

Proposed ICT Based ERP Model For Milk Cooperatives

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ABSTRACT

We have conducted academic research on ERP modules use in milk cooperatives. Our study was oriented around milk cooperatives and cattle farmers. Objective of study was to understand how ICT base ERP system can improve coordination between coordination between milk cooperative and cattle farmers and to propose ICT based ERP model. We have conducted our research in four different district of Gujarat. We have collected primary data from cattle farmer as well as milk cooperatives. In this research paper we will discuss research details and also discuss proposed ERP model.

Index Terms : ICT base ERP model for dairy industry, Disruptive technology in dairy industry, Farmer relationship management, Cattle management

Acronym : ERP: Enterprise Resource Planning, ICT : Information and Communication Technology, RFID : Radio-frequency identification, IOT: Internet on things, GIS: Geographical information system

Definitions :

ERP : “Enterprise Resource Planning (ERP) is an enterprise-wide software solution that integrates and automates business functions of an organization. This real-time information integration across the organizations functional areas increases operational efficiencies and helps managers to arrive at better decisions making the organization more competitive. Today having an ERP system is not a luxury, but a necessity. A robust ERP system along with a fully trained workforce is a must for an organization s survival.”¹

Disruptive ICT technology : “Disruptive innovation is a term in the field of business administration which refers to an innovation that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market leading firms, products, and alliances.”²

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¹(Leon, 2008) ²(Ab Rahman, 2017)

Full forms

IOT : Internet of things

GPS : Global positioning system

GIS : Geographic information system

RFID : Radio frequency identification

I. INTRODUCTION

India is one of the top milk producing country. Indian dairy sector is largely dominated by cooperatives. Cooperatives founded and formed by farmers are the key stakeholder of these cooperatives. Multiple small cooperatives have joined their hands to form milk marketing federations and milk processing units. At present milk cooperatives are well connected with its parent federations. There is an easy exchange of data, information, governance etc. at federation and cooperative level. But the missing piece in whole structure are farmers. Farmers are largely detached from their cooperatives and milk unions. So, to improve transparency and to integrate key stake holder milk cooperatives must adopt technology.

Milk cooperatives are passing through a challenging phase. Technology penetration is very less in milk cooperatives. It is difficult for milk cooperatives to manage their resources without any technology. It is tedious to manage operational, financial and investments activities without any central system. To manage all this aspect, it is important to implement a central system that can manage all the resources and supply chain of dairy industry.³

Apart from these farmers are also facing challenge. They found difficulty in managing their daily operations. Per capita milk production in India is much less compared to world average. There is no pre-defined best practice and cattle rearing. So, day by day cattle rearing has become less profitable compared to other agriculture activity.⁴

Privatization and foreign investments in cattle rearing and dairy industry has given rise to an artificial competition in the market. Private big cattle farms can easily achieve economy of scale and can sell milk at lower prices. Private dairies are not ready to give high prices to farmer and they also stop accepting milk in surplus seasons. This leads to exploitation of cattle farmers.

So, considering above challenges and problems regular software is not enough for milk cooperatives and cattle farmer. In our research we understood cattle farmer and milk cooperative's requirement based on those finding we have proposed ICT based ERP model.

³ (Ravi Jadawala & Dr. Satish Patel, 2018)

⁴ (Ravi Jadawala & Dr. Satish Patel, 2017)

II. LITRATURE REVIEW

a. Challenges of Indian Dairy Farms

India has large number of human capital so in the past Indian industry has cost advantage over other countries. But now over the period with the maturity and education daily wages have gone up exponentially. According to Dr. N.G. Hegde of BAIF Development & Research Foundation, Indian dairy industry has loosened the leadership in low-cost production. As some countries like Denmark, Australia, New Zealand, etc have reduced their milk production cost by achieving economy of scale. Due to low prices of milk & its allied products India become net importer of those products. This has directly affected Indian cattle farmer in terms of lower sale price. According to Dr. N.G. Hegde apart from this, Indian dairy industry are facing following main challenges.⁵

- *High cost of milk production*
- *High cost in milk handling and marketing*
- *Poor quality milk due to unhygienic milk handling*

b. Importance of ERP in dairy industry

Following are the use of ERP in dairy industry bifurcated by daily milk cooperative activities.⁶

<i>Milk cooperative activity</i>	<i>Use of ERP system</i>
Reception of milk, Testing milk sample	<ul style="list-style-type: none"> • ERP system used in recording milk quantity at the time of procurement along with the milk procedure name • Society can record detailed test sample results central system • Through ERP system society can end e receipts, SMS and print the passbooks • From ERP system milk cooperative society can audit the historical procurement data
Dispatch of milk-to-milk union	<ul style="list-style-type: none"> • ERP system can create, and user can print detail procurement report • ERP system can help in recording truck loading and truck dispatch time and also report this to milk union and dairies • ERP system helps societies to get exact time of milk delivery • ERP system helps in tracking milk van routes through GPS

⁵ (Hegde, 2001)

⁶ (Ravi Jadawala & Dr. Satish Patel, 2019)

Payment	<ul style="list-style-type: none"> • ERP help is remitting payment through payment gateway.
Accounts and book keeping	<ul style="list-style-type: none"> • Hassel free payment history maintenance • Easy to insert accounts related data • Easy to retrieve accounting data • ERP can auto generate reports like P&L, general ledger etc. • Auditor can easying search historical accounting data. This reduces fraud and improved transparency
Distribution of Profit	<ul style="list-style-type: none"> • Based on stored data ERP system can generate milk producer wise dividend report. and help in auto remitting.
Input Services	<ul style="list-style-type: none"> • ERP system can track all king of input service. • EPR can manag inventory of vaccines, Cattle feed, and semen

c. Importance of ICT in dairy industry

With the growth and degree of penetration of ICT product it becomes viable to use some of the ICT technology in managing and operating the value chain of animal husbandry. In (Syiem & Raj, 2015) study results showed that majority of the farmers owned mobile phones as well as television and radio. The most frequently used ICT was mobile phone. Mobile phones were widely used by the farmers for social communication, contacting middlemen for the marketing of produce and contacting experts on real time basis for getting agricultural advisories. Farmers also reported that mobile phones proved to be useful during health emergencies.⁷

A study conducted by Bowonder, Prasad, & Kotla, in 2016 argued that investments in ICT made in rural India are not effective. But the case of Amul proves that, where there is a will there is a way. Amul has become rural India's flag bearer in the IT revolution. Study paper also shows analyses and use of ICT in the dairy industry by the Gujarat Cooperative Milk Marketing Federation Ltd. The system makes it easy for farmers to get cash payment as soon as they delivered milk. Amul experience indicates that if properly

⁷(Syiem & Raj, 2015) ⁸(Bowonder, Prasad & Kotla, 2016)

designed ICT products are implemented, then rural poor can benefit from ICT platforms. Customization of ICT platforms for use in rural communities is emerging as a major opportunity for change.⁸

III. RESEARCH METHODOLOGY

Population

We have conducted our study in four different districts of Gujarat i.e., Ahmedabad, Gandhinagar, Sabarkandha and Mahesana district. Our population is all the farmers, farm worker who rear cow and buffalo in these four districts.

Sampling

Based on judgmental and simple random sampling method we have selected one talukas form district. In our study we conducted interview at 5 villages in each district. We have interviewed 160 farmers and 20 milk unions. Together we have chosen 180 respondents.

			Sample	
District	Talukas	No. of Villages	No. of Villages To Be Selected	No. of Cattle farms To Be Selected
Sabarkantha	Prantij	64	5	40
Gandhinagar	Mansa	48	5	40
Ahmedabad	Sanand	52	5	40
Mehsana	Kadi	120	5	40
	Total	284	20	160

To get data from milk cooperatives, we have selected one milk collection centre from each village we have gone.

Types of Respondents	1.	Cattle farm owner/ worker	160
	2.	Secretary / manager of Milk collection center	20
Total Respondents :			180

Tools of Data Collection

- Schedule interview (Questionnaire)
- Focus Group Discussion
- Observation

Data Analysis & Interpretation Techniques

In our research we have gathered quantitative as well as qualitative data. For data analysis we have used descriptive technique. We have converted all our data into numerical format and used descriptive techniques like cross tabulations, one-way ANOVAs, weighted average etc. For better understanding we will also use visual aids like graphs, chart, figures, etc.

IV. FINDINGS AND DISCUSSION⁹

We have analyzed our primary data using different descriptive techniques like weighted average, one-way anova, cross tabulation, charts, and graphs.

Hypothesis

- Milk cooperatives needs a centralized ERP system
- ERP system in cattle farm can help in improving animal health.
- An ERP system can improve work scheduling and management of cattle farm.
- ERP platform improves the coordination between cattle farmer and dairy.

A. Milk Cooperatives needs a Centralized ERP System

We have interviewed multiple milk cooperatives to know what information they want from cattle farmers to improve coordination between them. We asked below questions and based on milk cooperative responses we have analyzed and found importance level.

Table 4.1. Importance Level of Information that required by Milk Cooperative

Cattle farm details Rating <1 Not important, 1 to 2- slightly important, 2 to 3- Moderately important, 3 to 4-Important, >5 Highly important	Weighted average rating	Importance of level
Farmer wise cattle breed detail	2.61	Important
Number of cattle in each husbandry	4.67	Very Important
Per cattle milk production	3.44	Important
Husbandry wise milk production report	3.67	Fairly Important
Cattle wise medical expense detail	3.44	Important
Cattle wise breeding detail	2.28	Slightly Important
Loan account detail	4.11	Fairly Important
Per cattle expense report	1.89	Slightly Important
Per cattle earning report	1.94	Slightly Important
Total Weighted Average	3.11	Important

⁹(Ravi Jadawala & Dr. Satish Patel, 2019)

Discussion :

From above table we can say that there are many details that milk cooperative need at central level. In order to collect all this information milk cooperative has to integrate cattle rarer in one centralized system.

Milk cooperative considered below cattle farmer related information as essential details. Cooperative likes to maintain these data in centralized system.

- Number of cattle in each husbandry
- Husbandry wise milk production report
- Each cattle farmer loan account detail
- Per cattle milk production
- Cattle wise medical expense detail

Findings :

Based on above analysis and discussion we can conclude that Milk cooperatives should have centralized ERP system. This system should have specialized modules like farmer relationship management. This module is use to manage, monitor and integrate cattle farmer, cattle farms and milk cooperatives.

B. ERP system in cattle farm can help in improving animal health

We have collected data from different district of Gujarat. Based on below three questions we have find agreement of cattle farmers on our assumption that ERP system will help in improving animal health.

- It is difficult for farmer to keep the track of animal vaccination time schedule.
- Is it use full if you have number of lactation days and number of dry days detail?
- At present it is very difficult to find new veterinary doctor

Table 4.2. Weighted average of cattle health-related responses

Weighted average of cattle health-related responses			
	It is difficult for farmer to keep the track of animal vaccination time schedule?	Is it use full if you have number of lactation days and number of dry days detail	At present it is very difficult to find new veterinary doctor
Ahmedabad	4.18	2.92	2.13
Gandhinagar	3.30	3.05	1.84
Sabarkantha	3.18	2.83	1.93
Mahesana	3.26	3.33	1.79
Mean	3.48	3.03	1.92

Discussion :

From above table we can say that farmers agree that it is difficult for them to keep track of vaccination and related time schedule. Similarly, they agree that it is important to have cattle dry day and wet day data for future reference.

- Farmer like to know cattle wise number of dry days and lactation days
- Farmer doesn't face difficulty in finding veterinary doctor, but it is good if he has whole directory of nearby veterinary doctor.
- Farmer find difficulty in keeping the track of animal vaccination time schedule.

Finding :

From above analysis we found that ERP system will help cattle farmer in improving their animal health. Based of analysis and discussion we can say that it is good to have "Animal health management" module in ERP

C. An ERP system can improve work scheduling and management of cattle farm.

- Reception of milk is high time-consuming operational activity according to milk cooperative point of view
- Milk cooperative believes that Testing of milk, Accounting and Distribution of profit are moderate time-consuming work
- Milk cooperative believes that payment of milk is low time-consuming process.
- We found that milk cooperatives find difficulty in maintaining milk purchase detail, milk testing detail and payment history.

Table 4.3. ANOVA test to understand relation between ERP system and work schedule improvement

		Sum of Squares	df	Mean Square	F	Sig.
IT product like software and mobile apps will help in improving Animal husbandry management	Between Groups	2.98	3	.99	.47	.705
	Within Groups	315.90	149	2.12		
	Total	318.88	152			

P-value 0.705 is greater than alpha level selected (0.05). Therefore, we have evidence to accept null hypothesis and say that all the four samples have no significant difference in means and thus belong to same population.

Hence H₀ accepted: An ERP system can improve work scheduling and management of cattle farm.

Discussion :

Farmers are willing to use software, mobile app, etc. They believe that ERP system can improve their work schedule and husbandry management.

Findings :

Based on above analysis and discussion we can say that cattle farmers need a comprehensive ERP system that improves their daily cattle farm management.

D. ERP platform improves the coordination between cattle farmer and Dairy.

Table 4.4. ANOVA test to understand coordination between cattle farmer and milk cooperative

		Sum of Squares	df	Mean Square	F	Sig.
There is lack of coordination between cattle farm and milk cooperatives	Between Groups	9.79	3	3.26	2.45	.066
	Within Groups	198.32	149	1.33		
	Total	208.12	152			
Do feel that IT software will help you in making your cooperatives more transparent	Between Groups	5.85	3	1.95	1.32	.269
	Within Groups	219.46	149	1.47		
	Total	225.31	152			

F-value 2.45 is smaller than F-critical value for the alpha level selected (0.05) and P value in both the cases (0.66 and 0.269) is greater than alpha level (0.05). Therefore, we have evidence to accept null hypothesis and say that all the four samples have no significant difference in means and thus belong to same population. Hence H₀ accepted: ERP platform that can improve the coordination between cattle farmer and Dairy.

Discussion :

From above analysis we can say that there is a lack of coordination between farmers and milk cooperative. Moreover, farmers feel that IT products can milk cooperative's transparency.

Findings :

- From above analysis and discussion, we can say that farmer and milk cooperative need a complete ERP solution that has both on farmer's side as well as cooperatives side modules like **milk management, payment tracking, weather alert, expense tracking, marketplace, important contact**. On cooperative's side modules like **Milk collection management inventory management, milk transit management, sales, human resource management, farmer relationship management, cattle management, accounting**. Based on above hypothesis findings we have designed an ERP model.

V. PROPOSED ICT BASED ERP MODEL FOR MILK COOPERATIVES (IN THE ASPECTS OF CATTLE FARM).

In the vibrant market of information technology there are many solutions available that provide software to support milk cooperative operation and its regular activity. We are trying to propose a model that can holistically cover all aspects of milk cooperative especially to increase overall milk production, improves synergy between cooperatives and cattle farmer and increase farmer income. We have studied multiple aspects of dairy industry through secondary data. We have taken around 160 personal interviews of cattle farmers and 20 responses from milk cooperatives.

Through primary data analysis we have found the problem areas in cattle farm. We understood the challenges of milk cooperative and cattle farmer and identified the gaps between them. Based on all this aspect we have extracted an ICT based ERP model that can overcome those challenges and fill the gaps between them. We have limited our study in exploring ERP system model for milk cooperative in aspects of cattle farm. We have proposed model accordingly.

We have created ERP model considering two perspectives, one is from milk cooperative perspective, and another is cattle farm perspective. Based on our study below are essential modules require in ICT base ERP model.

¹⁰(Ravi Jadawala & Dr. Satish Patel, 2019)

ICT Based ERP Model¹⁰

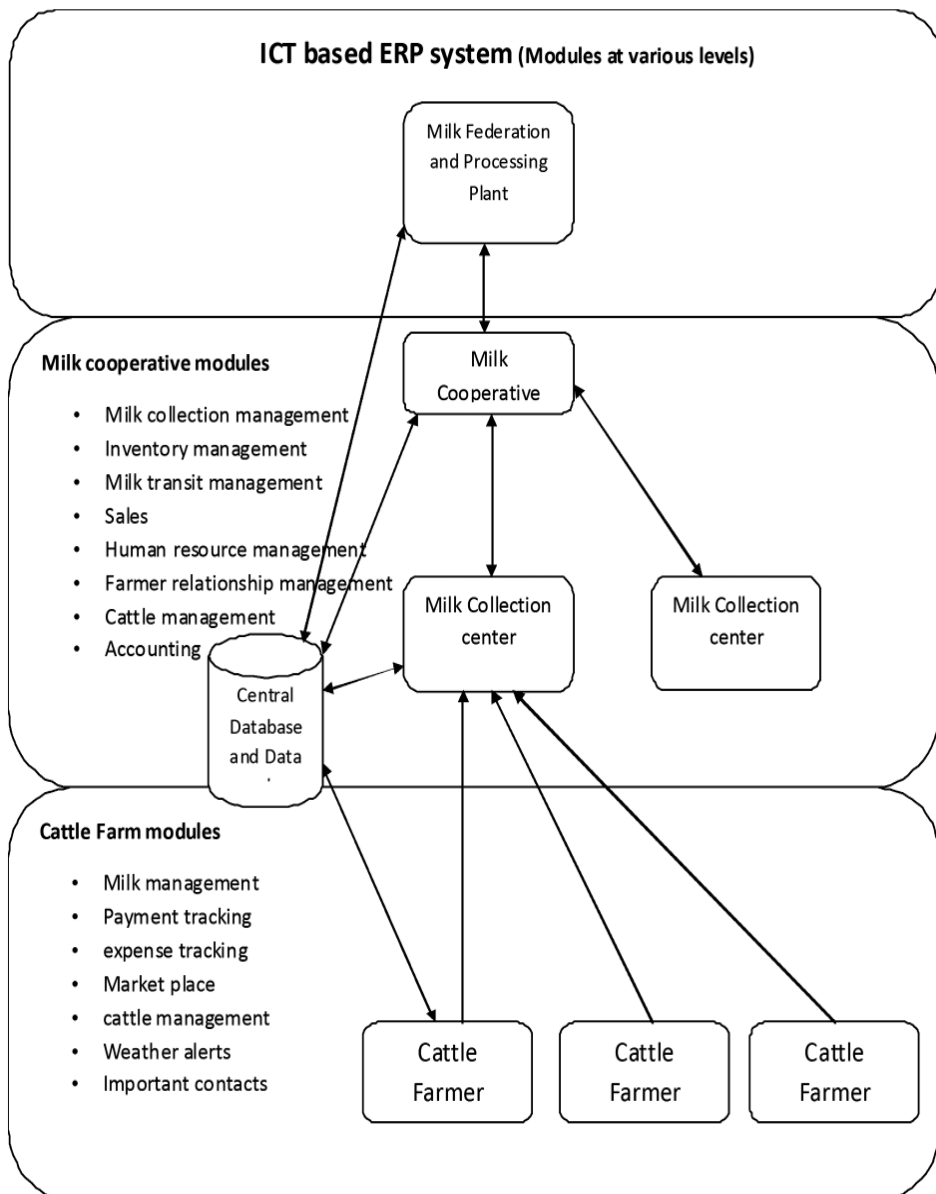
Milk cooperative is an organization which is engaged with multiple stakeholders. Milk cooperatives have to deal with milk federation, Milk collection centers, Farmers, government bodies etc. Milk cooperative stake holders are spread across vast geographical area. A milk cooperative must deal with diverse set of people. In order to manage whole organization, improve milk quality and increase milk production milk cooperative have to adopt technology integrated ERP.

We propose a model in which all the stake holder has its own access to ERP with related functionalities and modules. ERP should be able to integrate itself with tracking and monitoring devices like GPS, thermometer, odometer, IOT, GIS etc.

Following are key features of ICT base ERP.

- ERP should be run at central server.
- User access of ERP should be on web base and should be interactive to support any screen. In short it should be Desktop, tablet and mobile compatible.
- System must have centralized database.
- Database should be properly backed up in case of disaster management.
- Centralized database must have proper data warehousing.
- ERP should be able to integrate itself with tracking and monitoring devices like GPS, thermometer, odometer, IOT, GIS etc.
- Collection centers and cattle farmer user interface must be in form of mobile application.

Figure 1. ICT based ERP system (Modules at various levels)



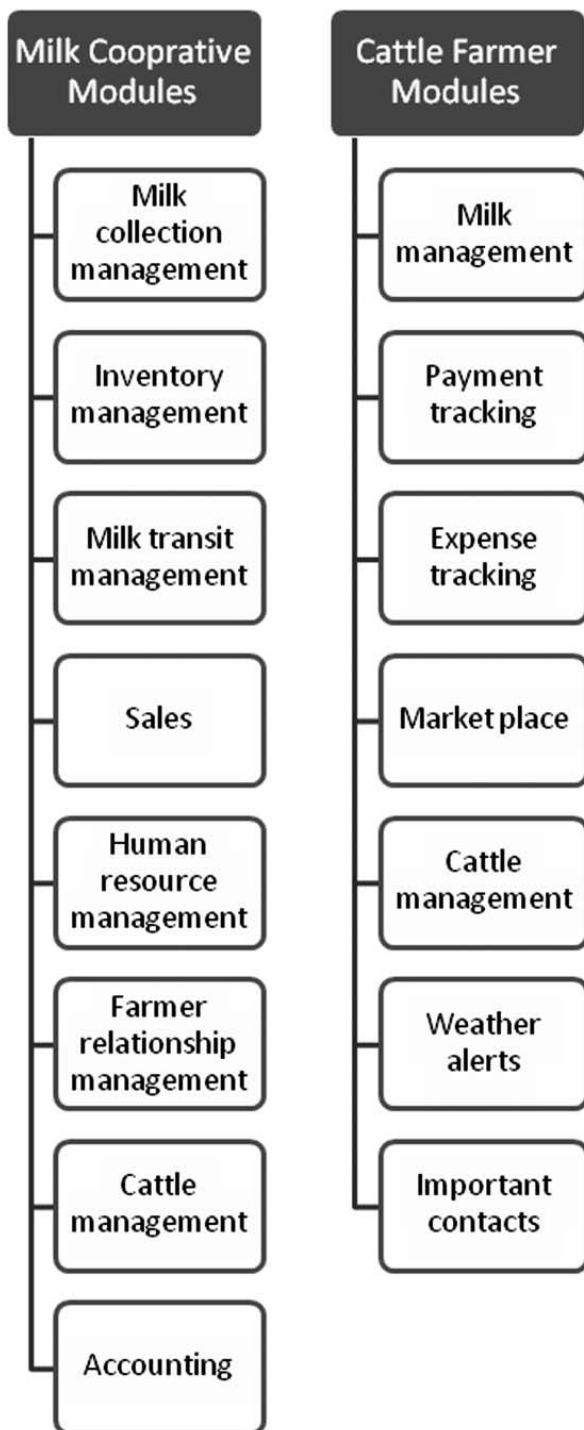


Figure 2. ERP Modules

Milk Cooperatives Modules

- **Milk Collection Management**

Milk collection is a daily process that is done by each milk cooperative collection centers. Usually in morning and evening all milk producers come to milk collection center and fill their milk into milk collecting vessels. At present many milk collection centers has automated milk collecting machine. These machines are connected to computers, and it gives acknowledgment receipt.

We are proposing to integrate fat analyzer and automated milk collection machine to central main frame system of milk cooperative. Farmer fills milk in collection vessel a milk analyzer will analyze milk content and milk. Based on fat, SNF, quantity printer will print out receipt with quantity, fat, and amount of rupees. It stores collected data in central database which can easily retrieved farmer, milk collection center, milk cooperatives and federations. This data can use in reporting as well as to initiate payments to respective farmers.

This kind of integrated system can reduce the human intervention and milk collection process can be designed in such a way that it can become human less process.

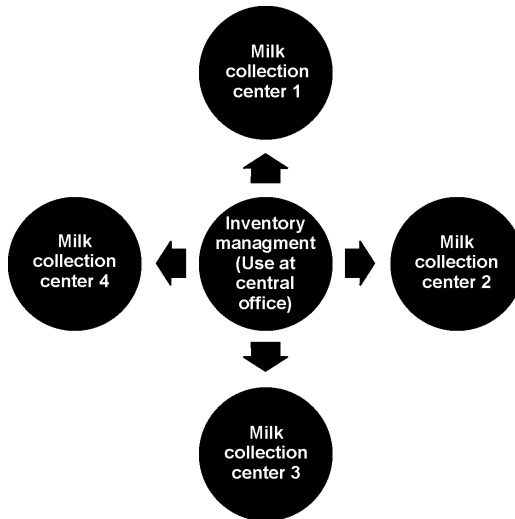
- **Inventory management**

This module will help cooperatives and milk collection center to monitor the inventory and tack stock in and stock out entries. Inventory module will help milk collection center and cooperatives to reduce turn around time and helps in improving milk shelf life.

Inventory management should track milk stock in and stock out entries. Milk cooperative can centrally view all stock in and out entries of all milk collection center. It can also help in matching milk collection stock out entries and milk processing plant stock in entries. This will help to reduce theft in transit.

Inventory management module should centrally integrate all chiller at all collection centers. This type of integration will help in managing temperature control and monitoring centrally from one place. For example, if any of the chiller machine get down or there is a power failure or any kind of catastrophic even central monitoring team can help collection center to mobilize milk from one center to another by reviewing available space in other collection centers. This kind of setup can greatly reduce milk contamination and improve milk shelf life.

IOT integrated chillers can be operated centrally as this will help in reducing power consumption. For example, on certain days there less amount of milk in chiller and it is not required to run at high speed this can be managed from central office.

Figure 3. Inventory Management Module

- **Milk transit management**

Logistic is an essential part of any industry. In dairy industry logistics plays crucial role. A dairy needs two-way logistics one on milk collection side and another is on milk distribution side.

Milk transit management is a module that helps milk unions to monitor and track milk purchase logistics. Milk union can start a central monitoring center for tracking and analysis purpose. This system should be efficient enough to record drivers that assign to which truck, it should record run date and route that driver has used, it should note dispatch time and reception time of truck. Based on collected data system should do comparative analysis of schedule run and actual run to find any flaws in transit. It should be efficient enough to create shortest optimum route so that with minimum trucks milk union can cover maximum milk collection center and do optimum truck load pooling.

All truck should be attached to GPS tracking and GPS fencing. It means from central monitoring center a person can review the truck location as well as system can create alert if truck has changed his route. This system improves the milk collection efficiency, it can help in better fleet management, reduce cost of transit and in catastrophic event like floods or infra failure, truck can be re-routed to avoid disasters.

Milk union can implement artificial intelligence to monitor truck transit time, distance covered, fuel cost, maintenance cost, etc. Based on these data system can take decision to replace truck, replace driver, change route, and open new collection center and close unprofitable collection centers etc.

- **Sales**

Milk cooperative usually operates two different sales channels. Cooperative must sell collected milk to its federations. In few cases cooperative also sell small quantity of milk at village level.

ERP should have a sales module which should keep sales done by milk cooperative to federation as well as the daily local sales entries. Keeping books of cooperative to federation sales entries will help in managing receivables and Local sales book will helps in tracking daily cash inflow.

- **Human resource management**

In any industry one of the most important resource are human resource. In milk cooperative we are considering internal working staff as milk cooperative human resource.

Like other organizations milk cooperative also face multiple challenges in managing and maintaining human resource. ERP should have powerful standardized recruitment management, Payroll system, Bond deduction and lien management programs. Module must be up to the mark of industry standard.

- **Farmer relationship management**

Farmer is the real owner of milk cooperatives. Without cattle farmers it is not possible to run milk cooperative. An ERP should have module specifically dedicated to cattle farmers. This module should manage all aspects of cattle farmers to improve synergy between milk cooperative and cattle farms.

Farmer relationship management module should store all the details of existing member like demographic details of farmer, enrollment or membership number, address, scan copy of submitted documents, cattle details, Milk filled history, financial detail, contact detail etc.

Module should help milk cooperative in acquiring new member, retaining existing member and reviving old members. Based on daily activity of cattle farmer ERP should be capable to generate reports that identify how much farmer is interacting with milk cooperative. ERP will fetch daily milk filling details and based on that it should identify filling patterns of cattle farmer. This detail will help milk cooperatives in forecasting milk inflow and out flow and to understand farmer's perception towards milk cooperative.

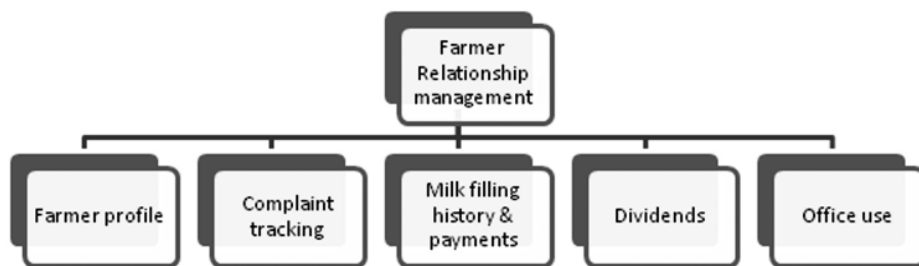
Now a days world is moving towards cashless economy. Farmer relationship management module should also move in same direction. It should integrate payment gateways, digital wallets, payment banks, net banking etc. So, all payments can be reconciled and verify at central office and then it can be remitted to respective cattle farmer's account. Along with this yearly dividend

payment must be done electronically. This functionality can reduce cost of cash management, theft and reduce dissatisfaction of farmer.

In order to retain cattle farmers and improve milk cooperatives transparency, cooperative has to adopt complain redressed mechanism. Usually due to bureaucracy and red tape true voices are suppressed and remain unheard. To overcome this milk cooperative should adopt proper complain tracking system. System should note complains and notify respective department's concern person. Module should also keep track of complaint disposal time.

If milk cooperative has dematerialized its share certificate, then module should have access to those information and gives complete detail of folio number linked to the farmers share certificates.

Figure 4. Farmer Relationship Management



- **Cattle management**

Cattle are the main actor of milk cooperatives and most ignored entity of whole dairy industry. If dairy industry wants to increase quality and quantity of milk production, then they have to concentrate on improving cattle health and have to improve cattle happiness index.

Cattle management module in ERP will record each cattle detail in system. It must be capable enough to record number of cattle by farmer, by village and by milk collection center. It should have breed details, per animal milk fat, per animal milk production etc. All this will be used in data analytics to identify the patters which further helps in complex decision making like breed selection, buying, or selling of cattle, increasing or decreasing cattle ration etc.

ERP should be capable enough to integrate devices like cattle body temperature measurement device, heart beats recorder, etc. that can collect real-time data from cattle's body. These data further can be used to identify health problems in early stages; data can be used by veterinaries to investigate diseases. With the use of real time milk cooperative can reduce animal mortality rates. These data also help in selective breeding to improve overall cattle blood line.

Integrating ERP with GPS will help milk cooperative in locating animal on map and RFID will give cattle a unique identity. These technologies will help insurance companies as well as cattle farmers in claim settlements.

From the daily milk filling data and based on per cattle milk production, per cattle fat production. An artificial intelligence base technology can be developed to do cattle profiling, to suggest replacement of certain cattle, increase or decrease the number of cattle at each cattle farm to achieve economy of scale these kinds of analytically calculated suggestion will help milk cooperative to achieve its optimum performance, system will improve animal health and save farmers money.

- **Accounting**

A robust accounting and book system is a key to transparent corporate governance. To increase transparency of milk cooperative it should adopt standardized account standard and ERP should those accounting standard. For example, ERP should support accounting standards like GAAP and IND-AS.

Based on operational data entries ERP should create General ledger, Aging reports, payables reports, receivables reports, cash flow statement etc. and module should help in milk cooperative audit.

Cattle Farmer Modules :

We propose that for cattle farmer it is good to have web as well as mobile application. All functionalities must be available on both the platform. On farmer side technology should show data in regional languages as well as in audio format.

- **Milk management**

In milk management screen farmer should be able to see his daily milk filling activity. He must get full detail of quantity he has filled, milk fat, money he earned. He should be able to access the historical data by shift, by day, by month and year. Farmer should be able to see all these data in numerical as well as graphical format and in regional languages. Farmer should get reports like his average daily milk filled, average fat, average money he earned etc.

- **Payment tracking**

In payment tracking system farmer will be able to see payment remittance. This section allow farmer to view his historical payment and he must be able to print or email milk filled recipes.

This section must be link with ERP complaint tracking section. If farmer found some issue in payment, he must be able to report that issue immediately by one click.

If milk cooperative integrates ERP system to respective farmer's bank, then farmer can see the bank balance directly from the app. This reduces farmer's efforts and increases transparency.

- **Expense tracking**

In India small farmers are not tracking any expenses that is incurred on cattle. They never maintain any records of cash out flow. Gradually this leads to cattle farm working capital diversification and bankruptcy. To avoid this milk cooperative should conduct expense management training and mobile app should provide a function from which farmer can voluntarily insert cattle farms daily expense.

Farmer should be able to insert all the expenses he incur on cattle like fodder expense, food pallets expense, health care, vaccination, insurance, monthly electricity and water bills, government taxes, fuel charge etc.

- **Market Place**

Milk cooperative should provide exclusive section in app that provides farmer facility to purchase food pallet, farm equipment's, and animal medicines, vet doctor service etc online.

Section can also integrate third party agriculture related verified e-commerce from where farmer can purchase cattle farm equipment's.

Along with this app should also allow farmer to list the profiles of animal he wants to sell or buy. Milk cooperative should support a platform through mobile app from where farmer can buy or sell his animal to other farmers. An e-commerce facility of buying and selling cattle can reduce illegal activity, help in identifying actual price of cattle. It can become boon to farmers.

- **Cattle Management**

For Indian farmers, their cattle are the helping hands. Farmer likes to keep their cattle herd in good condition. In India religious beliefs are also associated with their cattle.

ERP should provide set of functions and integration to external devices to record real time cattle activities. ERP should help farmer in cattle related decision making, analyzing cattle herd, tracking cattle health etc.

Cattle management module must have ability to integrate GPS, RFID tags and collared GPS devices. This helps farmer to view grazing cattle location from his mobile device and in case of theft farmer can searching cattle easily.

To track and improve cattle health module has ability to connect devices like thermometer, heart rate measurer, sensors etc. that can collect animal real time data. These data will help Vet doctor in diagnosing diseases from ill animal. These real time data will help in preventing any epidemic among animals.

ERP should have a scheduler. Farmer will enter all the daily, monthly, and yearly plans for cattle. Based on the schedule ERP will give alerts to farmer.

Scheduler Examples

Farmer will schedule early vaccination schedule. ERP will give reminder alerts to farmer on his mobile.

Farmer will feed in his daily schedule like fodder refill time, water refill time, milking time, etc. ERP on mobile can give notification time to time to maintain the schedule. ERP must be capable enough to give alerts/notification to other farm workers on his mobile

ERP should give farmer a functionality to post milking data of each animal on daily bases. Milk cooperative should encourage farmer to do postings and voluntarily share data to other farmers and milk cooperatives.

For each animal if farmer collects data like animal breed, daily milk production, milk fat, dry days, wet day, health expense, food intake, water intake, milking cycles etc., then farmer and milk cooperative can create an efficient data warehouse. These data can further be converted to information.

ERP should give artificially intelligent analytical reports to farmer. These reports should help farmer in buying new animal, selling old animal, replacing whole herd, breeding, increasing milk cycles, improving milk quality etc. These kinds of huge data warehouse can open number of possibilities in improving efficiency and effectiveness of cattle farms.

- **Weather Alerts**

With increase in global warming and rise in temperature earth has experience major climatic changes which leads to increase or decrease in rain fall, increase in monsoon floods etc.

In flood like situation cattle suffers most. Humans find their way to save themselves but tied up cattle drowns in floods. App should have weather alert integration. This can give early alert to farmer prepare him for any kind of catastrophic event.

Even weather forecasting can also help farmer in planning his procurement activity. In drought situation farmer can store more fodder and water to reduce weather impact.

- **Important Contacts**

ERP should have preloaded important contact information in App. It should have contact list of nearby veterinary doctors along with geo tagging on online map which help farmer finding good doctor for its cattle.

It should also have important contact details like nearby banks, farm equipment seller, government offices etc. which makes farmers life easy. We also recommend that app should have contact details of all milk cooperative staff.

App should have IT support and complaint registration contact details.

VI. CONCLUSION

Through our study we found that regular software base ERP is not enough to include milk cooperative's farmer in mainstream. We found that we need an ICT (Information communication technology) based ERP system to integrate geographically versatile stakeholders of milk cooperative.

Using different technologies like GPS, RFID, IOT, remote sensing, mobiles ERP can gather and store data in central database. Using central data at different level user can generate different user specific reports. These reports help milk cooperatives in decision making process. These reports help cooperative to improve overall cattle herds' health, breed, productivity etc. Through our study we found that overall productivity of milk cooperative and cattle farmer can be monitor and improve though the reports that generated from ICT based ERP.

Through our study we have identified different modules for cattle farmers and milk cooperative. These modules will help cattle farmers as well as milk cooperative in finding their optimum operational method, helps both cattle farmers and milk cooperatives to identify their best practice and helps in re-engineering their daily business processs.

Thus, we can conclude that ICT based ERP can significantly improve cattle farmer efficiency, effectiveness and integrate them in mainstream. Similarly, ICT based ERP will improve overall milk production, transparency, and efficiency of milk cooperative. ICT based ERP can become stepping stone for the revival for whole milk cooperative sector.

VII. REFERENCES

- Ab Rahman, A. &. (2017). Emerging Technologies with Disruptive Effects: A Review. *PERINTIS eJournal*, 7, 111-128.
- Bowonder, B., Prasad, B. R., & Kotla, A. (2016). *ICT application in a dairy industry*. Pune: Tata Management Training Centre.
- Hegde, D. N. (2001). *WTO CHALLENGES FOR INDIAN DAIRY FARMERS*. Pune: BAIF Development Research Foundation.

- Jadawala, Ravi&Patel, Satish (2017, October). Challenges of *Indian dairy industry*. *Indian journal of allpied research* , 516.
- Jadawala, Ravi & Patel, Satish (2018). Improving milk cooperative governance through ERP system. In D. L. Patel (Ed.), *Coopratives and rural development (Gandhian perspective for sustainable development)*. Ahmedabad: Reliable publishing house.
- Jadawala, Ravi & Patel, Satish (2019). A Study of ERP system for milk cooperative dairy. Randheja, Gujarat, India.
- Leon, A. (2008). Enterprise Resource Planning. In A. Leon, *Enterprise Resource Planning*. Tata McGraw-Hill Education.
- Mathur, B. N. (2000). *Current Problems and Challenges Confronting the Dairy Industry in India*. Karna: National Dairy Research Institute,(ICAR).
- Patel, Satish & Patel, Rajiv (2008). "Effectiveness of Information Communication Technology in Integrated Rural Development Management", *NICM Journal* (ISSN : 2249-2275), 11-19.
- Patel, Satish (2018), ROLE AND OPPORTUNITY OF ICT IN CO-OPERATIVE SECTOR, "Cooperatives for Sustainable Rural Development" by Dr. Lokesh Jain & Dr. Rajiv Patel, Reliable Publication, Ahmedabad.
- Tripathi, P., Bijl, B., Varshney, K., & Nagi, M. S. (2014). "Reimagining Indian Dairy" A result chain oriented action plan. Holland: Dairy Industry Vision 2030.
- Syiem, R., & Raj, S. (2015). Access and Usage of ICTs for Agriculture and Rural Development by the tribal farmers in Meghalaya State of North-East India. (M. Herdon, Ed.) *Journal of Agricultural Informatics.*, 6 (3), 24-41.

