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FARMER DRIVEN DESIGN OF PINEAPPLE MARKETING APPS: A SURVEY ON FARMERS' INTERFACE PREFERENCES

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ABSTRACT

In the ever-evolving landscape of agriculture, mobile applications have emerged as crucial tools for enhancing farmer productivity and market access. User Interface (UI) design is a pivotal factor influencing the adoption and effectiveness of such applications. This research delves into the specific UI characteristics that matter most to farmers engaged in pineapple farming and marketing, drawing from the existing literature and the unique context of Meghalaya, India. In the research, the locale of study are two villages: Marngar and Mawphrew, Umling C&RD block, Meghalaya, as these areas have actively dedicated to pineapple-related interventions and production. A total of 100 farmers were purposively selected, meeting specific criteria such as having at least five years of farming experience and being no older than 50 years. Data analysis will employ various statistical tools and techniques, including descriptive statistics**.** The research calculates Pineapple Mobile Application Preference Ratings (PRS) using Rating-scale responses. The research findings reveal that the top three item statements on farmers' preferences for the mobile application interface are Rank 1: Accessibility of agronomic and horticultural crop history, Rank 2: Incorporation of drone imagery, and the provision of push and pull customer care services and Rank 3: User-Friendly Interface and Order Tracking specifically. This study sheds light on the priorities and preferences of pineapple farmers for user-centric tailored mobile application to their specific needs in Meghalaya.

Keywords **:** Farmers' Preference, Marketing, Meghalaya, Mobile Application.

Introduction

In the age of digitization and rapid technological advancements, the agricultural sector stands at the cusp of transformation, offering novel opportunities for farmers to enhance their livelihoods and improve the efficiency of their operations. The practice of applying required inputs when and where they are needed is referred to as Smart or precise agriculture. Agriculture has gone through several stages. Agriculture 1.0, from antiquity through the 1920s, was mainly reliant on manual labor. Agriculture 2.0, which lasted from the 1920s to 2010, included mechanization and genetic modification led to increased output while depleting resources. Agriculture 3.0 emphasizes sustainability through high-tech tools such as sensors and cloud computing. Agriculture 4.0 blends internal and external networking while maximizing efficiency through AI and data analysis. Agriculture 5.0 is defined by robotics and advanced artificial intelligence, which drive smart farming through transdisciplinary innovation in information technology and machine learning. This is a watershed moment in agriculture's evolution.

Pineapple cultivation ranks fifth among the states that grow pineapple in the country and is a cornerstone of income for countless smallholder farmers in Meghalaya. In terms of area with 11.31 thousand hectares and fifth in output with an average productivity of 10.41 t ha-1 (Swett and Bera, 2018). Primarily the giant Kew Variety is grown, followed by the Queen variety which is grown in the areas of Ri-Bhoi, East Khasi Hills, and East and West Garo Hills.

Besides processing infrastructure, there are no storage facilities available to preserve the produce after harvest. Considering its perishability, the producers immediately sell the produce to wholesalers who also serve as village-level traders. Farmers frequently sell their produce at unfavorable terms and circumstances due to their poverty, liability, lack of information about market price, and financial inability. However, the user community's real-time or on-field utilization of a smartphone application for agricultural operations is quite low, which calls for a critical analysis of the available smartphone applications. There are no systematic or thorough research on the utilization of smartphone applications and their advantages for end users. (Pal *et al.,* 2018). Digital marketing applications have the potential to mitigate these challenges by connecting farmers directly to consumers and enabling efficient market access. To maximize the effectiveness of such applications, it is imperative to engage farmers in the design process, ensuring that the interfaces are user-friendly and aligned with their unique requirements.

In a rapidly evolving market landscape, the need for effective marketing strategies is more critical than ever. Mobile applications tailored to the specific needs of pineapple farmers hold immense promise in this context. To genuinely empower farmers and drive success, these applications must be created with the end-users - the farmers themselves - at the forefront of the development process.

This research holds immense significance as in an era where technology is poised to revolutionize agriculture, it strives to empower pineapple farmers by incorporating them in technological development, filling a literature gap, and focusing on pineapple cultivation and marketing. The specific challenge addressed in this study is the need to improve the user interface (UI) design of pineapple marketing applications by analyzing and adopting pineapple farmers' interface preferences. This research aims to bridge the gap by identifying and prioritizing the important User Interface elements preferred by farmers in order to design more user-driven and successful pineapple marketing apps, ultimately resulting to improved adoption, increased productivity, and economic empowerment in the region. The literature-driven facts clear that there is a pressing need for scientific research to address the problems. The following research objectives have been formulated for the study:

- To identify the farmers' preference for the interface of Mobile Applications in marketing Pineapple

Materials and Methods

The locale of study for this research is Meghalaya, specifically the Umling C&RD block in the Ri-bhoi district, known for its pineapple cultivation. This selection is purposeful, as the research project DHaBReT is actively involved in pineapple-related interventions in this region. Two adopted villages of the collaborative research project, namely (i) Marngar and (ii) Mawphrew from Nongpoh C&RD block had been purposively selected for the study. To gather data, a total of 100 farmers were purposively selected, meeting specific criteria of having at least five years of farming experience and being no older than 50 years.

'Farmers' preference on the interface of Mobile Applications' was operationally defined as the degree to which a farmer-respondent desires and aggrandizes the interface of a mobile applications on integration of UAV imageries for marketing of Pineapple of Meghalaya. The variable comprised of 12 item statements and a 4–point rating continuum was administered, wherein the scores of '4', '3', '2' and '1' were assigned to 'Strongly Agree', 'Agree', 'Partially Agree', 'Disagree' and 'Strongly Disagree', respectively to the positive statements and the reverse scoring of '1', '2', '3' and '4' were assigned for the negative statements. The research will employ various tools and techniques for data analysis, notably descriptive statistics to summarize farmers' preferences and factor analysis to discover the underlying elements influencing these choices. PRS will be calculated using Likert-scale responses, with weights assigned to each item statement defined by factor loadings. Ethical considerations are a priority, with informed consent, anonymity, and confidentiality for all participants, as well as seeking ethical approval from the institutional review board.

Data validation techniques, such as pre-tested questionnaires and thorough data cleaning, will ensure the validity of the data. The interview schedule was pre-tested against ambiguity and redundancy to a sample of 30 farmers in a non-sampled area. After pre-testing, necessary modifications were made in the interview schedule based on the result of the pilot study and thereafter final format was obtained for data collection. Finally, the study will evaluate PRS findings in the perspective of existing literature, providing significant insights for building or improving mobile applications that meet the needs of farmers in the region. The data collected were coded, tabulated and analyzed in accordance with the objective of the study. The Software used for data analyses included SPSS 23 and MS Excel.

Result and Discussion

To identify the farmers' preference for the interface of Mobile Applications in marketing Pineapple

In the scientific inquiry, the priority ranking scores and rankings for twelve important farmers' preference item statements were rated on a 4-point continuum scale by 100 pineapple farmers through a pre-structured interview schedule. These preferences provide valuable insights into the key features and functionalities that pineapple farmers prioritized for pineapple marketing in Meghalaya. Table 1 and Figure 1 critically discussed the Prioritized Rank (PR) apropos of the item statements *viz.,* **(1)** PF1: 'I found the interface of the PANANAS MApp for pineapple marketing in Meghalaya to be user-friendly.', **(2)** PF2: 'The incorporation of UAV imagery in the PANANAS MApp expands my knowledge of pineapple cultivation'. **(3)** PF3: 'The PANANAS MApp remains an efficient means of increasing pineapple sales in Meghalaya.', **(4)** PF4: 'Control on sale of produce (i.e., pineapple) for significant profit is possible through Pananas MApp by way of minimal bulk or bundle sale.', **(5)** PF5: 'The incorporation of Drone imagery in the PANANAS MApp boosts the confidence in the marketing of pineapple.', **(6)** PF6: 'The PANANAS MApp should provide adequate information about the nutritional value of pineapple.', **(7)** PF7: 'The PANANAS MApp is a great way to remain up-to-date with pineapple cultivation techniques in Meghalaya.', **(8)** PF8: 'The PANANAS MApp should have the provision to readily examine the agronomic/horticultural crop history right from land preparation till harvesting of the produce.', **(9)** PF9: 'The PANANAS MApp should enable the customers to track the order specifying the most likely duration on delivery of the fruit online.', **(10)** PF10: 'Feature on forecasting of maturity of pineapple intact in the field should be incorporated in Pananas MApp.' , **(11)** PF11: The PANANAS MApp should have a ready reckoner (digitized *Bahi khaata*) on calculating basic business derivatives (e.g. Cost of Cultivation, C:B Ratio etc.)'and **(12)** PF12: 'The PANANAS MApp should have the provision of push & pull customers care services'. are mentioned above from highest to lowest priority scores.

Table 1 : Prioritized ranking score for item statement of farmers' preference for the interface of Mobile Applications in marketing Pineapple.

S. No.	Farmers' Preference Item Statements	SDA	DA	A	SA	PRS	PR
1	**PF1**	3	12	42	43	**325**	**3.5**
2	**PF2**	3	14	42	41	321	**5**
3	**PF3**	2	15	42	41	322	**4**
4	**PF4**	6	15	41	38	311	**8**
5	**PF5**	3	11	40	46	**329**	**2.5**
6	**PF6**	4	14	45	37	315	**7**
7	**PF7**	8	16	38	38	306	**9**
8	**PF8**	1	13	40	46	**331**	**1**
9	**PF9**	4	10	43	43	**325**	**3.5**
10	**PF10**	5	12	45	38	316	**6**
11	**PF11**	8	17	40	35	302	**10**
12	**PF12**	3	9	44	44	**329**	**2.5**

N.B. *— Strongly Agree (SA), Agree (A), Disagree (DA), Strongly Disagree (SDA) & PRS (Prioritized Rank Score)*

The study could unveil that the three most important item statements on farmers' preference for the interface of Mobile Applications in marketing Pineapple are, namely **(Rank 1) PF 8:** 'The PANANAS MApp should have the provision to readily examine the agronomic/horticultural crop history right from land preparation till harvesting of the produce' with the PRS of 331, **(Rank 2.5)** shared by two item statements *viz.,* **PF5:** 'The incorporation of Drone imagery in the PANANAS MApp boosts the confidence in marketing of pineapple' and **PF12**: 'The PANANAS MApp should have the provision of push & pull customers care services.', with PRS of 329, and **(Rank 3.5)** shared by two item statements *viz.,* **PF1:** 'I found the interface of the PANANAS MApp for pineapple marketing in Meghalaya to be user-friendly.' and **PF9**: 'The PANANAS MApp should enable the customers

to track the order specifying the most likely duration on delivery of the fruit online.', with the PRS of 325.

A radar chart in Figure 1 graphically depicts the prioritized ranking scores supplied by farmers to various item statements, demonstrating their preferences for the interface of mobile applications in pineapple marketing.

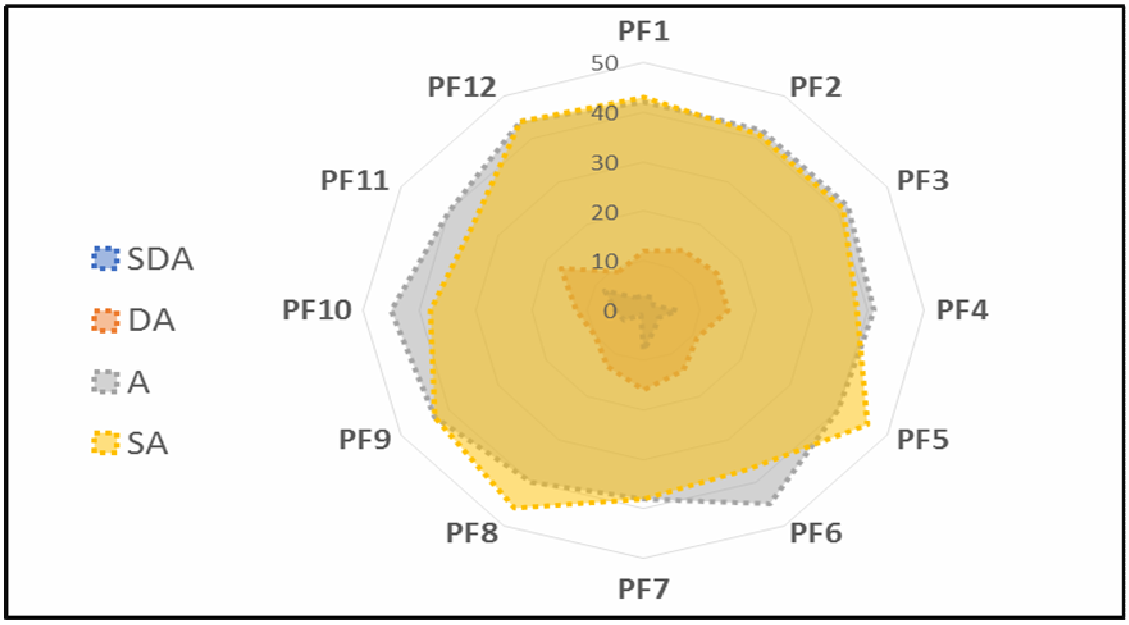

Figure 1: Radar chart displaying the Prioritized ranking score for item statement of farmers' preference for the interface of Mobile Applications in marketing Pineapple.

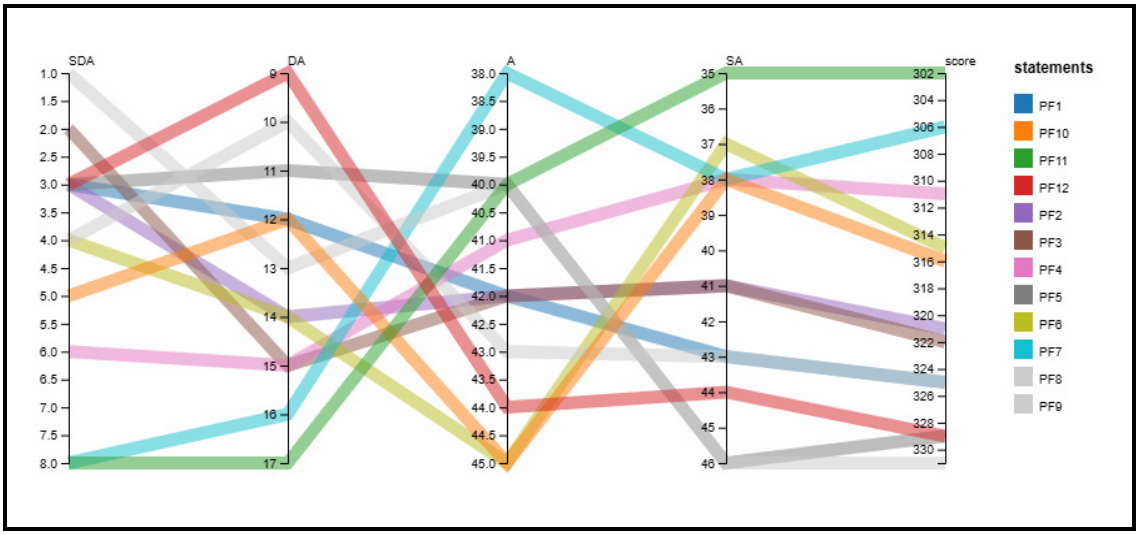

Figure 2: Parallel coordinates plot chart displaying the Prioritized ranking score for item statement of farmers' preference for the interface of Mobile Applications in marketing Pineapple.

Figure 2 depicts a Parallel Coordinates Plot chart displaying the Prioritized Ranking Score for farmers' preference of the interface of Mobile Applications for Pineapple marketing. Each axis represents a different item statement, resulting in a three-dimensional visualization. The plot enables a thorough understanding of the interplay of numerous elements impacting farmers' decisions. Here, 12 Farmers' Preference Item Statements are categorised into five categories: SDA, DA, A, SA, and PRS (priority ranking score). Each category can be represented on a separate axis in the parallel plot diagram, with the statements plotted as lines across the axes. This will allow for a visual comparison of the different categories and how they relate to each other.

Discussion

The discussion section will shed light on the priorities and expectations of farmers regarding the PANANAS MApp, ultimately contributing to more effective and user-centric tailored tools for pineapple marketing applications in Meghalaya. The farmers' preferences align with prior research findings and emerging trends in agricultural technology and mobile applications as follows:

Agricultural Crop History Examination (PF 8) emerges as the top preference among farmers. This demonstrates that farmers attach a high value to having access to full information on their crop's history, which can help them make informed decisions throughout the production cycle. This preference aligns with the need for farmers to access historical data for informed decision-making, crop management, and addressing challenges. Prabha and Arunachalam (2017) underscored the importance of providing farmers with detailed information, emphasizing the significance of text messages and interactive services. The demand for agronomic and horticultural history access is in line with this recommendation. This result also aligns with the findings of Pal et al. (2018), who emphasized the importance of providing users with access to price information and other relevant details in their locally preferred language, which the following study corroborates by highlighting the importance of examining agronomic/horticultural crop history.

Drone Imagery Incorporation (PF 5) and **Push and Pull Customer Care Services (PF 12)** are tied for second place in farmers' preferences. These preferences highlight the impact of technology in increasing farmers' confidence and marketing capacities. Lomotey *et al.* (2013) proposed using dual caching strategies to enable real-time updates, which matches with the requirement for instant access to information and customer care services. Furthermore, Joseph *et al.* (2021) emphasised the significance of feedback systems in relation to the need for customer care services. The integration of Weather and GPS-Based Services is an essential consideration for future development. This aligns with the broader trend of providing farmers with real-time, location-specific information, as highlighted by Hrustek (2020). These services can significantly impact crop management and decision-making, ensuring that farmers have access to timely and relevant data. This reflects the increasing role of technology in enhancing farmers' confidence and marketing capabilities, as suggested by Jan *et al.* (2019), who proposed various interfaces and interaction methods for agriculture, including visual imagery and speech-based interaction. Additionally, the findings of Chipidza and Leidner (2019) regarding the low uptake of decision support systems (DSS) and mobile apps among farmers due to various barriers highlight the importance of integrating user-friendly features like drone imagery and customer care services to overcome adoption challenges.

User-Friendly Interface (PF 1) and **Order Tracking (PF 9)** share the third rank. A user-friendly interface is crucial for ensuring that farmers can easily navigate and use the mobile application, which correlates with the findings of Laso Bayas *et al.* (2020), who emphasized the role of usability. The desire for order tracking aligns with the need for transparency and customer satisfaction, as highlighted by Joseph *et al.* (2021). Additionally, the ability to track orders and delivery times online is essential for enhancing transparency and convenience in the marketing process. This aligns with the emphasis on usability and user preferences highlighted by Jain and Purandare (2021), who assessed system usability and user preferences, stressing the impact of literacy levels and digital literacy on technology acceptance.

Furthermore, the study's findings resonate with broader trends in agricultural technology and digital transformation. The desire for real-time updates as mentioned by Hrustek (2020) and the integration of weather and GPS-based services reflect a growing appetite for data-driven decision-making in agriculture. The use of advanced technologies such as machine learning for fruit detection is also considered as the future of agriculture digitalization by Syazwani *et al.,* 2022. Additionally, the study by Narawi *et al.* (2022) on AnanasApp, which assists pineapple growers in managing their crops effectively, reinforces the importance of providing user-friendly and practical features in agricultural mobile applications.

Given the various requirements i.e., localized language support., accessibility in remote places is ensured by tailoring solutions to handle changing network availability and having user-friendly interfaces, especially for farmers who are unfamiliar with technology. Features that allow for real-time market data, weather updates, and supply chain management can improve efficiency. Collaborations with local cooperatives and government programs to enhance community engagement should be considered. Adapting to the unique cultural and economic characteristics of Meghalaya ensures a more effective and long-term marketing solution.

Conclusion

In conclusion, this research has identified the top preferences of farmers in Meghalaya regarding the

Mobile App for marketing Pineapple. The study revealed that farmers prioritize the ability to examine their crop's history, value the incorporation of drone imagery, and emphasize the need for push-and-pull customer care services along with User-Friendly Interface and Order Tracking Features. These preferences are lined up with broader trends in agricultural technology and mobile applications, emphasizing the importance of data access, technology-driven trust, and customer satisfaction. The outcomes of the study underscore the growing need for data-driven decision-making and technical improvements in agriculture, as well as the possibility for new tools to improve pineapple marketing in Meghalaya.

Limitations

Potential limitations such as response biases and generalizability will be acknowledged as it is limited to the specific context of Meghalaya and may not apply to other regions or countries with different agricultural practices and pineapple marketing dynamics. Hereby, this research conclusion does not discuss the long-term impact of integrating mobile technology into pineapple marketing practices, including sustainability, scalability, or potential unintended consequences. The other mentioned limitations are followed by the technical constraints specific to technological features in a mobile app i.e. without considering potential barriers to technology adoption, such as access to smartphones, internet connectivity, or digital literacy among farmers concluding it adaptability may not be concluded. Hence, require further research for a better understanding of the market related to the pineapple marketing and its application in domain.

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