technology for business or social relationships.

The digital gender divide is also fuelled by digital illiteracy, which often translates into a lack of comfort in using technology and accessing the internet. Such "technophobia" is often a result of concurrent factors, including education, employment status and income level. For instance, a survey shows that more than half of the women having no formal education said they were not familiar or comfortable with the technology. However, this percentage fell to 15% for women with at least a high school education.

Within Asia-Pacific, India had the widest gender gap in internet usage in recent years, a gender gap of 40.4 per cent, with only 15 per cent of women accessing the internet versus 25 per cent of men.

This gendered digital divide in India is frequently the result of a threefold disadvantage for women:

1. There is a rural-urban digital divide, with rural broadband penetration at only 29% compared to the national average of 51%. Women in rural areas are less likely to own mobile phones throughout states, with the rural-urban split narrowing in Goa, Kerala, and Northeastern states and widening in West Bengal, Gujarat, Maharashtra, Andhra Pradesh, and Telangana.
2. There is a digital divide between households based on income.
3. Intra-household discrimination prohibits women from having equal access to digital devices in the home, widening the gender-based digital gap.

While there is no doubt that India is quickly digitising, women in the country must not be left out of the virtual dialogue. Giving women equal access to smartphones and the internet will provide them with the information and resources they need to participate productively in the national economy. As a result, it is critical not only to expand women's smartphone ownership, which aids in internet adoption but also to expedite digital literacy programmes and work toward eradicating digital discrimination based on gender norms.

The online activity of women is frequently supervised by male relatives, even when they are permitted to possess or use household-level mobile devices. While mobile phones are considered a risk to women's reputation before marriage, they are viewed as an interruption to caring responsibilities after marriage. Due

to current social standards and fear of censure, women often avoid using their phones in public areas, preferring to conduct their conversations at home. In this societal framework, women have been excluded from the burgeoning digital economy following COVID-19, particularly when pursuing online schooling, skill training, entrepreneurship, and employment prospects.

Women businesses were inhibited from transitioning to online marketplaces after COVID-19 due to digital illiteracy and unfamiliarity with digital platforms. Despite their incomes being nearly wiped out due to the cancellation of physical fairs and exhibitions during COVID-19, Jhuri-makers (bamboo artisans) in West Bengal were hesitant to move to online platforms due to limited knowledge of social media and digital marketing channels, combined with high data costs, according to stakeholder consultations conducted by Nikore Associates. Women Self-Help Group (SHG) members in Maharashtra, Telangana, Andhra Pradesh, and Gujarat reported that while women in their communities used phones for personal purposes, they could not conduct financial transactions online and did not utilise phones for the business.

Due to a lack of digital literacy, most women still depend on men for numerous duties. Women rely on men to undertake daily tasks such as making online payments. This frequently results in low self-esteem and a lack of confidence.

Giving women equal access to smartphones and the internet will provide them with the information and resources they need to participate productively in the national economy.

## 5 The Ground Truth - Farmers as the NBU

In line with our methodology, we now narrow the focus of the current study to the specific case at hand - that of Indian farmers in rural settings. In a society where the aforementioned inequities are widely prevalent, the extent of digital adoption has been disappointingly limited, and predictably so.

To gain a more comprehensive understanding of the reality of the situation, we sought to reach out to individuals who would represent the three key agents in the agro-tech dynamic: the farmers, corporate entities, and technological facilitators. Below, we summarise key points we discerned from the interviews. The content, although reflected in a question-answer-like format, does not necessarily reflect the exact wording of the conversation, and is but a representative for the purpose of emphasising key information. For a verbatim / pay-by-play experience, recordings of the interviews that were conducted live/in real-time can be accessed here [LINK]. It is also to be noted that the interviews were conducted in Marathi.

### 5.1 Interview One: The Farmer

- Interviewee: Prasad Vaman Khadilkar
- Designation: Representative of the farmers of Jayagavhan, Sangli District, Maharashtra

– Mode of interview: Phone call, over an hour long

**Q:** Have you ever considered selling your crops online?

**A:** Not really, mainly because:

Setting up a whole new pipeline to enable the actual transportation of goods is hard. A large quantity of goods needs to be sold due to their perishable nature. We actually need to trust the platform. The offline mode is more suitable here. I am not sure how the internet could solve these problems.

We have distribution agents present physically in the village. The system works primarily because we trust them. We sell goods to Hyderabad and the greater Telangana region too, so the language barrier does affect us when dealing with agents from here. But the system has worked pretty well, largely speaking.

**Q:** Alright, you do however use the internet in your daily life right? How do you go about that in terms of usability and leisure?

**A:** Yes I do use the internet to help me in my daily life. I check weather forecasts using Google and consume YouTube videos to enhance my understanding of the latest farming techniques. The language barrier here is not a problem because everything is translated into Marathi.

**Q:** What happens when you encounter a problem/hiccup during this use?

**A:** We ask our kids! We grab hold of them and they solve it for us. They have ‘been trained’ because of covid and all, they have grown up with a smartphone in their hands.

**Q:** What would the internet need to do for you to be self-reliant when it comes to these things?

**A:** I really have no idea. There are very few people actually competent at using a phone properly, and that is because they have done some IT courses offered by the government. But no, the idea of using this mode for the distribution of crops is still very foreign to us, almost unfathomable.

**Q:** Well, let’s try to fathom it! If you were designing the very first app that farmers like you would use in the near future, what would the app need to do? Assume the whole question of the practicality of transport is taken care of.

**A:** Firstly, we hand our crops to the agents in terms of a quality hierarchy. They are taken to different places based on the quality that these places demand. So for my app, I would want some way to list crops with:

- A real photo
- A quality listing
- Moreover, I would also like the ability to communicate with the ‘graahak’, whether that be the retailer or the end-consumer directly.
- Lastly, payments should be taken care of. Timely payments are how you win the trust of farmers like myself. The government has now mandated we have bank accounts, so money can be wired that way.

**Q:** What about digital payments here? Do you use UPI?

**A:** There was general interest to switch to UPI a while ago, its convenience is pretty unbeatable. But there was a more fundamental issue. We don't really have cellular connectivity! I personally have to go to my elevated well to catch enough of a signal to watch a video without buffering. Trusting our money to be transferred on such a finicky network is not something we are willing to do. The first step in building your app should be to provide us with a cell tower, haha. There is, in general, a big drop in trust when software malfunctions, especially so when it involves our hard-earned money. As such, there is a big disparity between farms in the interior of Maharashtra like ourselves, and the farmers at the outskirts of cities like Pune, where connectivity has ensured a baseline level of trust, aiding companies to set up internet-centric pipelines.

**Q:** That makes sense. Are you connected to other farmers using some 'conventional' app currently? Is there a social network of sorts for farmers?

**A:** We are using WhatsApp to serve that very purpose! Normally, there exist family groups where all that is exchanged are pleasantries on birthdays and whatnot. But we have our own groups and forums that serve our purposes. We list sales there and share information about better crop breeds, irrigation practices, etc. When companies selling equipment/pesticides approach us, it is via WhatsApp. Our general unwillingness to adapt to new technology has led us to refashion the use case of this app that we're all familiar with, in our own unique way.

**Q:** One last thing, you mentioned some government courses that have been beneficial to farmers. Are there any government-led digital initiatives worth looking into?

**A:** (Note: I have no idea why it took so long to get to this, but here we go.) The government has indeed made an app for us. It's called 'E-PeekPahani' (Peek-Pahani = 'CropWatch'). The app is supposed to help us with surveying and reporting.

The government demands we use this app to register our crops, the land they've been planted on and various other administrative details. The problem is, the farmer's government records won't be updated unless they use this, and this affects compensation in case of natural disasters.

**Q:** What exactly irritates you about e-peek pahani?

**A:** The app demands we use everything at once, there are confusing portals to register total land use, then fill in details about that land and designate crops to various subsections. This approach is unintuitive for farmers because we think of our crops first. And the app just says 'Wrong!' when we make some kind of error, without telling us what actually went wrong. There is no step-by-step procedure. They have set up inaccessible methods as 'help' in case we face problems with the app. But these are just youtube videos and dummy helplines that charge money

as ‘nominal fees’ but don’t actively help us at all. Using the app, therefore, feels like writing an exam where you don’t even know the syllabus!

## 5.2 Interview Two: A Corporate Agro-Sales Officer

- Interviewee: Nitin Kapse
- Designation: Sales Spokesperson for a Herbal Pesticide Brand
- Mode of interview: Phone call, over an hour long

**Q:** There seems to be an air of general distrust towards tech being introduced into the lives of farmers. Does that hold in your experience?

**A:** The internet has certainly had an effect on the daily lives of many of the country’s rural citizens. Farmers today access information digitally using search engines such as Google, and refer to YouTube for education and community-forming. Payments have also indirectly been digitised; In 2014 a mandate was issued enforcing bank accounts for farmers and this opened up the scope for fully digital payments (such as UPI), and generally paved a way for agricultural money to be more by-the-book.

\*A couple of interesting anecdotes pertaining to the matter\*

**A1:** In the year 2000, a few of my friends and I founded [krishiworld.com](http://krishiworld.com), India’s first agro portal meant for farmers. We set up digital hubs in villages at the panchayat office, and positioned agents there full-time, with the exact role of helping farmers use the service. The concept was met with ridicule and the experimental startup failed spectacularly. [Mr. Kapse seems to be optimistic because the situation now is nowhere near this bleak, since every farmer has access to a smartphone]

**A2:** As part of routine farm visits a few years ago, I pitched our fertilizers to a grape farmer. I had high hopes, since grape farming is the most demanding in terms of upkeep and overall scientific nuance. However, I was dumbfounded when it was in fact the farmer’s fourteen-something year old son who had taken charge of the grape crop. He knew the ins and outs of the chemical compositions of the different fertilisers in use, and was managing his schoolwork in conjunction to his duties at the farm. His source of knowledge was primarily the internet.

**Q:** That’s interesting, because the representative of the farmers too mentioned the overall reliance on youngsters. What exactly is it that turns farmers away from embracing the tech by themselves?

**A:** It all has to do with the literacy levels. Internet is a very post-y2k phenomenon. Even us literate folks are sometimes hesitant when it comes to digital stuff. On the other hand, even kids in villages order online now. Us urban folks are even more extreme, we don’t even shop offline anymore. So in villages, phones have driven away the fear of tech. And these phones are in the kids’ hands!

**Q:** Considering the case of the E-peek pahani app, it seems that the general sense of hesitance and apprehension does not disappear even after the farmers have been properly onboarded. Why is that?

**A:** Unfortunately due to how things are, the digital ecosystem in India right now is framed in a way such that every app wants customers. Once they are onboarded, nobody cares. This has made the notion of credibility nosedive. Private sector is ironically better than the government at reaching out, but the subsidies at scale and economical factor that the govt has the ability to implement overshadow these initiatives in terms of the sheer authority they can command over the farmers. The private sector doesn't match that and it is distrust that keeps snowballing over and over.

**Q:** [I now repeat the last question I had asked Mr. Prasad to gain the corporate perspective on the exact same aspect of the problem at hand] If you were to design an app for farmers, how would you inspire trust and confidence?

**A:** I will address two problems: give them the economic power and share truthful information about how to empower yourself as a farmer. I will also facilitate two way communication between farmers. A full-fledged digital forum for farmers is lacking at the moment. Progressive farmers need truthful info shared via the internet.

When farmers in Punjab faced a bad storm recently, the government's attempts at surveys was criticised due to the lack of accountability and transparency. An app should enable this survey to be conducted in a factual and transparent way. This kind of real time data integration is lacking and nobody is working on it due to vested interests. **Establishing trust is paramount. Farmers can do wonders using their 'jugaad' once they trust a system.**

### 5.3 Interview Three: An AgroTech App Developer

- Interviewee: Krishna Handge
- Designation: Spokesperson for the CropGuru app.
- Mode of interview: Text questionnaire

Unfortunately, despite several days of following up, Mr. Handge has not responded to the questionnaire (as of the 15th of November).

## 6 Demystifying Digital Comfort

We found essential characteristics that influence digital comfort by conducting real-time interviews with farmers and performing a thorough analysis of the relevant literature review of research studies. The Digital Comfort Pyramid consists of three fundamental blocks: Ease of Use, Utility, and Trust - Trust being especially paramount, as established in the interviews with Mr.Khadilkar as well as Mr.Kapse.

A digital interface is a type of user interface in which users interact with electronic equipment using graphical icons and visual indicators including windows, menus, buttons, and sliders. Digital interfaces are typically simple to use because they give users visual clues to guide them through the device's operation. Furthermore, digital interfaces frequently provide feedback to users so that they may see the outcomes of their actions.



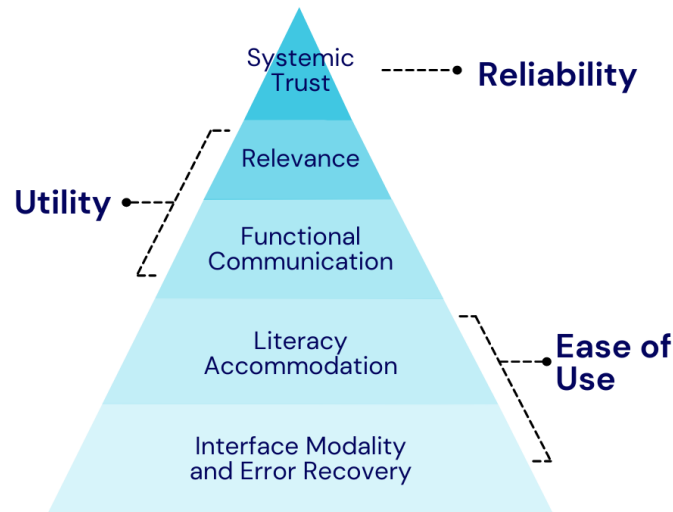


Fig. 1: Demystifying Digital Comfort

### 6.1 Ease of Use

In a world where we are constantly inundated with digital content, mediums must be easy to use. People will quickly move on to something else if a website or app is difficult to navigate. This is why user experience is vital in designing digital products. If people can't figure out how to use something, they'll go elsewhere.

**Interface Modality and Error Recovery** Interface modality refers to how users interact with a medium. The most common modalities are graphical (icons and menus) and text-based (command lines). Each has advantages and disadvantages, but generally, graphical interfaces are much easier to use. This is because they provide visual cues that help users understand what they need to do. Text-based interfaces, on the other hand, can be more challenging to use because they require users to remember complex commands. Error recovery is another important aspect of ease of use. If a user makes a mistake, it should be easy to recover. The interface should provide clear feedback and allow users to undo their mistakes. Again, graphical interfaces are typically better at this than text-based interfaces.

There have been experiments and studies conducted exploring the use of other

modalities too, most notably, voice-driven experiences. The appeal is quite apparent here - this modality accommodates conventionally illiterate people better. There already exist farmer-facing services that have employed voice-driven navigation and such - however, those are beyond the scope of the current study, as our focus is very specifically on smartphones and visual interfaces.

**Literacy Accommodation** In a world where digital media is increasingly becoming the norm, it is more important than ever to accommodate varying literacy levels. It is important to remember that only some have the same literacy level. By adjusting different levels of literacy, we can make sure that everyone has the opportunity to understand and engage with digital content. Digital mediums are increasingly crucial in our world, and those who can read and write in both language and digital literacies will have a significant advantage in using them. One of the great things about digital media is that it can be easily customised to meet the needs of different audiences. For example, text can be made larger or smaller, and the medium can use audio or video to supplement written content. This means that people with different literacy levels can still access and understand shared information.

## 6.2 Utility

Utility is a crucial motivator for people when it comes to using digital mediums such as business apps and social media. People want to be able to use these tools to make their lives easier and more efficient. Business apps can help people manage their work tasks and keep track of their schedules. Social media can help people stay connected with friends and family. There are many apps out there that can help small-time businesses in several ways. Here are three examples: 1. Accounting and bookkeeping apps can help business owners keep track of their finances and better manage their money. 2. Social media apps can be used to promote and market businesses to a broader audience. 3. Productivity apps can help business owners stay organised and get more done in their day-to-day lives. These apps can help boost small-time business people's utility in their daily lives. By using them, they can save time and money and better connect with their customers. Customers need to understand your app's utility to use it. It's essential to make the utility clear and well understood by the customer, so they know what your app can do for them and how it can benefit them.

**Functional Communication** Functional clarity is essential in digital mediums because it allows users to understand how to use a product or service. Users may become frustrated and give up if a product or service needs to be clarified. Additionally, functional clarity can help to build trust between a company and its customers. When customers can easily use a product or service, they are more likely to trust the company and continue to use the product or service in the future. The medium can inform users of what utility their actions create using linear flows concerning navigation and skeuomorphism concerning icons

and illustrations. Another way to potentially look at this aspect is, suppose a user is looking for specific information. In that case, they can be told how many other users have found helpful details, or they can be given an estimate of how long it would take to find the same amount of data using a different method. Additionally, suppose a user completes an action that is likely helpful to others. In that case, they can share that information with their social network or rate the utility of the action for future users.

**Relevance** Different types of users have different needs, so it is essential to show relevant content to them to keep them engaged. For example, an e-commerce website should show more content to someone just browsing than someone ready to buy. If the website only offers products to the person prepared to accept, they may get frustrated and leave. However, if the website shows a mix of relevant content, the person will likely stay on the site and eventually make a purchase. The same principle applies to other types of websites. A news website, for example, should show different content to someone who is just looking for headlines than someone who wants to read in-depth articles. If the website only shows headlines, the person who wants to read more may get frustrated and leave. However, if the website offers a mix of headlines and articles, the person is likelier to stay on the site and eventually find something that interests them. The bottom line is that showing relevant content to different types of users is essential to keep them engaged. If a website only shows content irrelevant to the user, they will likely leave and go to a website with relevant content.

In the context of agriculture, this aspect takes prime importance with regards to the 'credibility of information' dimension. Given how much local/regional variations in circumstances can affect crop needs and output, the personalisation of content in geo-temporal terms is very important.

### 6.3 Reliability

Trust and reliability are important to boost one's digital comfort and confidence. Most users trust the digital system unconsciously. They may not be aware of the potential risks involved in using the system, but they trust that the system will protect them from those risks. This is evident in Mr. Kapse's anecdote regarding the natural disaster in Punjab where users were at the mercy of the app, for that was the one sure way they knew they could reach out to the government. The fraudulent nature of the app being exposed led to great unease, as that was a violation of this reliability that had been taken for granted. In essence, when we know we can rely on our digital tools, we are less likely to feel frustrated or angry when things don't go as planned, leading to a more positive online experience overall.

**Systemic Trust** In digital media and applications, system-wide reliability is essential to maintain the content's accuracy and integrity. Inaccurate or corrupt

content can lead to severe consequences, such as misinformation, miscommunication, and financial loss. In an age where crop and accounting databases are increasingly becoming the lifeblood of the large-scale agricultural industry, it's more important than ever for farmer-facing apps to be transparent about their intentions and processes. Farmers should know what data is being collected and how it's being used. A farmer being asked to submit all of their detailed land plans and crop distributions should be in the know of what the app maker intends to do with that data. Moreover, free access to one's information in an easily understandable manner is crucial. The best apps are upfront about their data collection and use policies. This transparency builds trust and helps users feel confident about using the app.

## 7 Interface-Level Roadblocks and UI that Drives Digital Comfort

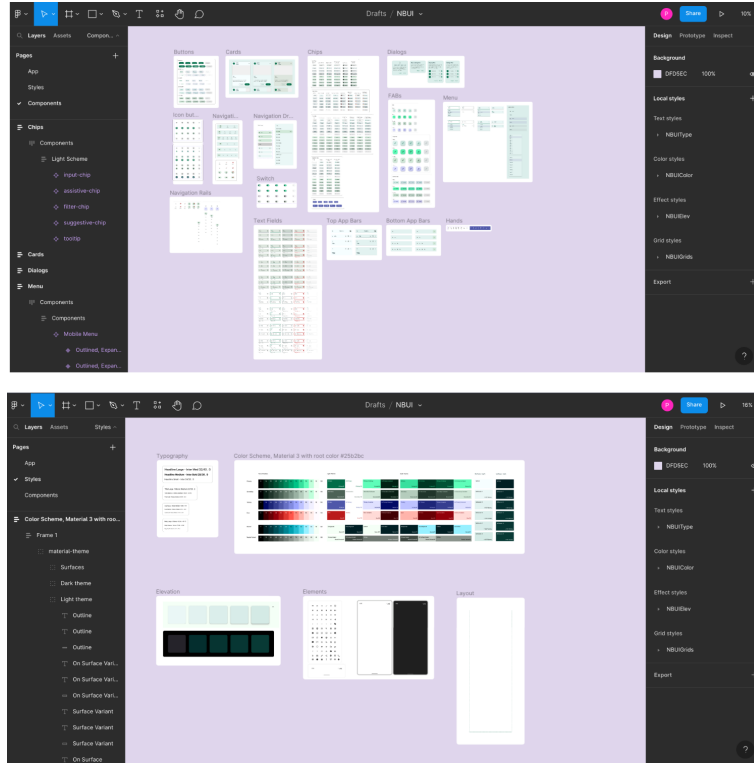


Fig. 2: Glimpses from the Figma Community File for NBUI

Now that we have narrowed down on precise, qualitatively defined parameters governing digital comfort for the NBUs, let us now connect this theoretic formulation with the leads that we could gather based on the ground truth. We audit the aforementioned E-PeekPahani app from through the lens of these principles and based on the works of Mehdi et al and Chaudry et al. This investigation

beings forth several interface-level roadblocks that are but a manifestation of real-world gaps between what the Government thinks the farmers want, and what the farmers actually want - a classic HCI user-centric design problem!

However, we deem it not enough to merely showcase and point out interface-level roadblocks in this manner. Our desire to provide a visual guide to overcome the roadblocks we highlight has led us to formulate a unified design framework of our own, to serve as a proof of concept, with definitive examples on how to tweak the user experience of E-PeekPahani to better suit the needs of the NBU. We call our framework 'NBUI'. NBUI is an extension of Google's Material Design system, applicable across the web, desktop and mobile. In order for our designs to be accessible to any companies/governments/NGOs who wish to incorporate our design principles into their apps, we have published NBUI as a Figma Community File [LINK].

On that note, we commence our analysis, starting at the very foundation of the pyramid of digital comfort:

### 7.1 Ease of Use

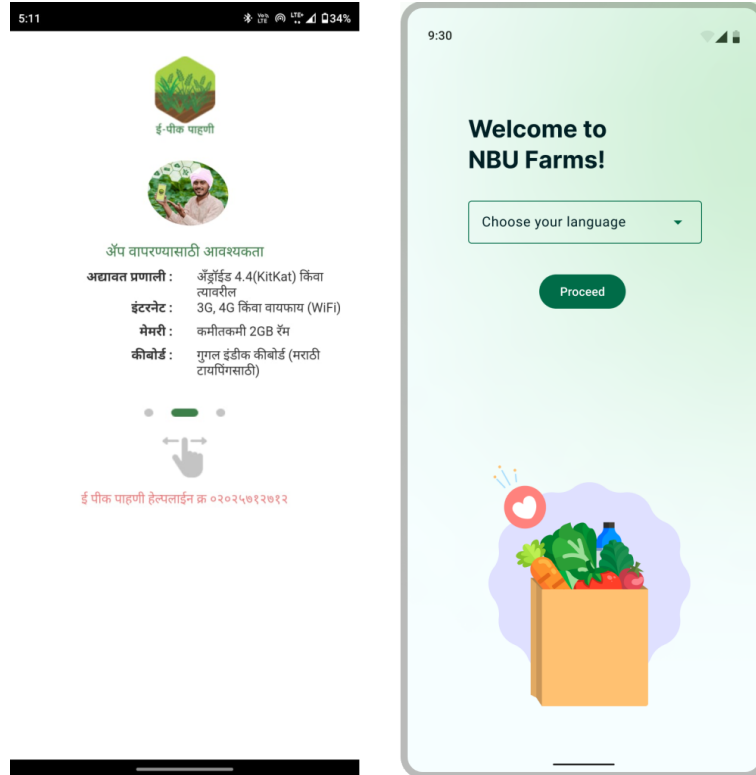


Fig. 3: The First Screen Upon Launching E-PeekPahani vs. an NBUI App

**Literacy Accomodation** A key consideration that is missing from E-PeekPahani is multi-lanaguage support. The apps locks its users into Marathi. The most basic step in increasing user comfort is being inclusive towards users who speak different languages based on their backgrounds and literacy levels. Another possible extension that would be feasible here is SpeakOut functionality, which has been integrated into most front-end libraries already.

Therefore, NBUI dictates that apps start off by letting the user choose their preferred language. This immediately communicates in a preliminary sense that the app makers genuinely care about the users’ preferences: a first impression that goes a long way in terms of driving comfort in the long run. Additionally, developers using NBUI are encouraged to place this language toggle somewhere in the app even after the onboarding process.

**Recovery** As discovered via Mr. Khadilkar’s interview, one of the main reasons farmers rely on youngsters for digital dealings so much has to do with the issue of recovery.

As Mr. Khadilkar specifically pointed out,

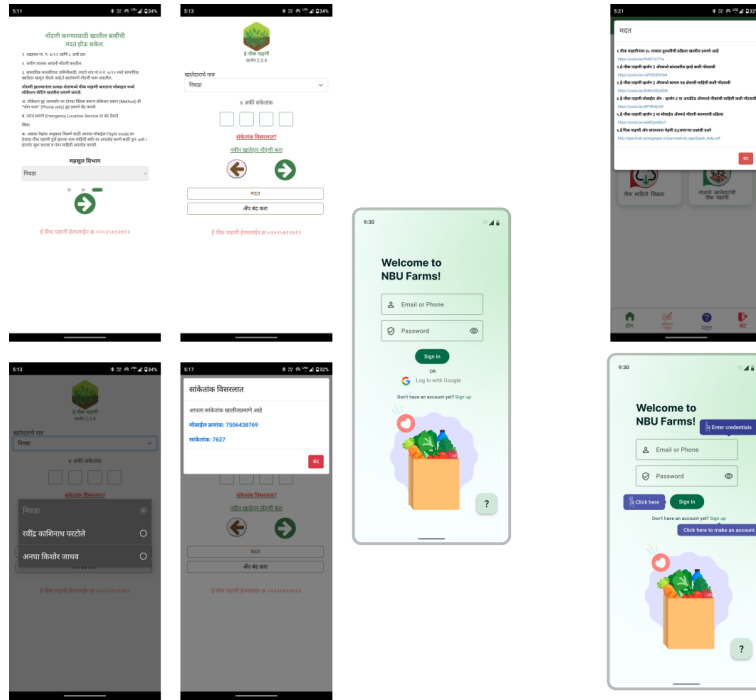


Fig. 4: Streamlining the Login Process for Usability — In-App Help Interaction

1. "The app just says 'Wrong!' when we make some kind of error, without telling us what actually went wrong. There is no step-by-step procedure."
2. "They have set up inaccessible methods as 'help' in case we face problems with the app. But these are just YouTube videos and dummy helplines"

Therefore, recovery mechanisms and in-app help are crucial to driving the ease-of-use factor. Unfortunately, E-PeekPahani does not fare particularly well here.

Firstly, the help button is absent during the onboarding and login process, a baffling omission given how convoluted the process is, with no 'back' option for users to fall back on in case they do mess up one of the many intermediate steps. These intermediate steps, by the way, consist of a gradual drill-down database search, from the district to the village level, that prompts the user to locate themselves according to where they are registered.

NBUI makes the following improvements in this area:

- A simple and conventional login system, where the app performs the database search on the user's behalf, as it should.
- A help button, with tooltips that spawn in and gently guide the user through the interface, in an intuitive manner. This eliminates the need for complex navigation in the onboarding process. An interactive animation can be viewed here [\[LINK\]](#).

**Modalities** - Modalities The design language for E-PeekPahani has only one modality, that stays constant throughout the app, although the app has various distinct functionalities targeted at users having varying literacy levels. Moreover, the low-literacy modality of the in-app help button is directly contradicted by what happens upon clicking it: a popup containing links to various YouTube-based tutorials and a few helpline numbers is shown to the user. Such a popup only confuses the kind of user who would click on the help button in the first place. This roadblock could have been easily avoided had the aforementioned in-app tooltip functionality been integrated into E-PeekPahani's default modality.

NBUI overcomes this gap between the app and the user by introducing the concept of modalities that differ based on the target literacy levels of the demographic. Below is an example of how this might be put to use. We have designed a Swiggy-like Farm-to-Fork app, which facilitates digital crop sale (as suggested by Mr. Khadilkar). The end-user app is simple and elegant, much like a 'conventional' user might have come to expect nowadays. The NBU-modality, consisting of clearer hierarchies, unchanging layouts and the aforementioned help button is geared towards farmers and delivery personnel, who may form the rudimentary supply chain of this hypothetical startup that is using NBUI to design its app.

## 7.2 Utility - Super App Structure

As per the Unix philosophy, an app should do one thing and do it well. As such, it is more appropriate to call apps such as E-PeekPahani as 'super apps' - a system that can be described as an aggregate of simpler services, all in one place. Examining the utility of E-PeekPahani as a super app brings forth quite a few usability roadblocks.

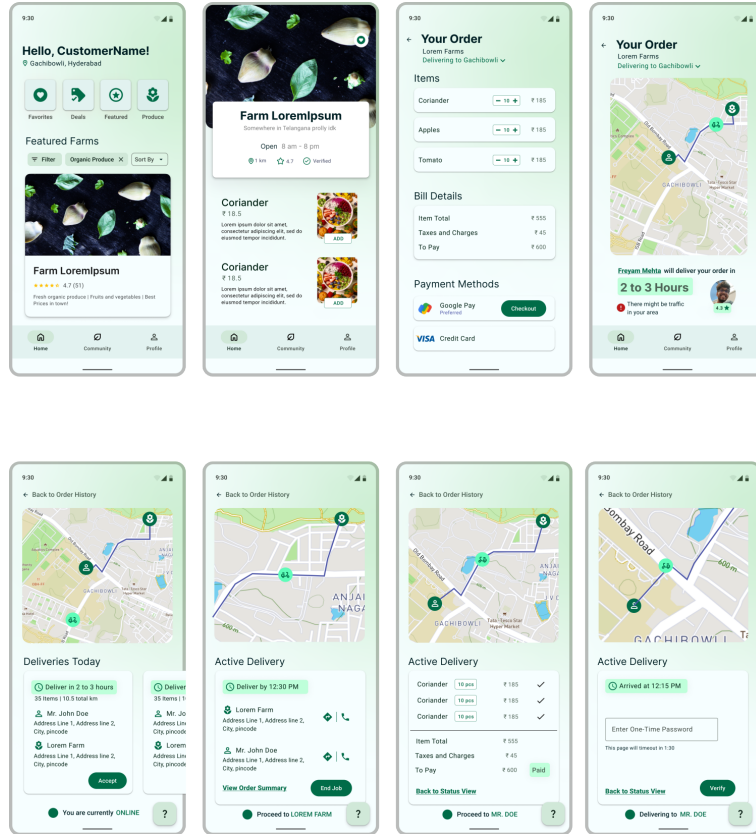


Fig. 5: A Hypothetical Agro-Ecommerce App Based on the NBUI Framework — Top Row = Consumer modality, Bottom Row = NBU modality

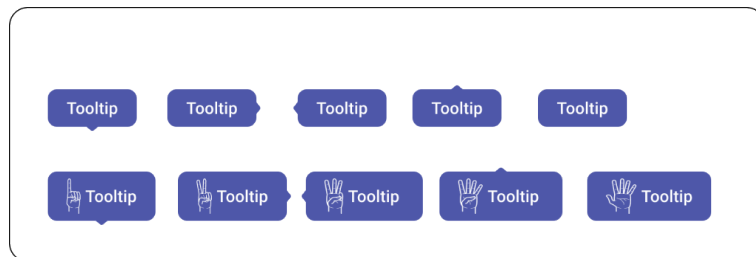


Fig. 6: The Skeumorphic Hand Tooltip - a Custom Component Created by Extending Google's Material Components Library



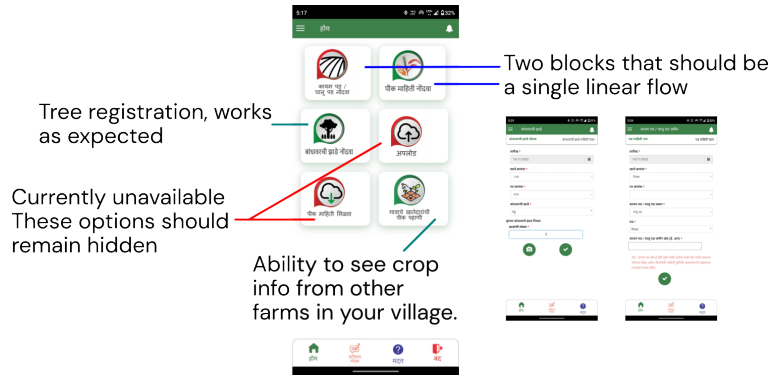


Fig. 7: Super App Usability Roadblocks in E-PeekPahani

- Certain functionality in the super app, such as uploads and downloads are only 'live' when there are pending submissions/retrievals to be performed by the farmer to/from Government agencies. When such functionality isn't live, it should ideally not be displayed on the home screen at all, in order to minimise clutter.
- Mehdi et al. put forth the concept of 'linear flows' specifically in the context of designing super apps for the digitally illiterate. The principle at the core of this philosophy is that every subfunctionality within a super app should be a simple linear (non-braching) flow. The user embarks on a flow, reaches the end, and is brought back to the homescreen, where they may choose another flow.
- Mr. Khadilkar's frustration with the land use and crop distribution accounts seems to have stemmed as a result of this very issue. What should have been a single, cohesive flow has been divided up into separate land and crop flows, which despite being co-dependent, exist as separate tiles within the layout of the app.

The NBUI design motifs detailed above also serve the purpose of designing a linear flow. In-app help tooltips and visual modal hierarchies can be employed to design an intuitive super app experience as per the needs of a particular business.

### 7.3 Systemic Trust

Lastly, the very reason we were able to log in and test out E-PeekPahani was due to a fundamental design flaw. Due to the unusual publicly visible drill-down database search login paradigm, a key security vulnerability exists wherein any arbitrary phone number can be associated with a pre-existing account. This enables the user with that phone number to gain rogue access to all the user functionality of the app. Aside from this, there is also the issue of the app not being transparent in any form whatsoever. There is no way for farmers to audit what is being done using the data they submit. Independent audits are out of the question due to the proprietary nature of the platform. Restricting the public

visibility of one's crop information is somehow not a feature either. In a dynamic where trust is paramount to driving comfort in the long run, the app makes no attempt whatsoever to try and establish it.

## 8 Conclusion

By performing a thorough literature review and conducting interviews with the farmers to learn the ground truth, this study established that there is indeed a fundamental problem in the technological ecosystems which hinders the digital confidence of the people using it. This strongly correlates with the graphical user interfaces and the digital comfort felt by its users. However, the strength of this effect is magnified further by the reliability factor, wherein there's a system-wide mistrust instilled deep into the minds of first-time users. To combat this, this study detailed a unified approach to designing GUIs that promote inclusivity of the varying literacy levels.

## 9 References

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