

Electronic Identification and Management System for Livestock with Ownership Interface, e-Governance and Global Supply Chain Traceability for Products of Animal Origin

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Abstract

This paper attempts to describe a novel and comprehensive method (a) for providing a secure electronic identification and management system (i) for individual livestock dynamically and irrefutably linked to their true ownership at any given time; (ii) for farms and commercial entities engaged in animal agriculture and processing /trading in animal products, by means of an electronic ID smart card mandatorily issued by government authorities to the owners of livestock and others concerned, which facilitates improved livestock management and administrative oversight including delivery of health and welfare measures; and (b) for the creation of futuristic supply chain traceability and e-Governance capabilities in the field of animal agriculture, resting on the platform of a robust, electronic National Livestock Registry to be owned and operated by concerned statutory authorities in various countries.

Background

As we all know, livestock constitute a precious national resource representing high value assets to their owners. Across the world, from time immemorial, livestock identification and proof of their ownership have been sought to be achieved by branding and marking domesticated animals. The symbols used in branding or marking came to be recognised by local practice in pastoral communities. Over the years, progressive agro authorities came to create registers to record brand marks adopted by livestock owners in their precincts.

Conventional branding/marking practices vary from one country to another. However, the broad methodology and orthodox nature of identification of animals remains the same, and branding remains widely prevalent to this day in all parts of the world -- albeit with incomplete coverage and / or deficient governance standards in most countries.

It is interesting to note that livestock authorities in various countries have enacted laws recognising branding as a legal means to identify livestock and created National / Provincial Registers containing various registered brand marks owned by respective livestock owners, covering several species such as cattle, horses, camels, ostrich, sheep, goats and pigs. Presently, laws make it mandatory for all livestock owners of those countries to register their brands/marks in this Registry, which is computerised in progressive countries. However, it is important to note that this form of identification merely helps establish the owner of an animal; it does not identify the animal. Also, there are several disadvantages and deficiencies in hot branding / freeze branding / tattooing etc.

Among them:

- (1) Lost or stolen livestock could be rebranded in the legally-permitted vacant branding position on livestock by those claiming to be their lawful owners.
- (2) Branding is absent in respect of livestock below certain age.
- (3) There is no method of affixing brand on sale subsequent to the third sale in case of livestock and beyond the second sale in case of sheep and ostrich.
- (4) The growth of hair over the brand mark is liable to obliterate the original mark.
- (5) Branding is not possible to impose on certain species of livestock for practical reasons, example sheep, horses, domestic pets.
- (6) Branding damages the hide of animals, apart from causing extreme pain and agony to animals – a procedure strongly opposed by animal rights groups.

Post detection of BSE in the US in 2003, a sense of urgency and seriousness set in to introduce scientific practices to assist livestock traceability. Some countries have adopted mandatory electronic tagging of valuable species such as bovine and equine stock, following a serious approach to eventual traceability. But many other nations have kept these programmes voluntary, leaving it to the discretion of stock owners. As a result, there is no globally uniform practice currently prevailing either for identification or for traceability, despite serious initiatives by national and international bodies.

The Hiatus

Much has been done to mark animals in order to achieve reliable stock identification as the basis for establishing a reliable traceability system. However, it appears that in general, all countries have consistently overlooked the paramount importance and necessity of also simultaneously identifying and registering their owners, the farms and the supply chain operators following uniform global practices and codified systems, in order to complete the chain of identification, which is only as strong as its weakest link. A multitude of agencies and operators are involved across national boundaries, from farm to retail. The hiatus in the global identification and traceability process is telling.

The number of livestock covered by electronic tags is a miniscule percentage of livestock population worldwide, and the vast majority of animals continue either to be covered by traditional branding methods or none at all. Legal ownership is presumed by mere possession and custody of livestock -- even if they were to be stolen earlier. There is no uniform method of livestock identification worldwide incorporating authentic ownership interface, which would provide the means of verifying the true ownership of livestock.

Some practical examples to demonstrate the above situation:

- (1) If authorities stop and check a farmer in transit anywhere in a given country and ask him to irrefutably prove (i) his ownership of the animal(s) in his possession and / or (ii) the authorisation he holds from local authorities to transport the animal(s) from Place A to Place B, it is nearly certain that he would fail, even if the livestock bears an RFID device. Where are his name and ownership data recorded, especially if it is a second or subsequent sale? What documentary proof does he have in his hands? Similarly, in the case of livestock sent to abattoirs for harvesting, or exported.
- (2) Branding is still widely practiced and recognised, even in developed countries. However, this identifies the owner, NOT the animal. How then can a livestock owner reliably distinguish one animal from another in a large herd of similar looking, similar aged livestock?
- (3) Commercial entities in the livestock industry including traders, abattoirs, butcheries, transportation companies, cutting halls, meat processing and packing units, exporters, dead-stock operators etc are also not compulsorily enrolled under a commonly

recognised and codified scheme of identification. How can traceability be achieved in a disjointed chain?

Over the last few decades, identification systems have gradually evolved in some countries from hot branding, ear notches, tattoos, paint marks, metal tags, etc to electronic ear tags, microchips and to a lesser extent, ruminal boluses, though these modern identification practices are neither intensive nor extensive, contributed also by the non-mandatory stance of governments worldwide.

Clearly, the requirements of good identity management and governance of large populations of various species of livestock in any country point to the need for deploying sophisticated, tamper-proof identity management systems which also incorporate ownership information, and utilise modern information technology to deliver reliable supply chain traceability and e-Governance capability. Such possibilities appear to be lacking in present systems, and this is cause for concern.

Appraisal of Present Livestock IDT (Identification & Traceability) Systems Worldwide

This vast subject is divided into three main groups as below, for the purpose of analyzing and understanding the intricate issues involved with each, and for arriving at intelligent solutions for the future. This feature is also followed in later sections of this paper.

- A LIVESTOCK ID SYSTEMS AND NATIONAL REGISTRY
- B. ADMINISTRATION, HEALTH AND SAFETY OF LIVESTOCK
- C. TRACEABILITY

Let us now evaluate the prevailing IDT practices worldwide under the three main groups:

A LIVESTOCK ID SYSTEMS AND NATIONAL REGISTRY

- 1 Globally harmonized, codified approach to livestock identity management and traceability absent
- 2 Official livestock ID systems and laws non-existent in numerous major countries [*example*: India]
- 3 Several countries have Livestock ID Acts [*example*: South Africa] but are based on age-old practices of branding etc. and lack stringent administrative control

4. Mandatory I&R (Identification and Registration) Systems for livestock and farm premises prevalent in very few countries [USA a notable exclusion]; even amongst them uniform protocol lacking
5. No uniform coverage of all valuable species of terrestrial stock under modern ID programmes [*example*: camelids, cashmere goats]
6. Valid documentary proof of livestock ownership non-existent in most countries – ownership presumed by possession
7. All ID and traceability systems dwell only on identifying individual animals – without linking them to the verifiable ID of their owners. No owner-centric livestock databases / animal ID
8. In many developed countries, RFID Ear Tags available over the counter (OTC) at veterinary supplies stores, devoid of regulatory issuance. Livestock I & R practices are largely insecure. *Example*: A can steal B's cow, destroy its RFID ear tag and replace it with own tag, then claim to be its lawful owner.
9. No scientific animal and farm premise ID numbering system generated by Authorities of each country.
10. No system of capturing and storing biometric data of (high-value) stock on national livestock database.

B. ADMINISTRATION, HEALTH AND SAFETY OF LIVESTOCK

1. Electronic ID system linked to national livestock registry providing administrative support to authorities prevalent today in only very few countries; and such registries are not utilized for range of potentially useful applications
2. Few systems in use for formal recording of ownership change with documentary validation of transfer
3. Minimal systems exist to regulate, pre-authorize and record livestock movement
4. Few systems exist to check proof of ownership of animals in transit
5. Limited issuance of paper book animal passports provide marginal utility; also cumbersome owing to physical record-keeping

- 6 Rustling menace prevalent worldwide. Few systems exist to expressly detect and combat livestock rustling. Serious lack of verifiable proof of ownership contributory cause.
- 7 Few systems of codified identification of various commercial operators involved in animal agriculture industry
- 8 Minimal facility for national livestock databases to either ‘speak’ to each other or to upload data online to world bodies [example: OIE and ICAR]
- 9 Livestock census operations largely manual process
- 10 Insurance industry not backed by authoritative livestock related data in most countries for verification processes relating to issuance of policies / settlement of claims

C. TRACEABILITY

- 1 No globally uniform practice prescribed/prevalent for traceability of meat supplies
2. Traceability often rests on the weak foundation of deficient / voluntary livestock and farm I & R systems prevalent in many exporting countries
3. RFID reference number of individual animals is the only prevalent data source for traceability in all countries
4. Tracing source farm of animal by mere reference to RFID ear tag numbers unreliable as these can be manipulated
5. Human readable trace codes on retail meat packages not in vogue in most countries
6. No codified system exists for trace-back of non-edible products of animal origin
7. Precise linking and correlation of input Livestock ID to output (packaged beef, for example) ID following ear tag numbers of individual animals is difficult to attain (as purported) owing to merging of tag ID’s – and of produce – in an automated, high speed continuous process scenario
8. Concept of ‘*Farm to Fork*’ traceability in reality does not as yet measure up to visionary expectation of concerned global authorities.

Objectives of new Global Approach

Livestock identification comprises two main requirements: (1) “private” or “management” identification operated by individual farmers for their own needs; and (2) “official” or “national” identification, mandated by a government authority.

Further, in any country, existing or planned systems for (a) terrestrial animal identification (b) traceability of source of animal products and (c) food labelling are three disparate subjects – with different goals, needs and applications, with no common solution in sight.

The described system provides a harmonised convergence of data concerning these three areas to efficiently achieve all the needs mentioned above and to deliver a globally implementable, unified solution based on a single, permanent, unique identity reference for each terrestrial animal, farm or commercial entity, which is simple to use, cost-effective and reliable. The described system thereby creates and synergises a deep underlying inter-connection between these three areas, and to provide a seamless, comprehensive identification system, valid worldwide, with the fundamental objective of safeguarding/promoting animal health AND food safety.

Accordingly, the described system seeks to provide an overarching, globally uniform electronic Livestock Identification and Management System to instantly establish their true identity and ownership; to provide Governmental Authorities developmental oversight and administrative control via a National Livestock Registry; and to provide Supply Chain Traceability to authorities and customers worldwide to achieve rapid trace-back of all edible and non-edible products to farm of origin -- all via a single identity reference.

Inexpensive stock such as poultry and non-terrestrial species are kept outside the purview of this system, either for lack of economic feasibility or operational impracticality. However, the system may be applied to cover certain species of non-livestock example, pachyderms, and also deployed for only the traceability function of farms, commercial entities and farm produce such as dairy products, honey, fish etc, without the need for identification of individual animals / birds etc.

System Capability

The described method addresses this serious and hitherto overlooked aspect by covering both animals and agencies involved in the field of animal agriculture under a common holistic identification programme based on smart cards linked electronically to a national livestock registry of a given country. Such a system alone would help bridge the divide between the vastly different domains of identifying live animals versus identifying products of animal origin – and precisely interlinking the two in to one seamless solution. In turn, this directly helps in planning and implementing actions that reduce risks in the animal-human ecosystem interface.

. Various developed countries engaged in animal agriculture have introduced livestock identification and traceability systems; however, all these systems revolve around providing an identification number to each animal and endeavouring to oversee their health / movement as well as supply chain traceability solely by referring to this number. These countries appear to have overlooked the importance of an owner-centric approach to livestock identification, and have thus lost sight of the advantage of dealing with those who own livestock -- often in bulk – in farms and beyond. This would readily obviate the need to deal with individual identities of numerous stock, for administrative oversight and developmental actions.

Animal health care and welfare programmes; movement of stock; and harvesting of animals owned by medium and large farms always occur in sizeable groups, never in isolation. For instance, vaccination or harvesting would be completed for the entire herd.

The described system provides an owner-centric system of livestock identification by dealing with livestock groups via the Group Livestock & Farm ID System, obviating the present inconvenience. For disease traceability, farm of source is vitally important and more relevant than tracing an individual animal. For the purpose of fixing onus and for initiating restrictive actions, tracing farm ownership and treating the entire farm as one entity are much more important.

From the regulatory, administrative control, operational and commercial angles also, reference to the farm / feedlot / commercial entity is of utmost importance – not to individual animals. *Example*: if a ban is to be imposed on import of beef from certain jurisdictions by a given country, the presently used reference of individual RFID device numbers of animals is of minimal utility, as their farm of origin and identity of their cohorts can only be ascertained

from the national database (if it is operational and up-to-date). But by the described system, such ban can be imposed with utmost ease and efficacy by reference to the appropriate IGs (Identifier Groups) in the 18-digit numbering system of the Type 2 Group Livestock & Farm ID Card, directed at a given country, province or even specific farm which needs to be banned / isolated.

The Livestock Identity Smart Card designed and described in three principal types acts as the crucial operating interface between livestock owners (and their stock) and the National Livestock Registry in a given country, which constitutes the government-owned and operated centralised repository of all essential data pertaining to livestock including their electronic identification device numbers and key data of the respective owners. The specie-wise livestock data stored on this national-level database -- which data is subsequently selectively ported to the chip of the said ID Card as well -- serves as the foundational platform for implementing a unique system of Supply Chain Traceability and e-Governance via a single, harmonized identity number of the above Livestock Ownership ID Card -- issued to owners and traders for single, multiple or groups of animals, specie-wise -- valid for the lifetime of respective individual owners or business entities.

The mandatory digital identification system described seeks to replace the age-old practice of branding or marking animals to establish their identity; provides numerous advanced, futuristic functionalities, for efficient, facile interface between livestock owners and government (as well as other agencies) covering statutory and non-statutory applications; provides Governments a modern system to oversee efficient nation-wide livestock healthcare and administration, provide reliable traceability of geographic source of livestock and supply chain management for animal products, assist in tracing lost / stolen animals and compliance with laid-down laws and national directives relating to livestock production systems; helps reach welfare measures uniformly to given livestock populace in chosen geo-territories; and to establish stringent administrative control relating to livestock sale / termination practices, internal security and border regulation with respect to transportation of livestock.

Accordingly, the present system seeks to provide a comprehensive means

1. to create, establish and operate a simple, permanent, single identity for all purposes and applications, and smooth livestock-owner friendly procedure for mandatory enrolment of livestock across the country under the Livestock Identification Programme;

2. to create, establish and operate a centralized government-owned and operated national-level database of all livestock known as the National Livestock Registry (NLR), and thereby provide governments a ready and comprehensive databank of all livestock, livestock premises and commercial entities engaged in the animal agriculture industry -- a resource that is non-existent at the present time; yet preserves the confidentiality of stored data and safeguards privacy of livestock ownership;
3. to personalise and deliver high security, tamper-proof Livestock Identity and Ownership smart cards to livestock owners, which can be remotely activated/ deactivated by authorities, thus altogether eliminating identity thefts and frauds, impersonation, forgery and misuse of identity cards, should they be attempted;
4. to create a seamless interface between concerned government and other agencies associated with policy and administrative overview of livestock in given geo-territories, livestock health / vet-care, insurance, police, etc to provide a robust and efficient platform for L2G (Livestock to Government) and G2L interaction;
5. to forge a strong operational relationship between animal identification, the traceability of animals and products of animal origin and food labelling, and linked through the supply chain by means of a harmonised, seamless system of identity management covering livestock, owners of livestock, farms and all commercial entities participating in the livestock processing industry supply chain worldwide. This reliable system of identification removes the present trust deficit / risk perception regarding product reliability when verifiable human readable trace codes are absent on wholesale and retail animal food packages.
6. to ensure an efficient and secure system of regulating transportation and verifying true ownership of livestock in transit in any geo-territory and especially across national borders, and to control internal security procedures concerning livestock in movement;
7. to facilitate expeditious customs clearance of livestock imports at international borders by virtue of reliable electronic identity of livestock and health certification described by the described system;
8. to facilitate a reliable, electronically verifiable admission protocol for livestock entry to abattoirs and butcheries;

9. to usher modern e-Governance practices with futuristic features and wide ranging capabilities for efficient administration of livestock populace, species-wise;
10. to create a novel and unprecedented procedure to achieve reliable traceability of country and farm of origin of any species of livestock through electronically verifiable means from any location, at all stages of the supply chain up to point of sale of animal products – be it meat, fibre, hides/skins, feathers or other animal co-products including offals — helping in the supply of safe, wholesome meat as well as quality non-edible products across international borders;
11. to create a novel and unprecedented method to achieve reliable traceability of disease of any species of livestock, providing medical relief to affected areas, isolating stock from movement to other areas, and containing spread of disease through appropriate administrative actions including compartmentalisation, in any given geo-location(s);
12. to offer an 18-digit scientifically composed unique livestock identity and ownership number [designed individually for the three types of Livestock ID Cards] valid for the lifetime of the livestock owner or of the commercial entity owning them, as the case may be, with specially designed identifier fields which serve as the crucial primary identifier and single reference point for all matters relating to the interface of each livestock owner with government and other agencies;
13. to provide for secure storage of data in the NLR covering all facets of livestock in novel, convenient and unique configurations referred to as Tabs;
14. to provide for secure flow of stored data selectively as required from NLR to chip of smart card via reader-writer devices by means of secure channels of electronic data transmission and stringent, multiple-level data access control ;
15. to hold a host of biometric data pertaining to each (high-value) livestock both in the NLR and on the smart card chip, which serve as infallible proof of the real identity of each such stock, deployed especially in the case of bloodstock and prized species;
16. to provide the means for verification of livestock data including their RFID device code and true ownership by authorized personnel of respective government or other agency at conventional, office locations via standard PC terminals or at remote locations via hand-

held reader units and mobile/wireless communication devices with inbuilt display units, described as part of the deliverable supplies ;

17. to provide a reliable means of visual identity by means of the said ID Card, which at the physical inspection stage is adequate to complete many routine applications of identity verification of livestock ownership;
18. to serve as a single identity card and ID Number for all livestock applications, hence truly multi-functional, and includes the needs of present and future e-Governance and Supply Chain Traceability practices ;
19. to provide the means for federal and state/provincial government authorities to undertake a wide range of statistical analyses covering innumerable parameters which assist in planning livestock production systems and administration actions, implementing macro health and vet-care actions, formulating breeding policies for given species, observing migratory patterns of livestock, etc;
20. to replace and render redundant the conduct of traditional physical, national-level livestock census operations, by creating and maintaining a dynamic, constantly updated electronic live-stock population database species-wise, function-wise, province/ state-wise, district-wise via the National Livestock Registry, thus providing reliable, up-to-date census datasets in dynamic mode to authorities;
21. to provide RFID device implant services to livestock and render other easy-to-access livestock owner-friendly services close to livestock owners' homes/farms covering all the needs of interaction with governments and other agencies, via Livestock Identification Centres (LICs) in every neighbourhood, manned by specially trained staff under the public private partnership format; where such RFID devices are never re-used in order to preserve the uniqueness of the identity reference once issued to a particular animal which shall never be re-applied to another livestock;
22. to create a method to ensure and oversee compulsive compliance by livestock owners with all rules and operating guidelines pertaining to livestock and livestock production systems prescribed from time to time -- especially preventive healthcare and harvesting / termination regulations -- thus ensuring a high degree of suasive operational discipline, which is an essential ingredient for safety and welfare of livestock ;

23. to serve as basis for issuance of e-Permits for movement of livestock— inland as well as international -- with utmost reliability and facility by the provision of Machine Readable Documents (MRD) to true owners of livestock (or their duly constituted logistics agents), thus preventing illegal transportation of stolen livestock by various modes;
24. to hold digital signature of livestock and farm owners and owners of commercial entities, and facilitate affixation thereof in a secure environment controlled by 6-digit user-PIN, for all e-Governance related requirements and online transactions appurtenant to livestock;
25. to assist in livestock auction traceability by enhancing trace-back capabilities at high-risk, high through-put sites where animals from different source farms co-mingle, example, at auction yards, stock yards, transit warehouses.
26. to provide a powerful electronic infrastructure with system of alerts and controls for remote surveillance and tracing of livestock theft, their illegal transportation, illegal termination and other unlawful activities, and to effectively combat misrepresentation of true ownership of livestock as well as false claims to livestock ownership.
27. for authorities to oversee the disposal of dead stock and offals in given geo-territories assisted by NLR with compulsory recordal of deaths and disposal of livestock, species-wise; and ensure environmental safeguards against risks of careless disposal of carcasses and offals through appropriate administrative process; and in the prompt recovery and handing over of RFID devices appurtenant to such animals to concerned LIDA.

The described system thus provides practical and real-time support to both animal agriculturists and to concerned government authorities alike in the protection, conservation and improved management of livestock including providing qualitative genetic management and propagation improvements, preserving bloodlines, achieved via a homogenised system of identification of both livestock and their owners reciprocally linked through irrefutable electronic means and held permanently on the National Livestock Registry and on the corresponding Livestock ID Card chips.

Furthermore, the entire gamut of people and organisations/ business entities in the “farm to fork” chain of livestock related activities are covered under a single, seamless omnibus scheme of reliable identification on a global basis. Thus, the described system helps in

systematically including and codifying the identity of all entities engaged in animal agriculture as well as in dealing with or processing livestock, following an inclusive approach. This enables rapid and reliable electronic supply chain traceability on a global basis -- of (i) livestock, (ii) of meat products and (iii) of all non-edible products of animal origin including wool, fleece, fibre, hides and skins, feathers, horns, etc -- right up to the source of origin of a given product, in a manner hitherto unprecedented, delivering a high level of product reliability and customer confidence, worldwide. In the described system, the 18-digit Livestock ID and Ownership Card Number which is globally unique is recommended to be utilised in lieu of all other existing Trace Codes followed by meat packaging and supply companies including all major branded supplies.

Consequently, under the present system, relevant data from the NLR databases of various countries would be available to authorities of other countries in the course of supply chain traceability exercises worldwide. When, for example, major meat importing countries insist on Trace Code being imprinted on every retail and wholesale package, all exporters in various countries must necessarily comply by affixing the relevant Livestock 18-digit code number belonging to the farm of origin as well as to the meat processing and packing company on the packaged products. This automatically provides the most reliable, GPS interfaced Trace Code, by disclosing at sight, the true origin of the livestock and of animal products.

Discrepancies between national identification of live animals and traceability systems of animal products in various countries make it difficult to trace products of animal origin throughout the food chain at world level. Developing countries risk losing out on market access because of trade barriers that sometimes are put in place as a result of these discrepancies. This described system provides an adept solution to the pressing need to bring about a convergence of systems that (i) identify live animals and (ii) provide traceability of products of animal origin, and achieve harmonious and seamless unification of both. The described system provides a comprehensive identification system which seamlessly merges the systems required to unify these two areas, and to provide a single, universal ID solution for all needs in this field.

System Features

Presently, there is no secure identity system *per se* to serve the primary role of irrefutably establishing the identification of livestock linked to their true ownership. In other words, there is no definitive and completely reliable documentary means existing for a person to prove his ownership of given livestock of any species, with the limited exception of paper book animal passports in a few countries covering bovine and equine stock, as well as domestic pets.

The system now described provides a unique livestock ownership ID smart card to each and every owner of livestock, which serves as a permanent and reliable means to establish the true ownership of each livestock, whose distinctive RFID device number is electronically interfaced with the ID of its owner on the NLR, on the ID Card chip and on the Linking ID Card under AIS. The smart card provides for multiple applications serving as a single crucial interface for all transactions required by livestock owners.

Livestock can be provided with the best RFID devices, but unless their original and successive owners are traceable with equal efficiency, no livestock ID or e-Governance programme can prove truly purposeful or beneficial to authorities.

Owners -- not livestock -- comply with laws and regulations and engage in trade and commerce. Hence the need for a modern electronic identity system with convergence of ownership and livestock identities is the real need, presently unfulfilled.

Subsidies and trade (export) incentives are availed by livestock owners or commercial entities in the animal products supply chain, not by livestock themselves. Hence the need for a stringent livestock identity system to recognise and monitor the availment of farm and other subsidies /incentives and State welfare benefits by owners.

The described system provides reliable identity information not only about livestock but also about owners of livestock, farms, feedlots and feed-yards; traders, commercial intermediaries involved in supply chain, abattoirs and butcheries, exporters of livestock, meat and animal products, and the like. This concept is truly pioneering and unprecedented worldwide. It provides a hitherto unknown method for comprehensive management of metadata required for achieve enhanced bio-security, meat safety and brand assurance, product integrity and supply chain traceability on a global basis.

Animal disease traceability does not in itself prevent disease. But knowing the geo-location and movement path of diseased / vulnerable livestock helps emergency response actions contain the disease swiftly. It is more important to trace their owners, and hold them accountable to authorities to ensure maintenance of proper health standards and prevent the cause of the outbreak of disease. Said owners are fully responsible for control / mitigation of zoonotic disease, and liable to be charged with contributory negligence, if authorities so rule. The described system through its unique ID numbering system combined with facility to store key segmented data in Tabs, provides irrefutable trace-back of zoonotic disease to farm of origin, worldwide, making way for veterinary authorities to initiate rapid remedial action.

One country's neglect to implement a reliable livestock identification system could jeopardise the safety and well-being of large parts of the world by supply of disease-borne meat/ meat products, hence a globally harmonised and standardised system of livestock identification uniformly followed by all countries through legislative compulsion alone can provide reliable trace-back of livestock and products of animal origin to their farm of origin, thus enabling agro and food authorities to initiate rapid corrective action, in the event of a problem.

Governments of various progressive countries have made it mandatory / recommendatory to deploy optional forms of electronic identification of animals via radio frequency identification ear tags or subcutaneous micro chip implants. In the case of bovine stock, implanting ruminal boluses is being practiced in some countries. However, these devices lose their relevance when animals are sold to third parties, as many countries lack the procedure to document and statutorily record such change of ownership of tagged animals on a central database.

The offering of the described system is a high security identity card issued to each livestock owner which serves the primary function of irrefutably establishing the true ownership of livestock recording therein, and confirming and validating that each livestock described therein is genuinely owned by the person / entity recorded in the NLR and on the Card, without any doubt. This provides the operational basis for a modern, reliable and uniform livestock identity management system on a nationwide basis.

The described system is perhaps the world's first method of creating a unique and comprehensive methodology to assign unique an unalterable identification to various species

of livestock following a well-defined globally harmonised and unified approach to codify the identification practice relating to various species and to embrace hitherto unknown e-Governance practices using Smart ID Cards as the physical interface to access a country-centric Centralised Livestock Registry with manifold advantages and utilities.

The novel solution now described provides both a visual form of identity as well as a more elaborate electronic means of establishing the identity of both livestock and the owner(s) thereof, with all relevant livestock information, available both on-line and off-line.

By this method, an extremely reliable basis is created for issuance and electronic storage of various certifications / registrations to livestock owners of respective livestock in any species, by concerned Government Departments and other Agencies, linked to the single, new high-security Livestock ID & Ownership Card with its unique, 18-digit number.

This procedure imparts high value not only to the process of identity management but also in providing registration/permits/ services to livestock by various Provincial/State/Local Government authorities and other agencies, achieved through the extremely simple, harmonious, unified and fool proof approach of the described system.

As a result, the possibility of fake livestock certificates, spurious ID Cards, misrepresentation and data manipulation/falsification -- which are all so commonly witnessed today -- would cease to be of concern to authorities and prospective buyers of livestock, since the stringent operating environment and issuance procedure for ID Cards and Certifications / Permits to be followed under the new system would altogether preclude any manner of physical or electronic manipulation, tampering, malpractice or deceit at any stage, due largely to the stringent enrolment procedures laid down for both livestock as well as for their owners.

Identification and traceability systems that suit authorities and the private sector can be based on very different requirements, with complexities involving the conditions of trade in live animals *versus* products of animal origin. The described system helps to uniformly achieve both these needs in an efficient, reliable and seamless manner, avoiding the present divide seen in the two fields of identification. It also helps fully avoid the presently witnessed conflict between national livestock identification standards followed by developing versus advanced countries, which is currently jeopardizing the importation of animal products from developing countries by major developed nations. Consequently, experts now seek the development of uniform and reliable global animal identification and traceability systems, as

priorities for developing countries. This need is fully met by the present system, which thereby helps achieve a broader and fairer international trade of animals and animal products.

The 18-digit harmonized number on the Livestock ID Card issued to each livestock owner entity has universal application with global validity and recognition. This unique ID number is composed of various IGs (identifier groups) which, when juxtaposed, ensure that only one unique ID valid for life is allocated to each livestock owner /farm / commercial entity, serving as the key primary identifier at all times.

The methodology for deriving the numbers for each field is as described below in respect of the three principal Types of Livestock ID Cards:

- (1) Individual Livestock Ownership ID
- (2) Group Livestock and Farm ID
- (3) Livestock Commercial ID

Type 1: Individual Livestock Owner ID								
710	02	15	1	11525	01	90	1	
▼	▼	▼	▼	▼	▼	▼	▼	
Country ISO Code [3 digits]	Province Code [2 digits]	District Code [2 digits]	ID Card Type [1 digit]	Farmer Specific Code [5 digits]	Livestock * Species Code [2 digits]	Year of Commencement of Livestock Farming [2 digits]	Farmer Rating Code [1 digit]	
Type 2: Group Livestock and Farm ID								
710	08	10	2	1	5045	06	00	4
▼	▼	▼	▼	▼	▼	▼	▼	▼
Country ISO Code [3 digits]	Province Code [2 digits]	District Code [2 digits]	ID Card Type [1 digit]	Farm / Ranch Classification Code [1 digit]	Farm / Ranch Specific Code [4 digits]	Livestock Species Code [2 digits]	Year of Establishment of Farm [2 digits]	Quality and Reliability Assurance of Farm Rating Code [1 digit]
Type 3: Livestock Commercial ID								
710	03	05	3	3	0525	03	89	3
▼	▼	▼	▼	▼	▼	▼	▼	▼
Country ISO Code [3 digits]	Province Code [2 digits]	District Code [2 digits]	ID Card Type [1 digit]	Trader Classification Code [1 digit]	Trader Specific Code [4 digits]	Livestock Species Code [2 digits]	Year of Establishment of Trading House [2 digits]	Quality and Reliability Assurance of CE Rating Code [1 digit]

* Including other animals in this generic group

Where a given pastoralist or farm owns several species of livestock in a common location, they will receive separate ID Cards for each species, all having the same 18-digit ID Number, with only the Identifier Group relating to Livestock Species Code changing.

Where a given pastoralist or farm has animal agriculture operations involving the same species in farms situated at multiple locations in a given country, they will receive separate ID Cards for each location, having the same Farmer/ Farm ID Number, but with Identifier Groups relating to Province and District Code changing in accordance with the geo-location codes developed by the concerned LIDA.

In addition, a further novelty described by the described system is the Auxiliary Identification System (AIS) referred above, which presently comprises two Types of Supplementary ID Cards, viz., (1) the Livestock Linking ID Card and (2) the Herdsmen ID Card. In respect of these AIS Cards, the same number of the Main ID Card to which they pertain is reflected on them. The Livestock Linking ID Card is issued individually animal-wise to small and marginalised farmers, owners of bloodstock, domestic pets and prized/exotic species of stock. The Herdsmen ID Card is issued to all herdsmen working on a Farm. With minor change of nomenclature, this same Card is also issued to shepherds, kraal keepers, cowboys, ranch assistants and others employees in farms and feedlots, as well as in commercial establishments belonging to or serving the animal agriculture industry.

In all cases, this numbering system facilitates efficient administrative control as well as rapid analysis and review of wide range of data relating to various facets of livestock populace, apart from enabling rapid supply chain traceability and effective e-Governance of operational activity.

Reliable traceability solutions pre-suppose and depend entirely on the existence of a secure livestock identification system, without which, verification of livestock-related claims are nearly impossible to consider.

Interestingly, there is no systematic practice in most countries to record change of ownership of all principal species of livestock. This is evidenced by the prevailing age-old practice of handing over cattle and sheep / goat and other species from seller to buyer upon verbally concluding a sale at livestock fairs. The mere handing over of monetary consideration by the buyer to the seller transfers ownership of the traded livestock. These practices are

susceptible to legal flaws concerning true ownership, especially concerning second and subsequent ownership.

In advanced countries, the practice of issuing sale receipt is followed indicating the brand mark of the seller. This document is used by the buyer as the basis for affixing his brand mark on livestock subsequent to purchase, the said brand presumed as having already been registered with the concerned livestock authorities.

System Advantages, USPs

The described system offers (a) a single, comprehensive national level livestock and farm premises identity management solution interfaced with true ownership, inclusive of e-Governance functionalities, together with (b) matching solution to achieve global supply chain traceability relating to all products of animal origin – both capable of seamless performance when implemented on any scale.

IT PROVIDES:

1. Permanent, distinctive, tamper-proof electronic identity reference lifelong for all species of valuable livestock with complete life cycle record, with RFID device reference of each individual animal irrefutably referenced and linked to true ownership by means of one of three types of smart ID Livestock Ownership Cards, which are distinctively colour coded for each principal species, to facilitate instant visual recognition.
2. Permanent, distinctive, tamper-proof electronic identification and registration reference of all farm premises, feedlots and commercial entities involved in animal agriculture and its supply chain in any form or domain.
3. Real-time spatial data to authorities on any aspect of livestock, nationwide and globally.
4. Reliable support in animal healthcare planning and administration of farms and livestock production systems.
5. Prompt support in zoonotic disease management and countering bio-terrorism attempts.
6. Reliable basis for authorities to implement conservation projects in respect of rare breeds of livestock and endangered species.

7. Uniform global standards and practices for livestock identity management and supply chain traceability of products of animal origin -- both edible and non-edible – to achieve “*one world, one health*” goals.
8. Reliable, perpetual dynamic species-wise, geo-territory-wise census data with multitude sub-national datasets connected with animal agriculture and livestock administration for use by national and international bodies and statutory /developmental agencies.
9. Authentic official record of change of ownership of livestock, farms and commercial entities pertaining to the livestock industry.
10. Accurate official record of livestock insurance including claims and settlements.
11. Official record of lien on / pledge of livestock.
12. Official record of movement of livestock from one farm / zone to another and basis for issuance of e-Permits for transportation of livestock across any geo-territory as well as for export.
13. Reliable traceability of livestock from birth to harvest, and consequent accountability for meat quality and source of origin of meat, fibre, wool, fleece, hides, skins, feathers, horns and other animal co-products supporting robust supply chain management with validation of produce source.
14. Proof of geographic territory source indication of given livestock and products of animal origin.
15. Basis for efficient import-export management of livestock between countries. For example, if a beef importing country strict traceability as a pre-condition for allowing import, only products that comply and are easily verifiable would have access to such markets. In other countries which do not have such strict import rules, traceable products would always command a premium in prices over non-traceable beef supplies.
16. Support in rapid tracing of lost / stolen / missing livestock with or without GPS / GPRS interface.
17. Harmless identification of animals via RFID device implants, which are recovered at slaughter (for harvested animals), hence will not pass down in the food chain; consequently, no harm is caused to consumers either. Where animals are exported, the

same RFID device shall continue to remain in the anatomy of the animal, after entering the importing country.

18. Efficient herd management including identification and recordal of key data of herdsman.
19. Valuable assistance to countries exporting products of animal origin -- both edible and non-edible -- to gain entry in to valuable international markets and seek premium prices; conversely, prevents unjustified trade barriers imposed on countries not adopting such modern livestock identification systems.
20. Option to utilise only the supply chain traceability function of products of animal origin, without implementing the individual animal identification part, for tracing source farm appurtenant to supply of, for example, honey, eggs, poultry, fish and the like.
21. Efficient livestock management including breeding practices.
22. An effective system for barring livestock sans electronic identification from entering the food chain pathway, as this will majorly help prevent transmission of zoonotic diseases, likely in the absence of certified health standards assured by following the system herein described.
23. A readymade system to assist in livestock auction traceability by enhancing traceability capabilities at high-risk, high through-put sites where animals from different source farms co-mingle, example, at livestock fairs, auction yards, stock yards, transit warehouses.
24. Improved brand management of livestock and products of animal origin.
25. Record of crime related to livestock and redressal actions by law enforcement agencies.
26. Permanent, tamper-proof storage of all Certificates pertaining to livestock in electronic format, such as birth certificate, breed/ pedigree certificate, change of ownership certificate, special attainments certificate, *halal* certificate, harvesting certificate, termination certificate, death certificate, etc
27. A smart card based identity management system for livestock and farms etc which constitutes a reliable basis to usher e-Governance programmes, as it is directly linked to

a National Livestock Registry which contains all relevant particulars of each livestock owner, farm and commercial entity.

28. System of alerts created on the National Livestock Registry of a given country which record lost, stolen and missing animals; livestock, farms or feedlots which are notified as disease-borne or disease-prone; defaulting or black-listed farms and commercial entities in the animal agriculture supply chain; quarantined farms/zones within a given magisterial district.
29. Reliable basis for delivering welfare measures and social benefits by various Government departments and private agencies directed at only genuine and approved recipients, eliminating fraud, misrepresentation of identities of livestock or their owners.
30. Ready means of curbing livestock rustling and detecting illegal transportation of livestock within any jurisdiction and particularly in border areas and 'hot spots' to check / curb illegal crossing-over of rustled livestock, including tracing and investigating rustling perpetrated or abetted by farm 'insiders'.
31. Harmonised codification provides reliable supply chain traceability of all products of animal origin on a global basis, with rapid trace-back of any edible (meat and dairy) or non-edible product to its originating farm as well as processing sources following human readable codes, avoiding the complex machine readable codes presently followed in the EU, for example, under EAN 128, which are of little use to end customers in a super market.
32. A reliable and cost-effective auxiliary identity documentation system for all species of animals linked to lawful ownership, which is vastly superior on all counts to paper book passports currently used in many countries.
33. Safeguard against low literacy levels of pastoralists and tribal populace in developing countries does not in any way diminish the utility or operating efficiency of the ID System.
34. Facility for deactivation of ID Card to deny errant / delinquent / defaulting livestock and farm owners from accessing livestock welfare services, fiscal subsidies, bank loans etc.

The described system when deployed as a national level programme fosters discipline among livestock owners, ensures prompt compliance with laid down rules pertaining to

livestock, curbs livestock theft, facilitates effective macro-policy formulation, enables efficient governance of livestock populace species-wise by various government and concerned non-government agencies, significantly improves livestock breeding, production systems and health management practices, assists in livestock disease management -- in a manner that preponderates all known practices in this behalf.

System Utility

- Introduces a globally pioneering concept in livestock identity management with unprecedented functionalities and benefits
- Provides transformational solutions based on novel concepts expected to provide extraordinary value to all stake-holders
- Offers comprehensive system comprising three critically-related components seamlessly integrated to deliver One Solution worldwide -- fulfils vision and mission of global bodies such as OIE, CAC and ICAR
- Recognises livestock as invaluable national resource -- seeks to protect and promote their welfare and bring sustained all-round benefit to animal agriculture industry
- Caters to the I & R and Traceability needs of both developed and developing countries

A. IDENTIFICATION OF LIVESTOCK AND FARM PREMISES,

NATIONAL LIVESTOCK REGISTRY [NLR]

1. World's first technology-driven system for global livestock identification and traceability based on proprietary concepts which are capable of fulfilling all present and emerging needs of stock owners and authorities
2. Provides globally uniform, harmonized system for electronic identification of
 - Livestock with correlation to their owners, for all stock holding sizes
 - Farms, feedlots and all other livestock related establishments in all ownership forms
 - Commercial operators and entities engaged in animal agriculture and livestock processing industry with single identity reference valid for life

3. Covers all valuable species of terrestrial stock and all forms of ownership under mandatory enrolment programme in each country
4. Delivers systematic, scientifically derived livestock-owner centric ID numbering system for all countries, independent of animal RFID device code numbers but directly correlated to them
5. Envisages certification, inventory control, issuance of RFID devices by appropriate government livestock authorities, administered in co-operation with veterinary authorities, simultaneously creating link to owner's ID on National Livestock Registry
6. All key life-cycle data relating to livestock and their owners stored on NLR in specially designed Tabs, and selectively ported to chip of ID Smart Card. Example: provides reliable age and health proof of each individual animal
7. Provides livestock ownership ID smart cards to all pastoralists, farms, feedlots and other establishments and linked to National Livestock Registry of each country
8. Under the Auxiliary Identification System [AIS] corresponding Linking ID Cards as well as Herdsman ID Cards are issued to bolster animal safety and deter rustling
9. Fulfils both private and official livestock identification needs with equal facility
10. Obviates all conventional methods of ID such as branding, tattooing, etc.
11. Project excludes identification of individual non-terrestrial species [*example: avian, aquatic*] and terrestrial species with low unit monetary value [*example: poultry*], being either not practically achievable or not economically viable.

B. LIVESTOCK ADMINISTRATION, HEALTH AND SAFETY, ANIMAL AGRICULTURE INDUSTRY–INTERFACE, E-GOVERNANCE

1. Introduces world's first e-Governance-enabled NLR with over 20 distinct data segments held in electronic format
2. Provides superior administrative control and developmental oversight of species-wise livestock to authorities in each country / province
3. Facilitates livestock movement control

4. Facilitates livestock performance and yield recording
5. Tab system provides for stringent health verification and export clearance certification prior to sale of livestock and products of animal origin, includes provision for recording DNA profile
6. Enables facile data exchange between NLRs of various countries via common protocol and standards
7. Facilitates global animal agriculture metadata flow online to world bodies
8. Compatible for interface with all farm management software packages
9. Operational efficiency of Identification System not affected by low literacy levels in developing countries
10. Enables progressive shift to paperless regime in animal agriculture administration
11. No stake-holder's interests are adversely affected.

C. SUPPLY CHAIN TRACEABILITY

1. Creates globally uniform system for rapid traceability of both livestock as well as edible & non-edible products of animal origin
2. Establishes true 'Farm to Fork' traceability with human readable twin trace codes of farm of origin + commercial entity engaged in livestock processing with facility for rapid online verification by wholesale and retail customers
3. Fulfils all statutory directives by authorities in various countries concerning livestock identification and traceability -- issued, proposed or planned -- concerning animal health and food safety
4. Traceability system designed to cover both domestic sales as well as export sales of livestock and all products of animal origin
5. Traceability helps monitor consumer preferences for products based on originating geographic indication
6. Only the traceability function of the system can be activated to ascertain farm of origin of, for example, honey, eggs, poultry, fish, seafood and the like, without involving the ID aspect. This is a unique advantage to inspecting officials as well as customers.

System Novelty

The described system seeks to introduce a wide range of novelties to the animal agriculture industry.

A. IDENTIFICATION AND NATIONAL LIVESTOCK REGISTRY

1. Creation of new Livestock Identification Authority [under Dept of Agriculture] in each country, suitably empowered by law to implement and oversee codified ID system
2. Creation of uniform National Livestock Registries worldwide owned and operated by respective governments operating on secure Oracle database, using principal official language(s) of each country
3. Creation of livestock owner-centric ID system electronically correlated to individual and group livestock I & R System verifiable from any geo-location, as opposed to present systems which merely seek to identify individual animals via RFID Devices
4. Establishment of country-wide Livestock Identification Centres (LICs) [Govt-owned but operated as PPP] to complete enrolment procedures for owners and their stock, with adjunct Veterinary services to administer RFID devices and assist stock owners in animal healthcare, recording sale of stock, issuing certificates, livestock transportation e-Permits, etc
5. ISO 7816 compliant secure ID Smart Cards linked to central database provide irrefutable proof of stock ownership at any given time
6. Creation of system to identify single / groups of animals in relation to their lawful owners whose ID is also recorded -- enduring identity preservation
7. Coverage of all valuable terrestrial species of livestock and beyond under uniform ID System – whether farm-based, domestic or otherwise
8. Coverage of farms, feedlots and all commercial establishments involved in processing livestock or engaged in the animal agriculture industry under uniform ID system

9. Effective replacement for (i) paper book animal passports and (ii) ownership documents presently issued by authorities and species-wise associations
10. Canine and feline species are not livestock, yet they are included under this ID Scheme to (i) provide administrative and health control to authorities (ii) provide benefits of uniform ID System to owners and (iii) to help deter theft and trace lost / stolen animals
11. Greatly mitigates livestock ownership disputes amongst tribals / pastoralists in certain countries
12. ID System represents a powerful tool to assist in protection and promotion of animal and human health
13. All ID Cards operate online/offline and have near field communication [NFC] capability
14. World's first system of classifying farms and commercial operators based on the quality standards and reliability of their products and processes – reflected by the last digit of the 18–digit ID Card Numbering System
15. Numbering System ideally fulfils needs of AIN, PIN, FIN, GIN, LID, etc. being planned for introduction, for example, by APHIS in the US
16. System expected to create pride of ownership of new ID Cards, especially among pastoralists and small farming communities
17. Same ID card serves as reliable identity proof of pastoralists etc for other applications as they are issued after thorough verification and contain owner's biometric data [optional feature]

B. ADMINISTRATIVE CONTROL AND e-GOVERNANCE

1. Single ID Reference with globally unique and readily distinguishable country-specific 18-digit ID Number valid for life of each livestock-owning entity, used for all purposes and applications

2. ID Smart Card is the crucial interface linking the animal's RFID device ID to the owner's ID under the Livestock Identification Programme, and reflected online in the electronic National Livestock Registry records of each country
3. Since owners – not livestock -- comply with laws and regulations, the ID system with convergence of livestock identity with owner's identity now described ensures responsible conduct and better accountability by owners
4. Since subsidies and fiscal incentives are granted and paid to pastoralists and farm owners -- not to livestock -- the authentic identity of former established by this System -- with the latter's identity being correlated thereto -- precludes fraudulent claims
5. Creates reliable basis for insurance and banking industry to serve the animal agriculture sector, mitigating risk
6. Only RFID devices can work as official identification of animals moving inter-State. Branding marks cannot as, for example, in the US, 36 States do not have brand inspection authorities, hence brand listing not possible
7. System designed to create serious barriers to livestock rustling and illegal transportation / trading in stolen stock
8. Traceability based on a good animal and premise ID system as proposed does not in itself assure food safety, product quality or prevention of animal disease. It only provides a reliable dataflow path to support these goals
9. Merely tracing animals in case of disease outbreak not sufficient. Tracing their owners rapidly is more important to fix responsibility and to hold them accountable to authorities. Being an owner-centric identification system, the ID numbering methodology enables just that, regardless of change of ownership or country of origin
10. Unique geo-territory based numbering system provides effective tool to rapidly trace-back and isolate source farm and / or processing plant of affected stock and contain spread of disease; and to place embargo on livestock and meat supplies

from countries / provinces / specific farms or abattoirs reportedly facing livestock disease or contamination, from entering the food chain. This is hardly possible with individual animal RFID device numbers

11. System absorbs existing and conventional ID practices of various countries. Facile migration of all existing, species-wise databases to new National Livestock Registry enabled
12. The needs of national bio-security, livestock data security and stringent livestock health administration dictate that (mandatory) Livestock ID Systems + NLRs must always be government owned and operated

C. TRACEABILITY

1. Traceability solutions now described cover
 - (a) animal health: for trace-back of disease
 - (b) food safety for trace-back of source of defective meat supply and
 - (c) geographic indication of valuable non-edible products of animal origin to validate sellers' claims
2. Recognises that owner-centric traceability of livestock movement is more important to pin responsibility and initiate disease control actions
3. Provides simple yet reliable traceability links for each stage of animal life-cycle from birth until harvest
4. Providing human and machine readable codes for rapid worldwide traceability of products of animal origin – edible and non-edible – to farm of origin + processing establishment
5. Tabs provide ready traceability of IDs of individual animals at (i) farm of birth (ii) feedlot (iii) sale-yards (iv) abattoirs (v) cutting halls
6. Traceability links lead to source farm of group animals in a batch, not to individual animals. When beef is processed and packed on high speed flow-line machines, source farm / feedlot IDs are relevant

7. However, given batch code on label of packaged beef, for example, will disclose complete data of individual animals comprising the group + ID No. of each operator in the supply chain, up to the retailer
8. Similar trace-back capability now provided for non-edible products as well.
9. Provides reliable audit trail and measurable performance criteria to gauge significant benefits of new system
10. Project transcends CAC Vision by also covering non-edible products of animal origin with equal efficiency
11. Helps fix product liability with precision and speed any where in the supply chain. No longer possible to dodge onus in event of faulty supplies. Helps rapid product recall and issuance of advisory to concerned
12. Fulfils objectives and needs of both private and public traceability
13. Even good traceability systems do not *per se* assure higher end product quality / safety. They only provides reliable dataflow linkage
14. For traceability systems to impact quality and reliability of end products, they must be associated with stringent QA and operating standards applicable uniformly worldwide to all farms and operators, drawn up by appropriate authorities [Ex. CAC in co-operation with ISO]
15. The last digit of the 18-digit ID Number relating to Group Livestock and Farms as well as CEs engaged in processing livestock, does exactly this by providing official Q & R rating
16. GPS interface to Trace Codes is possible and recommended for progressive deployment.
17. Multiple Needs – One Cost-effective Solution. Uniform worldwide.

The deployment of ID Smart Cards -- incorporating the unique 18-digit harmonised identity number -- to establish livestock ownership is critically essential (a) at the physical level, to officially validate and prove livestock ownership / farm identity; and (b) at the operational level, to access and transact with the concerned e-file in the electronic national livestock registry, where the ID smart card serves as the indispensable functional interface.

Without the vital medium of the said cards and numbers issued to livestock owners, farm premises and commercial operators engaged in the animal agriculture industry, neither (a) nor (b) above can be achieved with comparable ease, speed and accuracy.

For governments in various countries desirous of seriously implementing national livestock identification programmes, the suasive compulsion for pastoralists, farm owners and commercial operators to embrace mandatory livestock and farm premise identification is achieved by legislative provisions which require that the new, globally-harmonised ID number shall henceforth be compulsorily quoted by those engaged in animal agriculture, to

- 1 secure farm subsidies from government
- 2 secure banking support
- 3 secure livestock / farm insurance or seek claim settlement
- 4 obtain livestock movement permits
- 5 record sale / purchase of livestock or farms in the national livestock registry
- 6 renew / obtain fresh membership in species-wise livestock associations
- 7 secure livestock related certificates including export clearance
- 8 register stock theft or loss complaints with law enforcement agencies

The Valuable Multiple Roles of Livestock Identification Centres (LICs) -- a world-first concept -- covering 22 important and valuable roles and functions fulfilled by them, in any given country is a noteworthy innovation of the described system. Role examples include regulated issuance of RFID Devices for livestock, enrolment of livestock and their owners to the national livestock identification programme, issuance of livestock ownership ID Smart Cards, creating and supporting operation of national livestock registry database, registering change of ownership of livestock, assisting revenue authorities in collection of farm taxes and other fees, issuance of various certificates relating to livestock, issuance of movement e-permits for livestock including export certification, initialising livestock health and welfare programmes, issuance of public alerts in case of animal disease outbreak, overseeing livestock administration, and so on.

Figures and Tables

These may kindly be reviewed in the Power Point Presentation with the same Title submitted by this Author, available on the ICAR website. Drawings are not shown in this Paper to avoid repetition.

List of References

None

Abbreviations Used

AIN	Animal Identification Number
AIS	Animal Identification System
APHIS	Animal and Plant Health Inspection Service
BSE	Bovine Spongiform Encephalopathy
CAC	Codex Alimentarius Commission
CE	Commercial Entity
DNA	Deoxyribo Nucleic Acid
EAN	European Article Numbering
UCC	Uniform Code Council
GPS	Global Positioning System
GPRS	General Packet Radio Service
ICAR	International Committee for Animal Recording
IDT	Identification and Traceability
IG	Identifier Group
I&R	Identification and Registration
ISO	International Standards Organisation
L2G	Livestock to Government / G2L Govt to Livestock
LIC	Livestock Identification Centre
LIDA	Livestock IDentification Authority
MRD	Machine Readable Document
NFC	Near Field Communication
NLR	National Livestock Registry
OIE	Office International des Epizooties nka World Organisation for Animal Health
OTC	Over The Counter

PIN	Premises Identification Number
QA	Quality Assurance
Q&R	Quality and Reliability
RFID	Radio Frequency Identification
SCT	Supply Chain Traceability
USP	Unique Selling Proposition

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Non-solicitation

This Paper is intended to present globally-pioneering livestock identification and traceability concepts, ideas and solutions originally developed by the Author, to bring awareness of their features, benefits and value to readers and concerned authorities worldwide. Accordingly, it is not a business solicitation, and no commercial intent is implied by the contents of this Paper.

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