Uplift The Dairy Product Distribution Using Emerging Technologies Under the Covid-19 Pandemic Situation

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Abstract- Small and medium scale businesses proceed a huge role in inspiring the economy of the country. In Sri Lanka approximately 75% of all businesses as small and medium scale businesses and contributes to 45% of the total employment of the country. This research paper discusses the farming sector which can be given a big contribution to our day-to-day life. Fresh Milk and eggs are the main product on the farm. Before the COVID 19 situation, they delivered the products to our doorsteps. Under this circumstance that is not an easy task. Now we have to work under the COVID 19 safe guidelines. Wearing a face mask and keeping the social distance is at the top of the list. Presently, they cannot continue the business as the previous process. This research main target is to move the farming sectors to the online platform with the proper delivery process. Then they can be kept their social distance and continue their business.

Mobile application stands as the interface between the businessman and the customers and the application helps the customers place online orders and the farm is ready to deliver the items according to the request of the customer. This is not like a typical online order application. Further, this was highly customized for the farming sector and the ordering pattern of their customers. It can be helped to interact with the businessman and customer effectively and efficiently.

Indexed Terms- Covid-19, dairy product distribution, Mobile application, Online delivery

I. INTRODUCTION

In the typical world, we move to the place and buy the products and services as we wish. Word never used online systems as part of life. End of 2019 one of the pandemic situations started in Chine and today it spread all around the world. Now we know that pandemic is covid-19. It used two spreading methods, one is coughing or sneezing of the infected person. If someone is within a 1-meter distance of the person, that one also can be inflected from the virus. The next method is for someone to touch the component which was touched by the infected person previously. Therefore, social distance is the most important precaution in this situation.

With the starting of the covid-19 situation, online methods become more famous in the world like e-learning, e-business, online shopping, online delivery, online payment, etc. Many of the supermarkets, food suppliers, restaurants move to the online platform to deliver their foods and goods. Some taxi services like Pick Me and Uber start food delivery under Pick Me Food and Uber eats. Large scale businesses can easily do those changes in their organization. The main reason is they have enough funds and manpower. They were never reluctant to invest money to create and maintain a set of different online platforms like webpages and online mobile applications. This conversion became easier with the fast growth of the Internet facility and wireless technologies. The best example is smartphones become a common device in our lifestyle. This highly affected the small and medium scale business. They are difficult to do that much investment in a short period. Also, they haven't a big idea about those new technologies and they haven't any idea about how to get the first step. According to those reasons some small and medium scale businesses difficult to survive in this situation. They lost their customer base. They do have not any method to communicate with their customers appropriately. Without clear communication difficult to continue the delivery process.

In this research, we consider one of the small-scale businesses and we tried to take them to the online

platform by introducing an attractive and effective solution according to their solution. Belihuloya farm provides milk and eggs to their customers daily in that area. They have a customer base and delivery system. In this research, we introduce the fully customized mobile application to this process. Customers can easily place the order and suppliers can effectively deliver the product according to the request.

II.   PROBLEM DEFINITION

Belihuloya farm Dairy production distributes the dairy production in the Belihuloya area in Sri Lanka. It has a few products like Fresh milk (that mean cow milk and goat milk) with egg. In a normal situation, their process is to move house by house and distribute them. When the distributor gives the product, the customer places the order the next day and the distributer notes down it. but the question is in this lockdown situation they are difficult to follow their common method. Because there are some difficulties to contact the house owners according to the set of reasons. Some houses are quarantined. some of the days' persons are not in their houses. it builds a set of problems.

The main issue is there is no direct and strong connection between the seller and the customer. A simple phone call or note down the order on a piece of paper is not a good manner. Because mistakenly is can be forgotten or lost. Seller and customer have not any clear idea about sold or bought products. like a log. Some changes are not mentioned by the seller. the seller has some kind of log on the book. but the customer doesn't maintain this kind of thing. simply they try to keep in their mind. Sometimes it made some arguments when doing the payments at the end of the month. Keeping the log about selling and buying products is already an existing problem in this sector. This system tries to address those problems also.

Under the covid-19 situation, we should be considered keeping the social distance, the safety of the product, delivery hygiene by following the COVID-19 guidelines in the delivery process and the productions.

III.   LITERATURE SURVEY

Kotmale the milk factory collects 17,000 litres from a large number of local dairy farmers and they have

earned 5.2 billion as their direct income in 2020 for the society of dairy farming. Today, Kotmale is the largest private milk collecting company in Sri Lanka and they collect 180,000 litres per day [1]. Kotmale has turned to the national dairy brand of the country and it helps to enhance the society of local dairy farming. Cargills PLC owns Kotmale as it is one of the famous food companies in Sri Lanka and it is a Lankan company with a percentage of a hundred. Today, the percentage of 60 should be imported to provide the milk needed for the country. Therefore, the country misses 320 million of foreign exchange every year. Lack of milk is a major problem faced by the country. Generally, the supplement of the milk is lower than the local demand. Indians are independent as they are not depending on other countries regarding milk requirements. Sri Lanka faces two major issues in milk production. The first one is, having less number of milking cows and the next one is, low yield per cow compared with other countries. It mainly affects the profit of the milk farmers in the land. Dairy products need high-quality milk and dairy productions in all stages of milk-producing [2] [3].

The population of the milking cows available in the country has fallen to a lower level. In 2015 it is 596000 and in 2019 it has turned to 444000. The population of milking cows has fallen to 25% within 4 years. Everybody should pay attention to this matter by considering those statistics and addressing the problem. The next step must be the involvement of the stakeholders in the farming sector. Average of the worldwide milk production of a cow is 7 litres. Generally, India collects 8 litres from a cow as an average. Sri Lanka can collect less than 3 litres. That becomes the main reason to drop the in yield and profit. Milk farmers also leave the dairy farming and local milk production is getting weaker.

In the agricultural sector and identifying the issues of vendor-specific production systems and that research proposed a multimodal communication model for the systematic integration of multi-vendor agricultural production systems. Internet of things also agrees on the farming industry with smart farming [4], [5].

Cargills played a major role to enhance milk production and helped small scale dairy farmers to get a better income. Also, Cargills could support by

providing technical and financial sides to improve the capacity of milk production done by farmers. There is another important fact regarding Cargills, as they provided some market and they collected milk also during the lockdown of Covid 19. They could give fair prices to the milk farmers in the country.

Cargills add value for local small-scale farmers and milk manufacturing sectors to compete with the international brands. When increasing the income and profit of the milk farmers in Sri Lanka, then they can easily provide reasonable nutrition for their customers. As a country, Sri Lanka could save more than 28 million in 2020 when sourcing fresh milk in the country. That income is directly sent towards the Lankan farmers and it helps to increase the nutrition level in the country with quality products [6].

A. Sector review
Agricultural contribution for Sri Lanka gross domestic production is 16.8% in 2006. In 1998 it dropped by 21.3%. 2005 statistics show 30.7 % contribution in the agricultural sector in a rural area. There is an essential part of many other agricultural sector enterprises as long as draught power, transport and dung for fertilizer.

TABLE I Milk Production In, 1998–2005

| Year | Fresh milk *('000tonnes) | | | |
	Cow milk	Buffalo milk	Total milk	Per capita availability (kg/year)
1988	124.48	25.09	149.57	4.80
1999	126.42	25.50	151.92	4.99
2000	127.74	25.52	153.26	4.96
2001	129.02	25.58	154.58	4.90
2002	129.09	25.64	14.73	5.3
2003	132.22	25.56	157.78	5.47
2004	134.88	25.84	160.72	5.34
2005	136.67	26.12	162.79	5.37

Fig 1. Source: Department of Census and Statistics, Sri Lanka

Expected milk production for the year 2015 was 162 million litres and it was 3% more than the previous year. Milking cows could supply 13.6 million litres. With this growth, could added milk of 98.9 million litres to the normal market. General usage of milk production became 528.2 million litres and in 2003, it dropped to 76 million refer Table 1. In 2007, Food and Agricultural Organization estimated it and it was 174 million litres [6].

Estimated imported milk production is 429.3 million litres in 2004. The total value of that is 12.26 billion rupees. Approximately local milk usage will be 80 per cent.

B. Areas of the production
Milk production is happening in every district. The lowest production is reported in the northern district. In 2002, according to the census of agriculture, the largest cattle populations in dry and intermediate zones in the country. Suppose that the wed mid and upcountry areas have high milk production and it is more than 50 per cent of the manufacturing rate of the country. Refer the Table 2 to get a clear idea.

C. Location and scale of livestock operations
There are many contributions in the milk production of the country that is taken by small scale farming sectors. The following Table II shows the important topographical and climate in order concerning dairying systems.

Table II Main dairy production systems in Sri Lanka

Production systems		Average daily milk production per cow (litres)	Popular management system
Hill country		6 to 8	Intensive
Mid country		4 to 5	Semi-intensive
Coconut triangle		3 to 3.5	Tethered
Low country	dry zone	1 to 1.5	Extensive
	wet zone	3 to 3.5	Tethered

D. Marketing
There are some complexity and variety in the country to marketing the milk productions. Some hotels, canteens and customers have their own or individual suppliers. The dairy products market is consisting of small dairy cooperatives, larger local cooperatives, district dairy cooperatives, dairy supportive unions and networks of collection points and milk chilling centres operated by the major dairy processors.

The country creating new informal market and supplier chain with private milk collectors helps small processors of conventional dairy products, retailers and dairy producers to sell directly to hotels and restaurants or customers and also small local processors of modern dairy products, contribute to the supply chain [7].

Table III Native vs Hybrid vs Crossplat-form [8]

Application Type	Native	Hybrid	Cross-platform
Debugging	Uses native debugging tools	Uses native and web dev debugging tools	Depending on the framework
Codebase	Individual coding separate for each platform	Single codebase with potential platform-specific capabilities	Single codebase with potential platform-specific capabilities
Dependency	Les depended on other open-source libraries and platform	Extensively dependent on different libraries and tools	Extensively dependent on different libraries and tools
Cost	Higher	Cost-effective	Cost-effective
Time to market	Time-consuming as develop as an app at a time	Time-savor as code is reusable	Time-savor as code is reusable

There is various mobile operating system available in the world. Android and iOS in the leading operating systems. Therefore, developers need different types of programming skills, spend much time and cost to build applications to those different operating systems under these circumstances world can see the importance of

cross-platform solutions in Table III. Nowadays ubiquitous computing is in a good position in the world [9].

IV. METHODOLOGY

Our solution is an App to build a strong connection between the seller and the customer with some transparency. We provide fresh products, directly from farmers without any Intermediaries. It is helpful to keep the customer's satisfaction level in a higher place. Customers can place the order nicely and they can change it appropriately.

Customers can download the app and first they have to register the app providing their details like name, address, contact numbers. Next, they can place the order as they wish as figure 2. Application display all available products on the farm with the maximum number of supply count. Supply count means we have some limitations in their productions. As an example, the farm can produce 20 litres of milk, if the daily total order reaches the 20-litre limit, the system automatically locks the product. Because provide high-quality products to our customers is one of the important factors to keep a strong customer base. We permit the seller to limit the order.
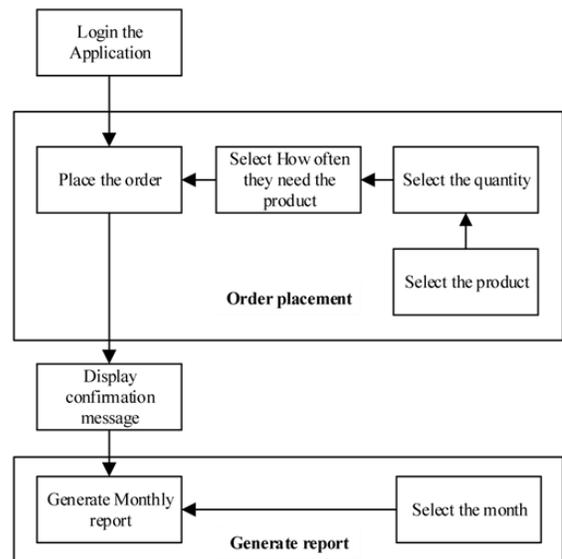

Fig 2 block diagram for customer's application

This order is the most important facility in this system. As an example, fresh milk is one of the products we are using daily. Therefore, customer has to place the order

daily for this product in other existing online delivery systems. This application gives the facility to the customer to select the order as only tomorrow, daily, weekly (should indicate the day of the week) and only for weekdays or only for weekends. Then customers no need to place their orders again and again.

If customers want to do changes in their orders, applications give that facility to do those changes easily. They can cancel the order, add more items to the order or reduce the number of items. Morning of the day, farmers can view the daily report from the application. The farmer starts to collect the products according to the requests, at that time farmer closes the order for that day and generate the report digitally. That means after the farmer closes the daily, customers cannot do any changes for order on that day.

Now both sides have some kind of confirmation about everyone's request on a specific day. Farmer can maintain the proper log about day to day selling and changes are not a big issue. After ready, all orders distributor can start the delivery process. Using the app distributor get a clear idea about the location of the house and the order without any argument. When they give the order to the customer, at that time delivery guy can change the status of the order as delivered. At that time customers get the message as the order is delivered.

The end of the month application generates the report for every customer. Customers can also check their orders and payment over the application. This is the easier and proper way with high transparency.

V.   USING TECHNOLOGY

For the backend we use .netcore 3.1 is an application programming interface for a web application. It uses HTTP protocol to communicate between mobile apps to have data access. Asp.net Core web API is a cross-platform web API. Users can access the application from different devices like mobile, web apps. Mobile app requests to Web API and Web API will respond in JSON format.
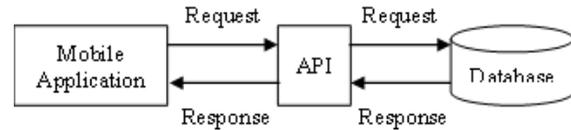

Fig 3. Data transmission between the database and mobile application

Web API connect with the backend database. we use the database as Microsoft SQL. Database connection done by entity framework and repository pattern.

End-user can access it by mobile app. The mobile app was developed using flutter. Flutter is an open-source UI software development kit created by Google. It is used to develop cross-platform applications for Android, iOS, Linux, Mac, Windows, Google Fuchsia, and the web from a single codebase.
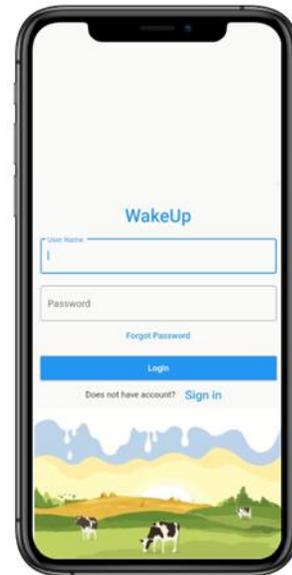
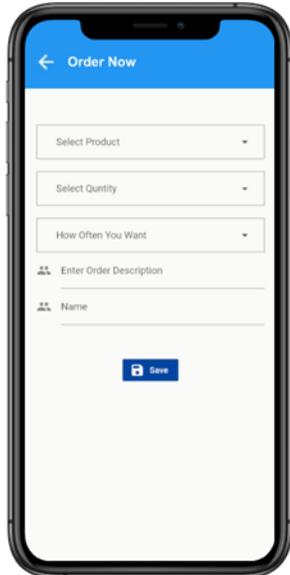## VI.   USER INTERFACE DESIGN
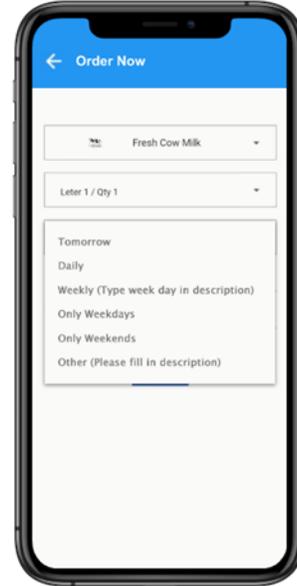

Fig 4. Customer's first screen

Fig 5. Select the order

When opening the application, it displays the order now button on the welcome screen like Figure 4 and Figure 5 displays the interface used to select the product to the customer. After selecting the product, the customer can select the quantity. Also, it has the facility to select how often they need the product.

Fig 6. Select the product

Fig 7. Supplier's user interface

The product selection interfaces are displayed in figure 6 and figure 7. Suppliers can define the products which display in this section. This is the place which customers can select how often they need the product.

Fig 8. Monthly invoice of the customer

Customers can generate the monthly report from the system as figure 8.

VII. TEST RESULTS

We used only one sample of customers for daily milk consumption around Belihuloya for this purpose. "Belihuloya Agri farm" gave the support to find the specific customers from their customer basis. Among them, liquid milk consumers are given priority to this study. The purpose of this cause is that liquid milk consumers are even involved in this service daily. As a result, the data gathered has a high level of accuracy taken. We have used several methods to raise awareness about the new mobile app. By social media, posters and messaging to the existing client base. More than 100 clients will be selected in the early stages to get useful statistics. After deleting errors and incomplete information, as well as outliers, we were able to acquire 35 observed data for the research. This mobile app was downloaded to their phone and made to be used. This allowed them to get a sense of the app interface and how it may meet their needs.

The supplier continues the delivery process as usual for all customers. That selected customers placed their orders via the application and the supplier handle only those customers over the application. They caught the method quickly because most of the customers have some experience with using online delivery applications. They engaged with the new feature "on-time order" method because they no need to place the order again and again. 20% of users said they want to do their order placement daily and 70% absolutely like that feature because it can save time and help to avoid the fail remembrance. With this new feature no need to keep the reminder and do the placement daily for the product like milk. Also, they have the facility to stop that automated iteration process at any time.

Table IV. Test results of WakeUp mobile application

	Number of customers
Installed the application	35
Placed orders daily	8
Used one-time order facility	27
Cancel one-time order	3
Generate reports	35

Customers and the suppliers were well pleased with the reporting facility. Still, that farm didn't provide that type of receipt/report to their customers. They had some idea to generate a proper bill to their customers according to the few requests. It did not succeed because they do not have a suitable method to keep the details of all orders. Going through the logbooks and creating the report is not an easy process. Over the system anyone no need to worry about the reporting part, the application can generate it quickly and it helps to do the confirmation regarding an order of every customer. It will be an added advantage for the supplier and the customers by improving transparency.

Meanwhile, their opinions were also recorded to investigate the research questions. Important test results display in table IV. Consumer feedback on the new mobile app has taken many forms. The majority of consumers believed that these new services would suit their needs of the times. Others felt that the service should be linked in several other ways through the mobile or web app. It was largely due to several issues related to technology. Few people paid attention, preferring to walk door-to-door or buy from retail stores.

Table V. Test results of WakeUp mobile application

Description	Test Step	Expected Result	Status
Type	Functionality		
Login Screen	Adding Username & Password then click the login button	Go to the main screen	Success
Type	UI		
UI Main Screen	Main page components	Should be in are in the correct order	Success
Type	Functionality		
Order submit	Click on order now directed to order page and create order	If Valid order only save to database	Success
Type	Database		

Save Changes	Click on save order	Values should be in the database	Success

After execution of the application, it successfully passed the test results and now it can provide the proper service to the suppliers and customers. Refer the table V for the test results.

CONCLUSION

This application mainly forces to provide a friendly interface to the customers and suppliers with high transparency of the orders and delivery process. It provides the facility to customers easily select the product, quantity and how often they need that product. That is the new concept for online delivery applications. Customers don't like to place orders every day for daily needs like milk. This application gives the ability to the customers place the order at one time if they like system can recurrent the order as daily, weekly, etc. This one-time order placement is helpful for the customers.

Payment report is another important feature is in both ends. The supplier can generate the proper bill and get the digital report without any arguments. It can increase the transparency between customers and suppliers. For feature development application will provide the route map for the delivery service. When a customer registers the system, it can get the location of the permanent address of the customer. When placing the order, the system marks the location on the map. In the morning before the start, the delivery process, the system displays the easy and shortest route for the delivery team. This application can give the new look for all the online delivery applications and it helps to increase the reliability between supplier and customer.

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