

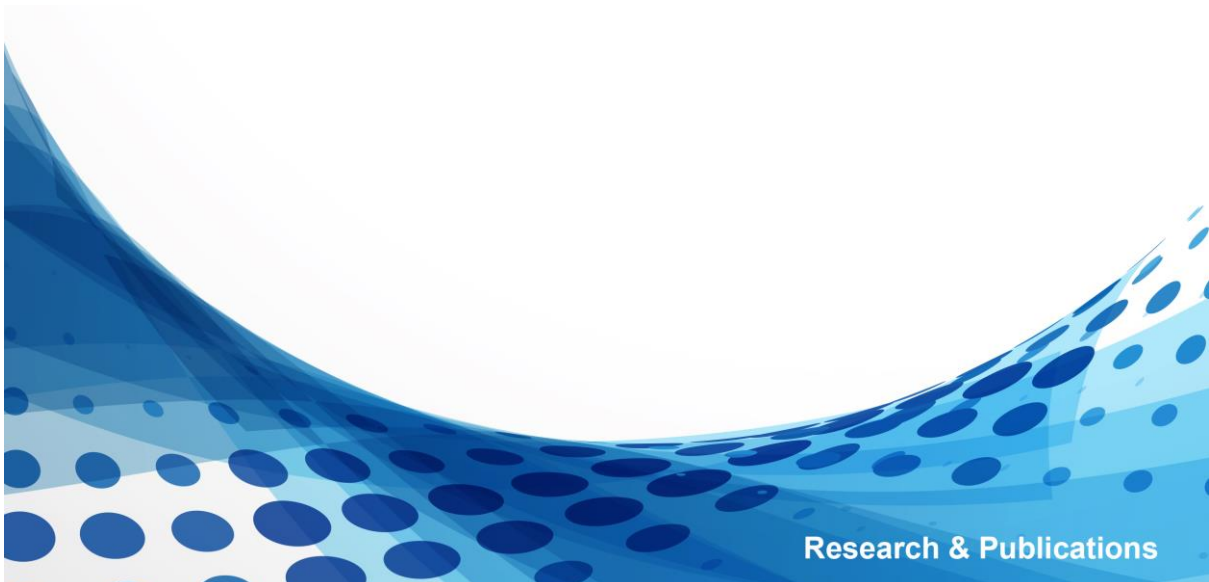


INDIAN INSTITUTE OF MANAGEMENT AHMEDABAD

**IIMA**  
Working Paper

## **Gai Aadharit Unnati (GAU)\*: Modernizing Cow based Economy through Application of Advanced Technology**

Gaurav Kumar Kedia  
Amit Garg  
Pradeep Kumar Mishra  
Nishant Krishna  
Aprajita Mishra



Research & Publications

# **Gai Aadharit Unnati (GAU)\*: Modernizing Cow based Economy through Application of Advanced Technology**

Gaurav Kumar Kedia  
Amit Garg  
Pradeep Kumar Mishra  
Nishant Krishna  
Aprajita Mishra

**May 2022**

The main objective of the working paper series of the IIMA is to help faculty members, research staff and doctoral students to speedily share their research findings with professional colleagues and test their research findings at the pre-publication stage. IIMA is committed to maintain academic freedom. The opinion(s), view(s) and conclusion(s) expressed in the working paper are those of the authors and not that of IIMA.

# Gai Aadharit Unnati (GAU)\*: Modernizing Cow based Economy through Application of Advanced Technology

*\*Literal translation from Hindi - Cow Based Development*

**Gaurav Kumar Kedia<sup>i</sup>, Amit Garg<sup>ii</sup>, Pradeep Kumar Mishra<sup>iii</sup>, Nishant Krishna<sup>iv</sup>, and Aprajita Mishra<sup>i</sup>**

This working paper with the advanced tech demonstration delineates the possibility of linking donors directly with cows in a transparent manner utilising AI-based facial recognition technology for the development of a self-sustainable cow-based economy.

## Abstract

The cow<sup>#</sup>, in the Indian context, has been the backbone of our agricultural economy since the early age of human civilization. Our agriculture-based economy thrived alongside cow welfare; thanks to a bounty of natural gifts such as dairy products, manure, crops, vegetables, fruits, and medicinal and natural products derived from cow dung and urine. Mahatma Gandhi even talked about the importance of cow by saying “Mother cow is in many ways better than the mother who gave us birth”. Unfortunately, due to several economic constraints, cow owners are bound to leave the non-milching cows when they become non-productive. Such stray cows are forced to survive on the garbage and suffer from fatal health problems. The recent ban on illegal slaughterhouses by the government (*although rightly so*), while beneficial for the cows, has further complicated the situation. These stray cows cause crop damage in villages and become victims of several injuries and casualties via accidents. There are already five million stray cattle officially on the streets of India, and with the ban on slaughterhouses, the numbers are only going to go further up. This is an alarming stage to analyse and tackle this problem in a systematic manner. In order to conquer this problem, it has been observed that Artificial Intelligence (AI)-based model incorporation can provide a solution by integrating stray cows in a circular economy. Donors could provide support to cows through a sustainable AI-based business model that is created in this paper. It provides donors to track their donations in real-time while also caring for cows (Gau Seva). Economical optimization of stray cow by-products: cow dung derivatives like cakes, compost, briquettes, incense sticks, etc., and cow dung as such along with urine can be sold to the biogas/bio fertiliser generation plants for further economic benefits. The real-world application of the model also demonstrates how a community biogas plant can help sustainable energy transitions for our villages and even the cities to become self-reliant and lower their dependency on LPG, which can save millions of dollars per year for the government through lower oil imports for LPG generation. In the long run, the proposed model relies more on internal revenue generation and phasing out the donation part to enable the GAU-based sustainability model for an economy.

*#Cow represents a generic term covering the entire Gau-vansh. It is also sometimes referred to as cattle.*

<sup>i</sup>Indian Biogas Association, <sup>ii</sup>IIM-Ahmedabad, <sup>iii</sup>Dr. A. P. J. Abdul Kalam Technical University, Uttar Pradesh, <sup>iv</sup>TechMachinery Labs

## Introduction

Since ancient times, India has been predominantly an agrarian economy, and cows have been a major player in the agriculture ecosystem<sup>1</sup>. In India, cows are revered as they provide food, fertilizer, and medicine in the form of milk, dung, and urine, while the male cows/bulls are powerful animals and are supposed to be used for draft power like cart pulling, crushing mills for oil extraction, etc.

Cows play a much deeper and more impactful role in our economy than what is appreciated. India is the top milk producer in the world, accounting for 23% of the world's milk production. India produced 210 million tonnes of milk in 2021, out of which roughly 47% was cow milk. The total dairy market in India stands at 11.35 lakh crore with exports of 378.8 million USD<sup>2</sup>. Despite contributing to the Indian economy, the plight of cows is such that after repeated pregnancies for 6 years, they are retired due to a decrease in milk yield. In states where cow slaughter is not banned, the cows are sent to slaughterhouses, while in other states they are left to roam the streets as the cost of fodder and maintenance on non-milching cows makes them unaffordable to the owners<sup>3</sup>. There are ~5 million stray cattle in India as per the 20th livestock census, with Rajasthan and Uttar Pradesh having 1.27 and 1.18 million stray cattle, respectively<sup>4</sup>.

Stray cows feed themselves on garbage, often consuming potentially dangerous items like plastic, wire, strings, etc., which cause fatal health problems. They also cause road accidents, resulting in injuries to both humans and cows. Lastly, stray cows in rural areas raid the farming fields, resulting in crop damage and altercations between the animals and humans. With the recent bans on slaughterhouses for cows, the number of stray cattle (mostly males and non-milching females) is going to only increase, and the problem needs to be addressed in a systematic manner before it becomes big<sup>5</sup>.

Considering the important role of cows in the Indian economy, the emotional attachment of the Indian population to cows, which are also considered sacred, and the problems associated with stray cows, it is the need of the day to establish a socio-technical-financial system (STFS) in which the cows are taken care even after they stop giving milk, as our social, cultural, and ethical responsibility. Therefore, a circular economy model is proposed and discussed in this paper that helps in the upliftment of stray cows while also creating employment and boosting the economy through cow-dung and urine-based products.

---

<sup>1</sup> Chandra S., *The Cow in India*, Vol. I & II, 1945, Khadi Pratishtan, Calcutta

<sup>2</sup> <https://www.investindia.gov.in/sector/food-processing> (accessed on 22 May 2022)

<sup>3</sup> Fox, M.W. *India's Sacred Cow: Her Plight and Future*. *Anim. Issues* 1999, 3, 1–35. Available online: <https://ro.uow.edu.au/ai/vol3/iss2/1> (accessed on 22 May 2022).

<sup>4</sup> 19<sup>th</sup> and 20<sup>th</sup> Livestock census, Department of Animal husbandry and Dairying, Ministry of Fisheries, Animal husbandry and Dairying

<sup>5</sup> Ghatak, S.; Singh, B. *Veterinary public health in India: current status and future needs*. *Rev. Sci. Tech. O.Int. Epiz* 2015, 34, 2. [CrossRef] [PubMed]

Cow dung from 2 cows can generate enough biogas to cook 3 meals a day for a family of 4, including 2 adults and 2 children<sup>6</sup>. To put that into perspective, India consumed 26.3 million metric tonnes (MMT) of liquified petroleum gas (LPG) in 2019–20, out of which 56.2% was imported<sup>7</sup>. Utilizing cow dung can be an excellent way to become self-sufficient in replacing the need for LPG production through biogas generation while also providing shelter and food to stray cows. If a sufficient number of cows are present, a compressed biogas plant can be installed in the area that can provide cooking, vehicle, and industrial fuel. As a matter of fact, India has the potential to save at least 55 billion USD foreign exchange outgo every year, if 50% of the potential of biogas is realised. E.g., India’s ~300 million cattle population can give ~18 MMT equivalent of bio-CNG per year along with providing ~200 MMT of biofertilizer per year.

## Methodology

### The concept

The idea deals with providing fodder to the needy Gaushala/Panjrapol<sup>8</sup> with donor money through the help of a local NGO, which can facilitate the fodder via a company as depicted below. The aim is to create an aggregator-based ecosystem, which can help India achieve its job creation, social, and sustainability goals (Figure 1).

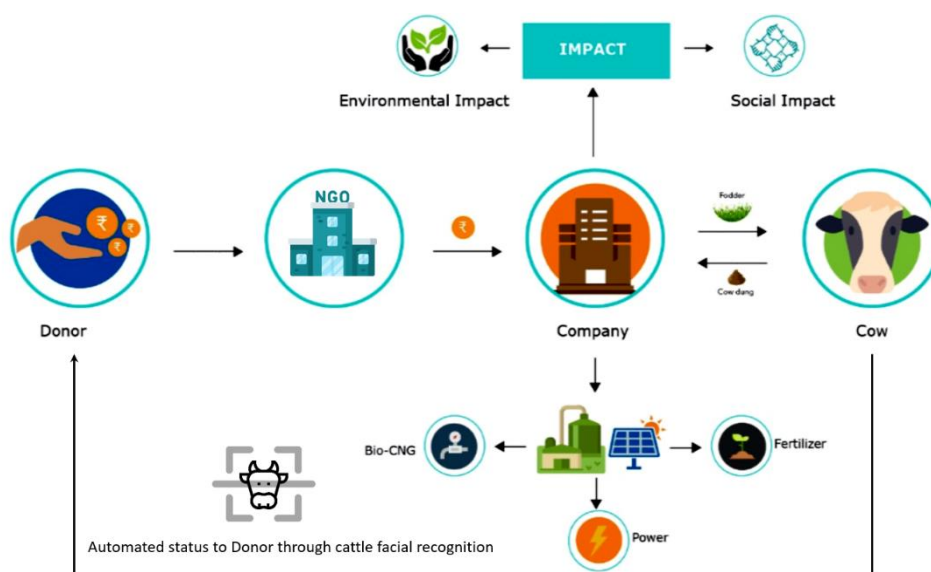


Figure 1: Framework of socio-technical-financial system (STFS) model

The business model is for creating a sustainable financial system that involves various stakeholders namely the cows, the gaushala caretakers, the fodder providers, the bio-CNG processors, Bio-CNG users, infrastructure creators for these, the farmers who would receive bio-fertilizers, the donors, local NGOs, business entities, aggregators, and finally an IT company that facilitates face-recognition for every cow. There would be material flows (cow dung and urine, fodder, bio-CNG, fertilizer, etc), financial flows, and technology flows (cow

<sup>6</sup> Information brochure, Indian Biogas Association

<sup>7</sup> India’s Oil and Gas ready reckoner, Oil industry information at a glance, PPAC, MoPNG, GoI, July 2021

<sup>8</sup> Cow shelters

face recognition IT creation and deployment, bio-CNG plants, and supply chains). It would be a thriving and live ecosystem. Social systems would be integrated at every stage appropriately.

The involved steps in the proposed concept are given below:

1. Donor money goes to an NGO via the GAU platform.
2. The NGO facilitates the fodder availability to the Gaushala via a fodder providing company.
3. In exchange, the Gaushala provides the company with the equivalent amount of dung on a daily basis at no cost.
4. The company can further utilise the dung for various purposes, including biogas generation, to create an impact with the help of the NGO. The respective NGO is responsible for smooth operation, monitoring, and evaluation.

The GAU concept not only delineates a socio-technical system (STS), which normally is considered to be spanning around hardware, software, personal, and community aspects but also takes the financial perspectives resulting in a socio-technical-financial system (STFS).

### NGO selection criteria

The concept's core is transparency, which ensures that everyone values the confidence and faith donors have placed in them while making a donation. We created a proper screening process for the NGOs listed in the GAU ecosystem to ensure that we live up to the trust.

Selection criteria include:

- Organizations must be registered non-profits with no political links that execute social development programmes in India.
- At least half of its recipients must be economically disadvantaged.
- The organisation must be registered with Niti Aayog NGO Darpan. The NGO DARPAN is maintained by NITI Aayog. Niti Aayog invites all Voluntary Organizations (VOs)/ Non-Governmental Organizations (NGOs) to Sign Up on the Portal. Vos/NGOs play a major role in the development of the nation by supplementing the efforts of the Government.
- NGO must have experience of working with GAUSHALA, agriculture, animal husbandry, and rural development.
- The organization must be willing to give donors rapid feedback on their donations.

### Process of Selection

One way in the selection process could involve the following steps:

- Organizations must complete a thorough listing application form that has stringent disclosure requirements. On the GAU site, donors can access information such as important functionaries' salaries, international trip expenses, and so on.
- It also ensures that organisations submit copies of required documents such as financial and annual reports, as well as various legal registration forms.
- The organisations are then evaluated. On the GAU platform, only organisations that meet all of these criteria are listed.

- Finally, we go to the organisations and observe their operations first-hand. In some circumstances, we acquire references from trusted partner institutions that have assessed and screened these organisations themselves.

The selection's objectivity:

No one can influence the selection process because it is based on a fully objective set of criteria. The procedure is step-by-step, and each organisation must complete each step before being profiled on the system website. Organizations that match all of the requirements are immediately added to the list.

Gaushala selection criteria

As such, any needy Gaushala can apply but the health report of the cows must be required along with the present mechanism to provide fodder to them.

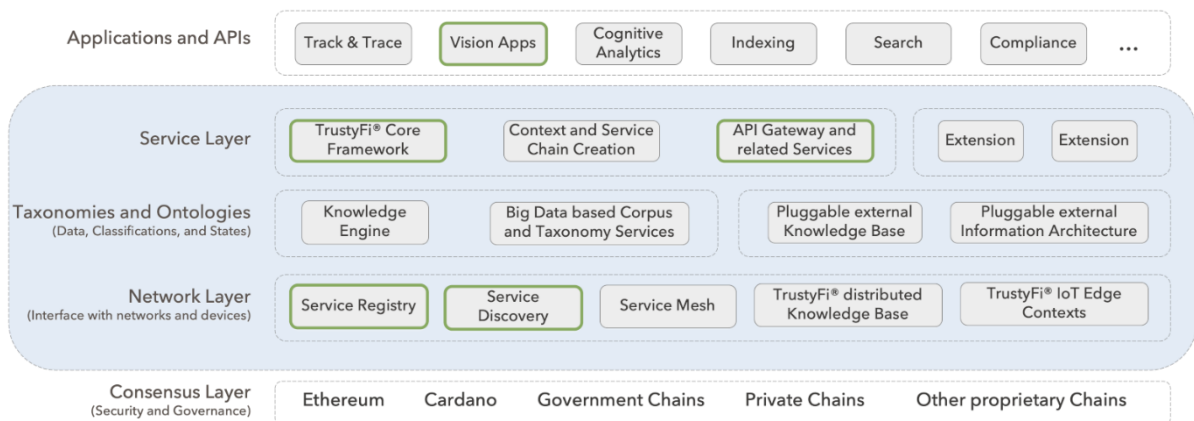
Executive entity/firm/company selection criteria

These could be any implementing agency in the form of a trust, NGO, or a company. It could also be a cottage industry or a small-scale unit. It should be run by people with a background in the gaushala, biogas, fodder, or some aspect of the value chain with experience of not less than 5 years in the selling/marketing/trading of fodder/cow dung-based products/local aggregator company. They should be willing to create jobs through their business. If the NGO is itself involved in the sale/marketing of cow dung-based products, then it can also perform the role of an executive entity.

GAU ecosystem and technology

GAU Decentralised Technology Mesh Stack

Figure 2 shows all the important architectural components\* of the GAU Technology Platform.



\* The software architecture represents the structure or structures of the system, which consists of software components, the externally visible properties of those components, and the relationships among them

Figure 2: The decentralized GAU knowledge mesh

GAU Decentralized Knowledge Mesh is a multi-layer architecture that is used to create an extensible platform with options for integration to enable GAU Ecosystem. This Service Mesh also defines the following – (i) communication mechanism between internal and external components, (ii) extension points and the contracts for extending the functionalities, (iii)



Ontological contracts for the state of the systems at any given point in time, (iv) Knowledge Engine with in-built extensibility using Machine Learning and Analytics. As part of the GAU MVP (Minimum Viable Product) or demonstration, work was done on the components highlighted in green. All the other components and modules are in the process to be implemented as part of the overall R&D on GAU.

### Facial recognition and digitisation of cows

In-house and proprietary research done by TechMachinery Labs created Machine Learning models to recognise the face of a cow from a live cow or from a photo of the cow. The face can be recognised for all those cows for which the model is trained with a minimum accuracy level of 92% (figure 3).

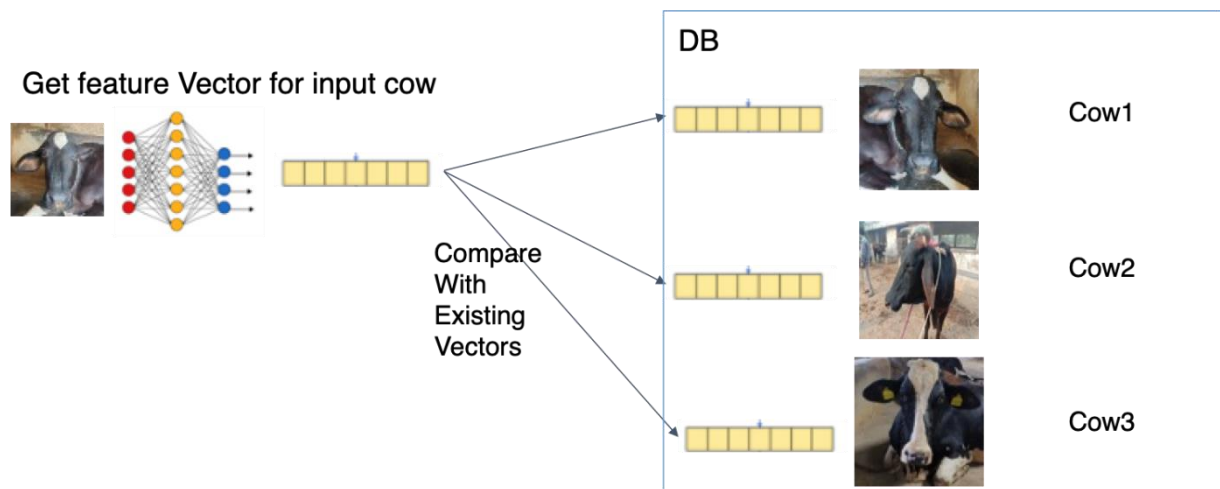


Figure 3: Cow face recognition system

Such comparison uses Classification, Regression, CNN, and other Machine Learning techniques for very quick identification. The cow facial recognition app is a Computer Vision app and is called GAU Vision.

Following is the flow chart for the entire Cow Recognition Engine, called GAU Vision.



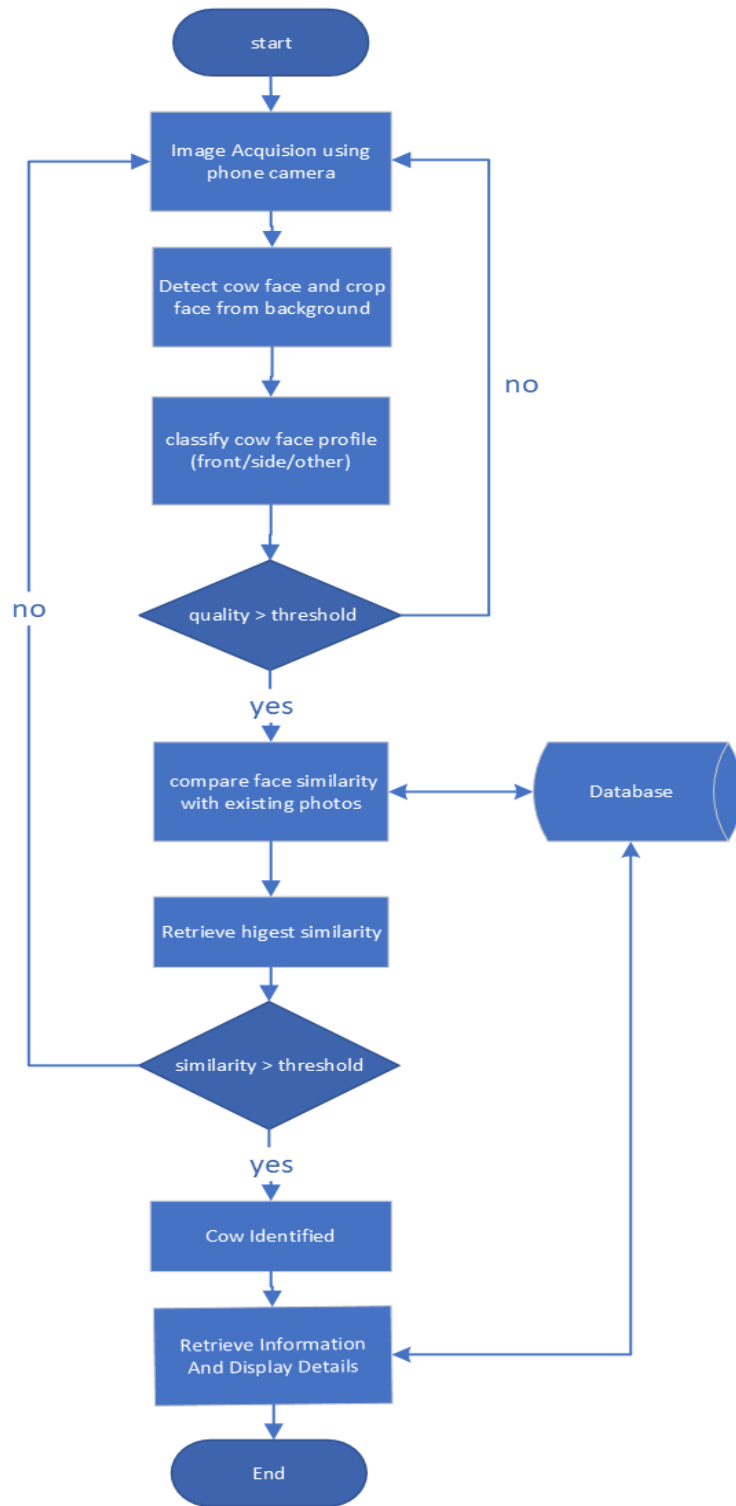


Figure 4: Flow chart of face recognition system

Figure 5 provides the overall flow of GAU Vision and GAU Portal used to create the GAU Ecosystem.

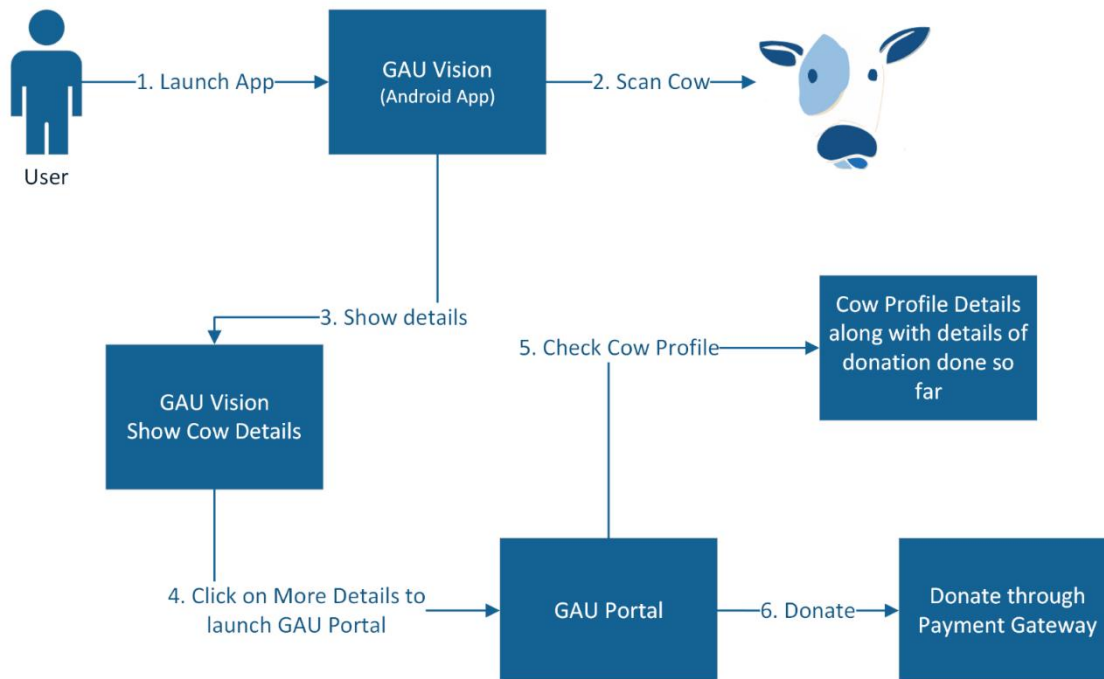
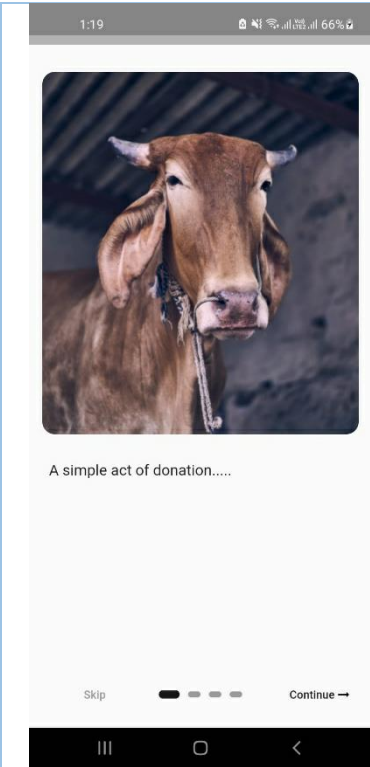


Figure 5: Integrated creation of GAU ecosystem

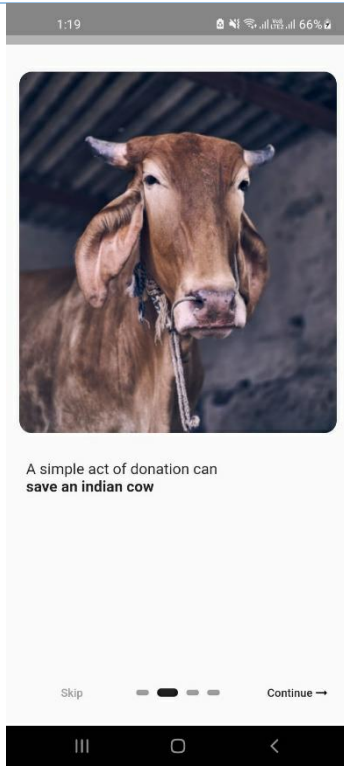
In the demonstration run, the followings were achieved:

1. Onboarding of the cows on the GAU Portal
2. Recognising the face of the cow using GAU Vision App
3. See the details of the COW on the GAU Portal which is linked right from the profile on the mobile app
4. Donate from GAU Portal
5. After donation, automatically send an email to the donors so that they are aware of the donation made

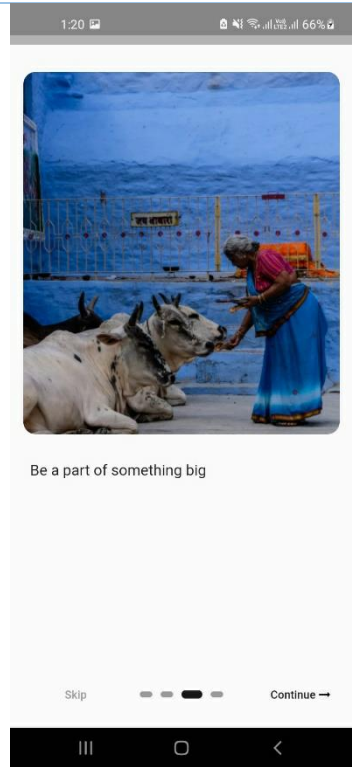
Following are a few of the screenshots of GAU Vision (mobile app) and GAU Portal/platform (web portal) to give an overall view of how they were implemented.



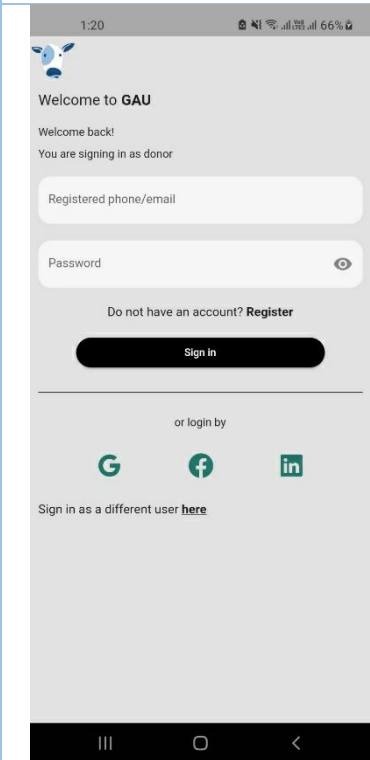
Introduction Slide



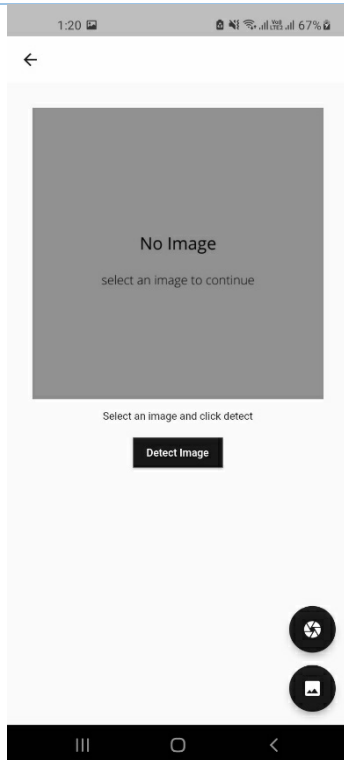
Introduction Slide



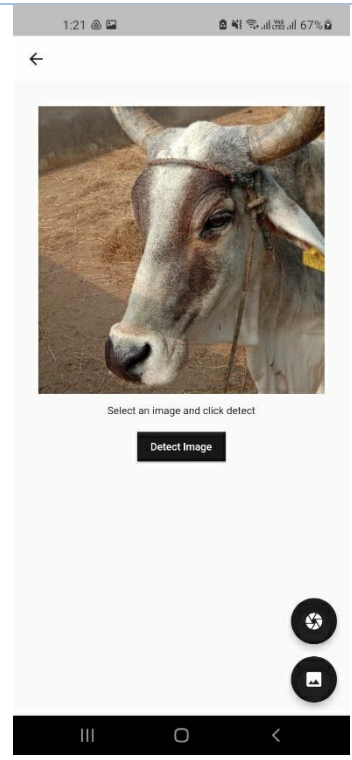
Introduction Slide



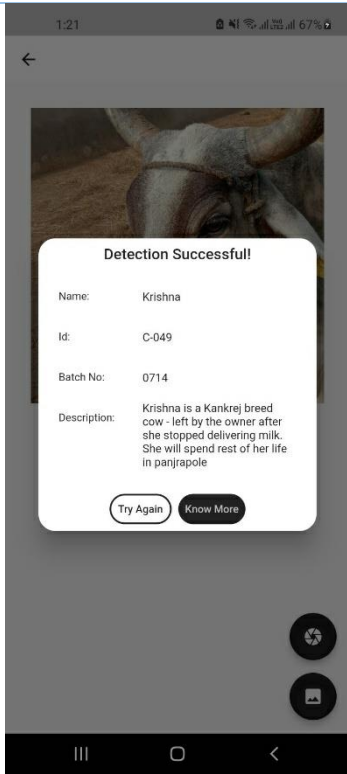
Login Screen



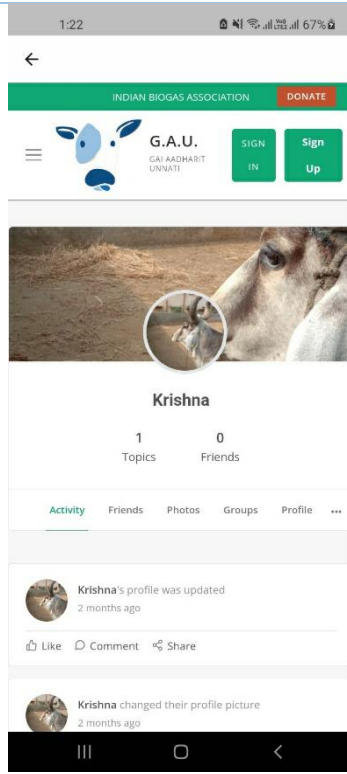
Scan screen



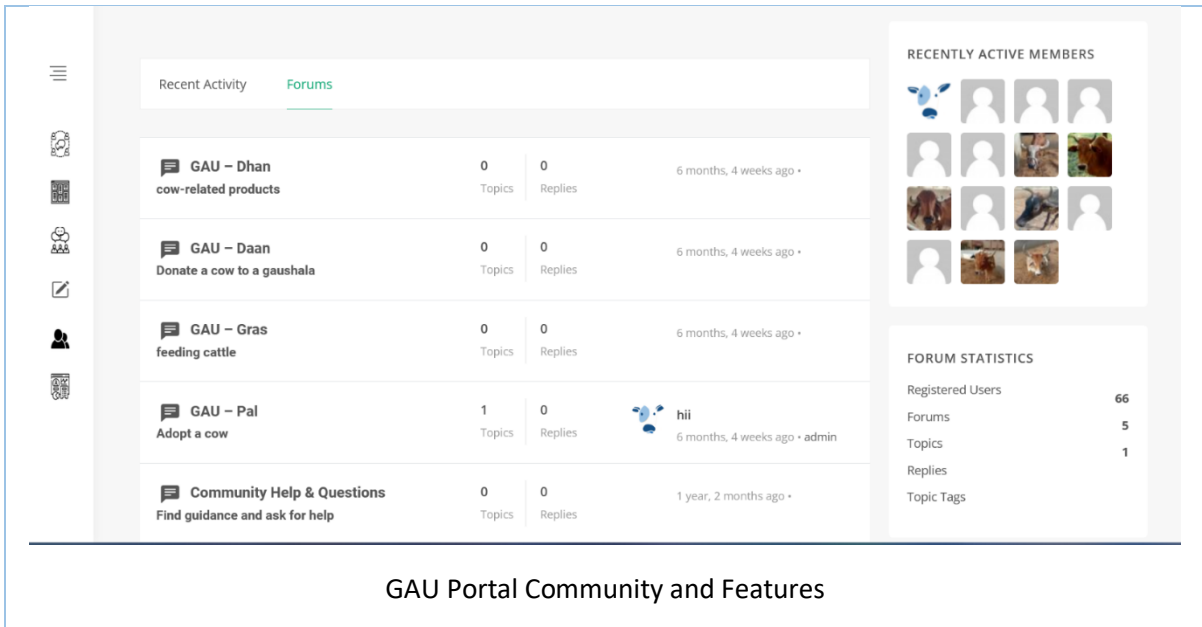
Scanned cow or uploaded image of the cow



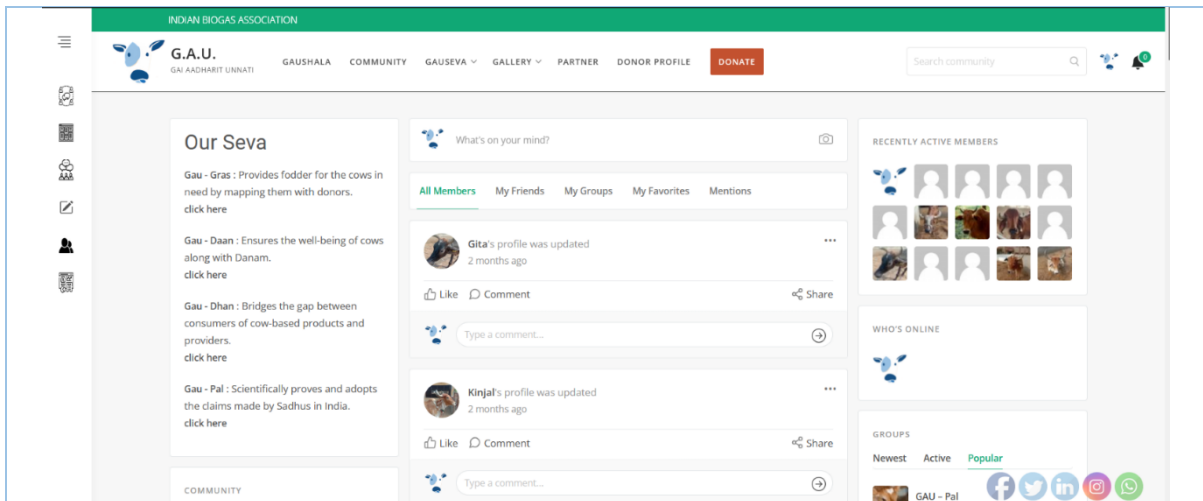
Detection of the cow and related details



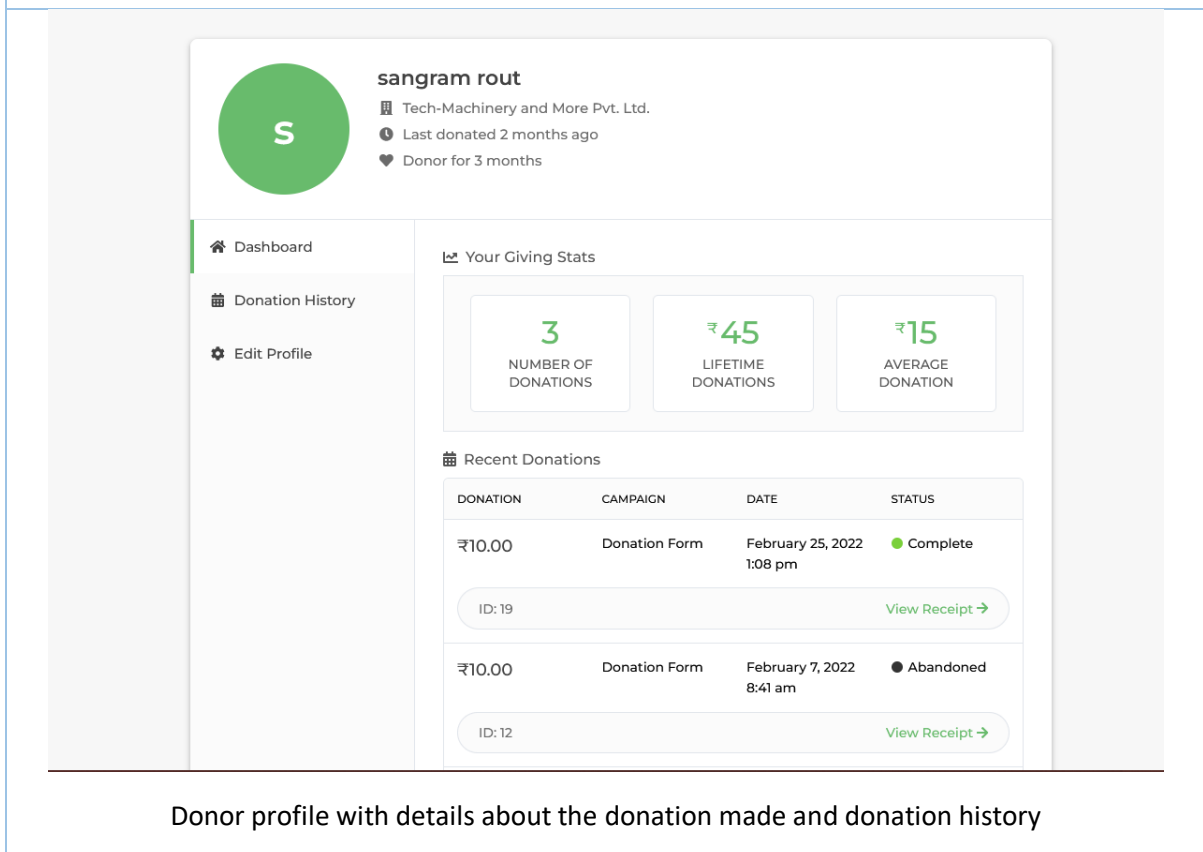
Cow's own profile in the GAU Portal



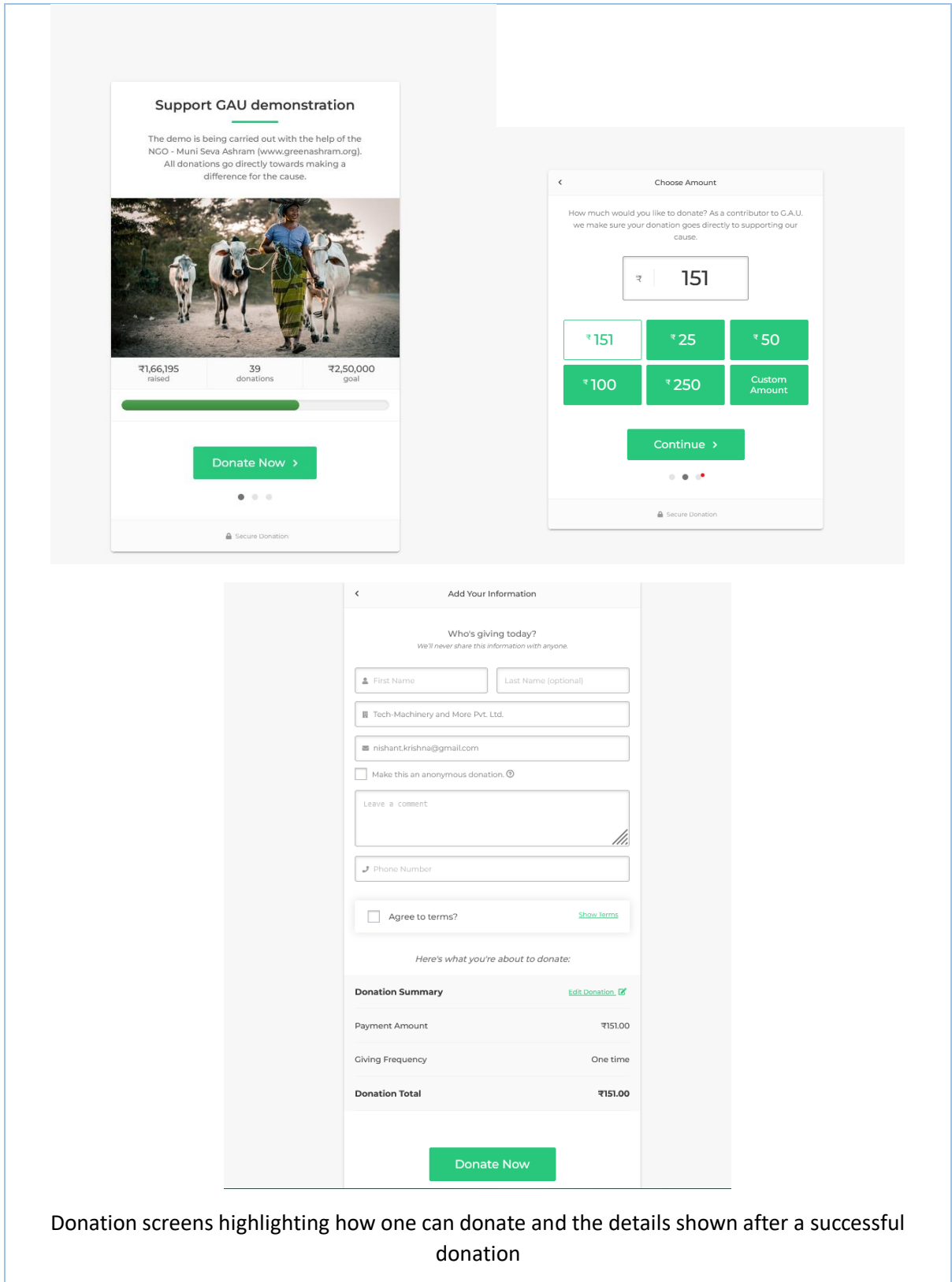
GAU Portal Community and Features



GAU Home Page with Social Networking features



Donor profile with details about the donation made and donation history



Figures 6 (a, b, c and d): Various demonstration screens from the App

## Demonstration/implementation

### Implementation of the model through NGO, Gaushala, and Executive entity

As explained earlier, the implementation of this model requires three stakeholders: an NGO, preferably working in the animal husbandry sector (cows in particular), a Gaushala harbouring non-milching cows and an executive entity/company/firm for providing the fodder. The NGO is responsible for the purchase and disbursement of fodder based on the donation made to particular cows, in particular gaushalas. The gaushalas, which are already taking care of non-milching cows, will utilise the donated fodder to feed the cows. The gaushala will also update the status of cows on the app, which will be shared with the donor in real time, thus ensuring transparency of the model. Further, the gaushala will provide cow dung from cows in return for the fodder to the executive entity/fodder providing company. This executive entity will use the cow dung for biogas plants, composting, cow dung briquettes, etc., which utilise this cow dung in their business model to generate revenue from the cow dung sold and to generate employment. Figure 6 (a, b, c and d) capture screen shots of the GAU platform App to demonstrate its successful implementation.

It is important to note here that a tech platform envisaged under the GAU model is necessary for establishing a self-reliant chain as the NGO or gaushala already involved in their respective tasks cannot be burdened with the bookkeeping/inventory management and marketing/sale-related operations required for self-sustainability of this model. The development of the GAU model also aims at self-sustainability through the GAU/Cow-based economy, and it is not expected to run on donations alone. This will reduce dependency on the donations and coming donations can later be utilised in other aspects of the maintenance of cows like medical, shelter, and gaushala maintenance, along with provisions for employing a skilled workforce, if needed.

### Results and discussion

The demonstration of the GAU model, including the tech platform, was launched in Jan 2022 and is being run in Gujarat, with further such plans in the state of Uttar Pradesh. The selected NGO, i.e., Muni Seva Ashram situated at Goraj, Vadodra, Gujarat, was setup in 1978. It is already practicing organic farming, agroforestry, horticulture, animal husbandry, solar energy, and biogas generation for its financially, socially and technologically self-reliant ashram and is involved in running schools, hospitals, and other public welfare institutions.

The chosen gaushala for demonstration of the model was late Dilip-Paresh Ashok chand Sarvajanic Panjrapole, which serves 1000 cows, 172 bovines, and 128 heifers. It has in-house veterinary facilities with 120 acres of shelter and 650 acres of pasture as open grazing fields. Hitherto, 21 non-milching stray cows were digitised for the demonstration.

The ecosystem as described earlier is set and is currently under live demonstration phase. The tech has been created and seems promising in connecting the stakeholders. Each cow was also given a name and their profile was created on the tech platform.

## Benefits

The benefits of the GAU-based self-sustainable economic model are described below.



The fundamental benefits include monitoring and transparency in the disbursement and utilisation of funds. The platform provides freedom to the donor to choose a cow or cows present in the database of GAU and donate for fodder as per their budget and allows them to access the welfare of the cow. This will help in forming donor-cow linkage (a kind of personal link between the donor and the cow), while also creating a sense of social satisfaction by donating to a social cause, thus encouraging cow welfare.

Becoming a GAU (Gai Aadharit Unnati) based self-sustainable economy can help India in multiple ways. GAU can help governments achieve their green economy, organic farming, job creation, social justice, and sustainable development objectives.

### Augmenting Farmer's Income

Cows are a source of subsidiary income for the small and marginal farmers of the country, especially those with meagre or no landholding. A large number of landless farmers are leaving farming and working as labour in remote cities due to a lack of support systems. Cows help these farmers earn income in many ways by selling milk and milk products as well as from animal wastes such as cow dung and urine. They can be used to make dung cakes, organic fertilizers, and manure. The bulls can be used for draught power. They can be used for ploughing the fields, transportation, and other agricultural activities.

### Employment Generation

GAU can help the government to provide sustainable employment to a large section of the unskilled population. Apart from dairying and food processing, they could be engaged in various activities such as animal upkeep, growing fodder for cows, dung collection, production of dung-based products, biogas plants for energy, and fertiliser, manufacturing of organic manure and fertilizers, etc. Since all these activities are gender-neutral, they can help to achieve social equality and empower girls and women.

Some employment opportunities that can be created in a cow-based economy include:

#### Gau sevaks

Unskilled youth from the villages can be trained to become gau sevaks, who take care of the daily activities of the cows, such as cleaning the animals, supplying fodder, processing the fodder, and maintaining the premises of the gaushalas, etc. It can help to solve the problem of unemployment among the rural youth while also ensuring that gaushalas get a trained workforce to take care of the animals and the premises.

#### Establishing Gaushalas

Cow dung-based product or concept possibilities include, e.g., the setting up of a biogas plant. These plants can be set up in rural areas to focus on creating hyper-local economies, which act as hotspots of social and economic activity. The biogas plants consume the animal waste and generate clean energy, fuel, and organic fertiliser that can be supplied to the local community at competitive prices. Biogas plants generate 3 types of employment: direct employment, indirect employment, and induced employment. Moreover, biogas plants also play a crucial role in job creation in both the skilled and unskilled categories.

Various tasks, such as building and fabricating biogas plants, plant maintenance, research and development of the technology, etc., demand a skilled workforce, while other activities, such

as the collection of dung and other materials, transportation, and routine tasks, need semi-skilled or unskilled labour. Biogas plants also encourage the development of micro-industries in the vicinity, thereby, generating indirect employment opportunities. Various industries engaged in the manufacturing, processing, and transport of the by-products generated by the plant, etc., help to create more jobs.

### Social benefits in terms of a circular economy and a zero-waste/low-waste economy

A cow-based economy results in a circular and low-waste economy in various ways. The most important ones are summarised as follows:

1. The GAU ecosystem connects all stakeholders and participants in such a way that it encourages a highly optimised circular economy. For example, vegetable waste and straw can be used as fodder—cows eat these to produce biological waste; biological waste, such as cow dung and urine, is used to generate biogas, which is used as a clean fuel; and the by-product of the biogas plant, i.e., biofertilizer.
2. People taking care of cows in this ecosystem are very close to nature, and they create other derivatives that are completely green, biodegradable, and close to nature themselves.
3. In India, cows were domesticated for the dual purpose of cattle farming and dairy farming. This practice is still common in remote rural areas of India. GAU will promote this for small farmers, as it will help them in supplying biogas for cooking gas and supplying manure.
4. Handicrafts made from such micro-industries (kutir udyog) are naturally green and sustainable.

## Sustainable Development Goals (SDGs)

The cow-based economy has the potential to help the country achieve the Sustainable Development Goals set by the United Nations. Some prominent SDGs that can be achieved through the GAU ecosystem are:

### SDG 1 - Zero Hunger

A cow-centred economy pays attention to animal care, which ensures that the cows are well fed and taken good care of. Moreover, it also focuses on sustainable agriculture and biodiversity. This effectively means zero hunger both for the cows and humans. Cows provide milk and milk products such as curd, ghee, cheese, paneer, etc. All of these products are nutritious and provide the country's predominantly vegetarian population with much-needed animal protein.

The GAU ecosystem promotes gaushalas to look after the stray and sick cows. These Gaushalas house both productive and aged cows. Since the gaushalas are financially supported by this programme as well as by donations, they can give back to the community by providing milk products to the needy population at a nominal cost. The GAU platform offers employment generation potential too. This effectively means that the vulnerable members of society, who were struggling to get jobs will now get sustainable livelihoods and can feed their families.

## SDG 5 - Gender Equality

GAU provides opportunities to bridge the gender gap and achieve gender equality. The establishment of hyper-local businesses in the villages' vicinity aids rural women and girls in becoming financially and socially self-sufficient. Cattle farming can help women develop jobs and become financially self-sufficient, allowing them to participate more actively in decision-making. Gau-based economies provide women with opportunities to meet household nutrition needs, increase their income, and get recognition as providers.

According to the Gennovate study, livestock farming provides women with opportunities to acquire their own asset base and provides building blocks for women's empowerment. Cows rearing can change the trajectory of the lives of rural women and give them more freedom to work, study, and move freely in their community. Apart from animal rearing and dairying, women can be encouraged to set up small and micro units in food processing, manufacturing, service, or social sectors. This will help to close the gender gap and give girls and women the opportunity to demonstrate their leadership abilities. Thus, here are a few key points in the context of gender equality being the focus area of the GAU project:

- The gender gap will be bridged by volunteering opportunities for both men and women.
- As a result of this entire ecosystem, the corporate and non-profit sectors will help in training and educating everyone involved in GAU's goals, with a focus on girls.
- As part of this ecosystem, girls will be encouraged to become ambassadors for many social issues and activities. They will be given the authority to lead groups of volunteers and workers. This would then lead to the development of leadership skills in females.

## SDG 8 - Decent Work and Economic Growth

SDG 8 focuses on promoting sustained and sustainable economic growth, full and productive employees, and decent work for all. The GAU ecosystem can achieve targets in the following manner:

- Employment opportunity for local people, as they will be employed as gausevaks and in many other job requirements in the ecosystem.
- The biogas plants and other micro and small businesses that are going to be run by social entrepreneurs will create a large number of jobs in rural and semi-urban India.
- GAU ecosystem has many other opportunities for jobs to be created for local artists and artisans. Each of them will boost the local economy and will help create a self-sustaining model.

## SDG 11 - Sustainable Cities and Communities

SDG 11 focuses on making cities and human settlements inclusive, safe, resilient, and sustainable. GAU ecosystem can achieve many of the targets of this SDG in the following ways:

- The ecosystem discussed in this paper is being developed with sustainability as its inherent feature. Every product and by-product of this entire ecosystem is as close to nature as possible.
- The waste and by-products generated as part of various processes are biodegradable and don't add pressure to an already fragile ecology.
- Circular economy where there is zero/minimum waste can create sustainable cities and communities

### SDG 17 - Partnership for the Goals

A sustainable development agenda requires an effective partnership between the government, private sector, and civil society. The partnership should include financing development; developing proper networks to connect people through information technology; managing international trade flows, and developing modern tools for data collection and analysis.

GAU is being developed to facilitate multi-stakeholder partnerships where each stakeholder can share knowledge, expertise, resources, and technology to support each other in achieving all the other sustainable development goals. GAU is a social impact-focused ecosystem, where anyone who wants to partner with other participants to achieve sustainable development goals can be on board with great ease.

- GAU is being developed as a partnership model between the stakeholders, where each of them has to play an important role to play in order to achieve all the other goals
- Due to GAU being a tech-driven, transparent and social impact-focused ecosystem, onboarding and partnering can be done with ease.

### Future steps

In continuation to the above-mentioned points, further use cases can also be envisaged.

#### GAU Dhan

With more than 60% of people of Indian origin across the world who may be looking for authentic cow-based products including milk, ghee, and other including puja items, a gap exists in this section. A modern tech-driven authentic e-commerce platform shall even give an opening to people at the so-called bottom of the pyramid. A Competency development program is envisaged to promote cow centric economy.

#### GAU Pal

A scientific approach shall be taken to prove and adopt the claims made by Sadhus in India like cuddle a cow is one of the ancient concepts, but it is getting popular in Holland (and now in USA) to say goodbye to many personal problems under the name "koe knuffelen" (literally "cow hugging" in Dutch). Even getting licked is part of the therapeutic practice. This has been a practice elucidated in several ancient texts in India.

## GAU Daan

Gau Daan is the most powerful and pure donation anyone can do in their lifetime. It is believed that performing Gau Daan helps a person to get rid of all the sins. Under this, the GAU vision can ensure about the transparency in the whole system. Few of the important points are:

- Pratyaksh cow will be donated
- Gau Puja will be performed before giving Danam
- Technology will bring transparency even after cow is donated about its status

## Conclusion

This domain of research needs more public and government reach for significant outcomes, resulting in the welfare of all. Deep understanding and stronger government-public-private support can consolidate the GAU model. Among the important points brought by the GAU model to solve stray cow issues are:

- Transparency in donation utilization will increase the trust of donors in Gaushalas.
- Fulfilment of social, cultural, and sentimental obligations of donors: a sense of satisfaction.
- Real-time monitoring creates a sense of a more responsible attitude and accountability in Gaushala staff.
- Marketing and sales of stray Cow by-products: Cow by-products include cow dung, urine, cakes, compost, cow dung briquettes, cones, and sticks, as well as biofertilizer/manure for soil fertility.
- Biogas can be used to substitute wood/coal burning to reduce carbon emissions, increase efficiency, and save the environment.
- In the starting period, GAU can provide employment to unskilled labours (cleaning the animals, supplying fodder, processing the fodder, maintaining the premises) and, in the long run, skilled workforces (animal product e-marketing, sale, optimal use of premises, tracking policy progress) for better management (animal product e-marketing, sale, optimal use of premises, tracking policy progress).
- Women from rural areas may be able to find work in animal care, growing fodder for cows in the Gaushala premises, dung collection, dung cakes, biogas production, manure management, and selling the other bye-products through a cooperative model or self-help groups.
- No stray cows on the road.

The AI-based GAU model is a practical solution to accommodate stray cows in Gaushalas with the above-mentioned benefits. It is a promising sustainable model where transparency in donation-expenditure, monitoring, and well-being of cows will create a win-win situation for all stakeholders. Establishing gaushalas for aged and sick cows can also generate numerous (skilled and unskilled) employment opportunities. The community biogas plant will provide bio-fertilizer and biogas for cooking. Biogas will lower dependency on LPG and boost the Indian economy. Biofertilizer will help improve soil health. The model has got the potential to speak in tune with Mahatma's opinion, which says "**Cow protection to me is one of the**

most wonderful phenomena in human evolution. It takes the human being beyond this species”.

## References

1. Chandra S., The Cow in India, Vol. I & II, 1945, Khadi Pratishtan, Calcutta
2. <https://www.investindia.gov.in/sector/food-processing>
3. Fox, M.W. India's Sacred Cow: Her Plight and Future. *Anim. Issues* 1999, 3, 1–35. Available online: <https://ro.uow.edu.au/ai/vol3/iss2/1> (accessed on 20 October 2019).
4. 19<sup>th</sup> and 20<sup>th</sup> Livestock census, Department of Animal husbandry and Dairying, Ministry of Fisheries, Animal husbandry and Dairying
5. Ghatak, S.; Singh, B. Veterinary public health in India: current status and future needs. *Rev. Sci. Tech. O.Int. Epiz* 2015, 34, 2. [CrossRef] [PubMed]
6. Singh, B.; Ghatak, S.; Banga, H.; Gill, J.; Singh, B. Veterinary urban hygiene: a challenge for India. *Rev. Sci. Tech. O. Int. Epiz* 2013, 32, 645–656. [CrossRef]
7. Government of India (GOI). Road Accidents in India—2016; Ministry of Road Transport and Highways, Transport Research Wing; Government of India: New Delhi, India, 2017; p. 50.
8. Sharma, A., Schuetze, C., Phillips, C., 2020, The Management of Cow Shelters (Gaushalas) in India, Including the Attitudes of Shelter Managers to Cow Welfare, *Animals* 2020, 10, 211; doi:10.3390/ani10020211
9. Information brochure, Indian Biogas Association
10. India's Oil and Gas ready reckoner, Oil industry information at a glance, PPAC, MoPNG, Gol, July 2021.

## Bibliography for further reading

11. A Guide to Developing a Business Plan for Farms and Rural Businesses, 2018, Minnesota Institute for Sustainable Agriculture (MISA), Sustainable Agriculture Research and Education (SARE), College Park, MD
12. Cow and Gaushala, 2018, Mumbai Sarvodaya Mandal
13. Harsdorff M., 2014, The economics of biogas: Creating green jobs in the dairy industry in India, International Labour Organisation