Digital Agriculture Project

(Toward Digital Climate Smart Agriculture Project)

Climate Change, Agriculture and Food Security (CCAFS)

Consortium of International Agriculture Research Center (CGIAR)

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Outcomes Harvesting

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Acronyms

UN: United Nations

ICESI: University in Colombia

ITA-Buga: Technical Agricultural Institute

CIMMYT: International Corn and Wheat Improvement Center, Mexico

Fedearroz: National Federation of Rice Growers, Colombia

Fenalce: National Federation of Cereal Growers

UNC-Palmira: National University of Colombia

Asohofrucol: Horticultural Association of Colombia

R+D+I: Research, Development, and Innovation

INTA-Ar: National Institute of Agricultural Technology of Argentina

INTA-NI: National Institute of Agricultural Technology of Nicaragua

"Agriculture and extension are going to change with technologies. This will have an impact for farming families to have new tools that help them improve and prepare in time for what comes with climate change." Fenalce.

Presentation.

The Digital Agriculture Project is one of the CCAFS initiatives. It was born in 2013 and has had 2 execution periods (2013-2017 and 2018-2021). The project works in Climate-Smart Agriculture, its first period develops projects in Climate-Site-Specific Management Systems (CSMS).

Quickly, after about 2 years, the focus on climate-smart agriculture is strengthened by expanding its scope of work digitally. At that point, it begins to be recognized as the Data Mining Project. Then, when the second phase began, it started to be called the Digital Agriculture Project, to address the adaptation and mitigation of climate change.

The Project is defined as a research initiative for development, as proposed by its director: "We are talking about democratizing technology in the region." The central team of the project has had as its goal the development of a digital agriculture centered on the Latin American region. The Project has focused on strengthening the use of data and digital tools for climate-smart agriculture and on developing capacities in professionals, technicians, and institutions of the agricultural sector in Latin America.

Based on this work, a network of partners and allies in the Latin American region and internationally has been built. For example, processes have been developed with union groups such as Asohofrucol, Fenalce, Fedearroz in Colombia, with various partners from the Latin American Irrigation Rice Fund in different countries of the region or with other CIAT research centers such as CIMMYT.

The project has achieved several very important recognitions that have contributed to position the Digital Agriculture Project and its work team as a relevant, rigorous, and quality actor in data mining work for agriculture. Among those, there is the first place in 2014 of the UN-ICTs climate change data mining award for small-scale farmers in Latin America awarded by the United Nations Framework Convention on Climate Change in 2017, in 2018 the first SYNGENTA place on data analytics, and the INFORMS Innovative Applications in Analytics award in 2020.

The Digital Agriculture Project has had several phases in its growth process. In its first years between 2010 and 2013, it went through a period of creating credibility and conviction about the importance of working on the issue of data mining for agriculture, in addition to building the first institutional alliances. In the period from 2014 to 2017, work is carried out mainly in Colombia and from the end of 2017 until now, the work of the project has been internationalized mainly to the Latin American region.

This document presents the results of the evaluation of the Digital Agriculture Project carried out in the second half of 2021. It is divided into a first methodological chapter where it is explained how the Outcomes harvesting was prepared, a second chapter with the results, and a third chapter with conclusions and recommendations. In addition, the most important supporting documents can be found in the annexes.

Chapter 1

Methodological Approach

This analysis of the CCAFS-CGIAR Digital Agriculture Project is carried out through the Outcomes Harvesting approach [1]. This is an approach that values projects that are developed in complex contexts and is aimed at understanding the great transformations generated by action. A short description of the World Bank can help to understand this approach.

> *"Outcome Harvesting is used to identify, monitor, and learn from changes in social actors, through harvesting bites of detailed outcome information with colleagues, partners, stakeholders. The information described what changes for whom, why it matters to the development objectives -the significance of change-and how the program contributed to the change.*
>
> *Outcome Harvesting is useful for complex aspects of a program when the significance of particular milestones and outcomes may be unknown in advance. There is often a need for learning to understand how the change happened.*
>
> *The harvesting process is stakeholders-centered and captures qualitative, tacit knowledge. It includes tools to substantiate this knowledge collaboratively and communicate progress toward impact to clients, management, and partners. The tools are flexible to adapt to a program´s design and ca provide useful details to inform the theory of change, implementation lessons, outcomes, and indicators."*[2]

"Scope" is understood as the observable changes of individuals, communities, organizations, or institutions that have modified their actions, agendas, relationships, policies, practices of one or more actors in the context where the Program is developed. For this reason, in order to work with this approach, it is essential to access all the information, documentation, people, and actors that allow us to understand the changes produced.

A summary of the methodological steps is as follows.

1. The scoping harvest process is developed using the basic instrument that is proposed by this approach.

When did the change occur?	Whom did it change for?	What changed?	Why is the change important?	How did the Project contribute to the change?	Sources (remain anonymous)

[1] Wilson Grau, 2019
[2] World Bank, 2014

In 1 or 2 sentences, it is described when the change happened, what changed, to whom the change happened, related to participating in the Digital Agriculture Project.	In 1 or 2 sentences, it is described why this identified change is important for the strengthening of digital agriculture in the region.	In 1-2 sentences, it is described how the Digital Farming Project contributed to the change.	Finally, the source of the identified change is indicated.

For the Outcomes Harvesting, documents and distance interviews have been used. From the first analysis of interviews, the first version of the harvest is obtained. In a first round of harvests, 120 evidences of change were identified from 22 interviews (see Annex 2), which were achieved in the shared management between the Project team and the consultant.

2. **Analysis of the first harvest**: The evidence of change is in the results table from the harvest (Annex 1) and it begins to verify which ones refer to the same type of change, which are complemented to try to specify the change produced as much as possible and eliminate repetitions. The result of this first review was 90 evidences of change.

3. **Scoping verification**: This means that the claims that have been identified must be confirmed and triangulated in different ways: either that there are different sources that reach the same scope, or that some scopes are similar, or that there are duplicates. All scopes must be verified. In case of doubt, they are eliminated or sent for corroboration with the Project stakeholders. At the end of this process, 65 evidences of change were confirmed - of the 90 originally collected - this is found in a document in Annex 1.

4. **Identification of changes**: In the next methodological step, the evidence is organized in the scope line, which allows a timeline analysis to be made, to see the behavior over the years and, in addition, it is identified according to the type of scope or change: input, milestone, behavior or structural change. Combining both aspects, the scope line is made.

5. **Identification of the major areas of transformation that emerge**: In this fifth methodological step, the scopes are grouped by large areas of transformation. In this case, in the scope line, the evidence that were grouped into 4 transformation areas were identified by color.

6. **Analysis of the large areas of transformation**: Subsequently, the evidence from each of the transformation areas has been grouped to identify which changes occurred. These grouped changes constitute strategies generated by the Project that contributed to the transformation taking place.

7. **Construction of the theory of change**: The main outcome expected from the Outcomes Harvesting approach is to understand how the Digital Agriculture Project is driving change. Which is why the Theory of Change is emerging based on the evidence collected in the field. With this Theory of Change, it is possible to understand the contribution that the Project is making to the Development Objective that it contributes to promote.

   The following chapter shows the results of the Outcomes Harvesting of the Digital Agriculture Project.

Chapter 2

Results and Analysis of the Outcomes Harvesting

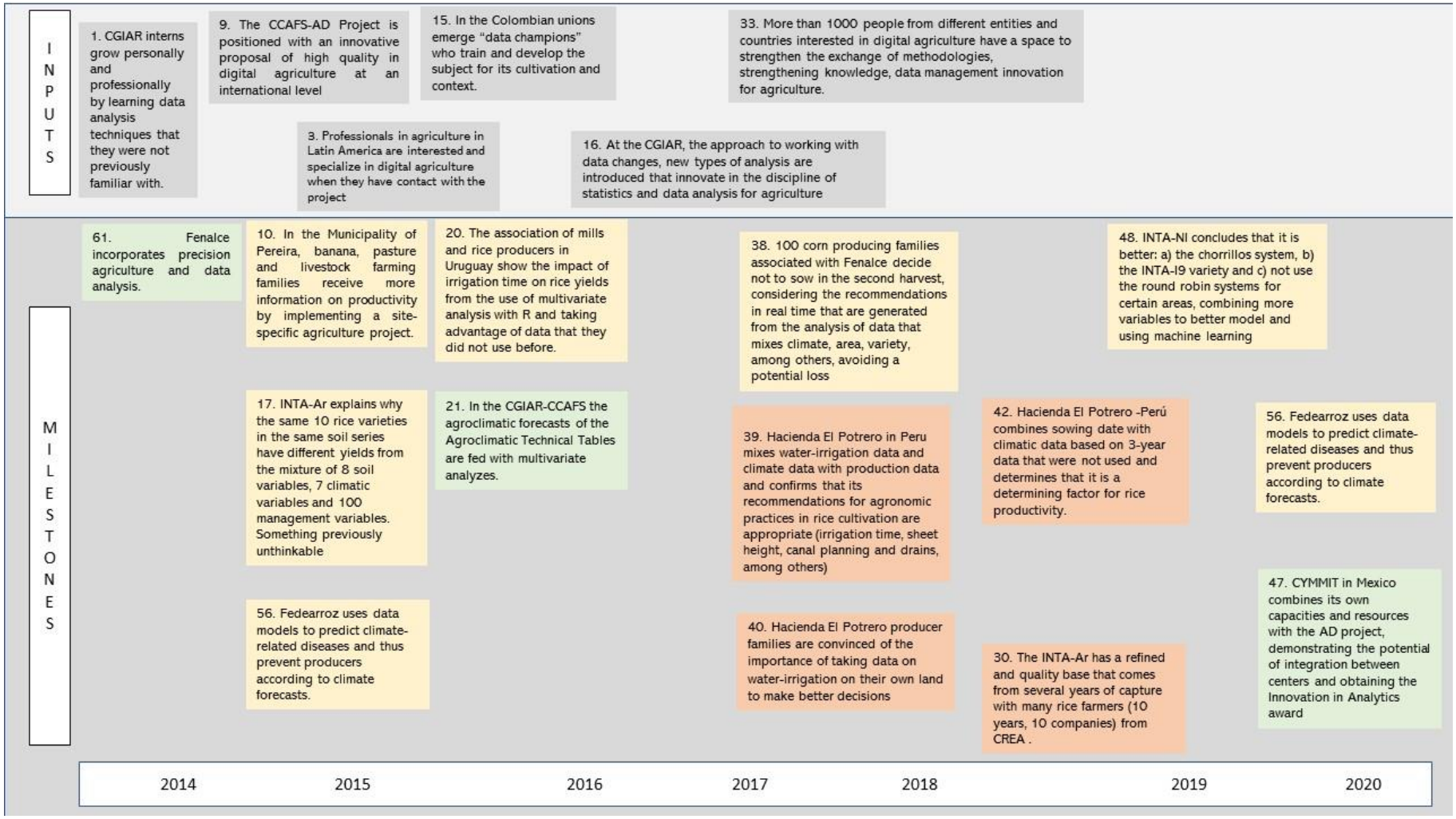
2.1 The scope of the Digital Agriculture Project.

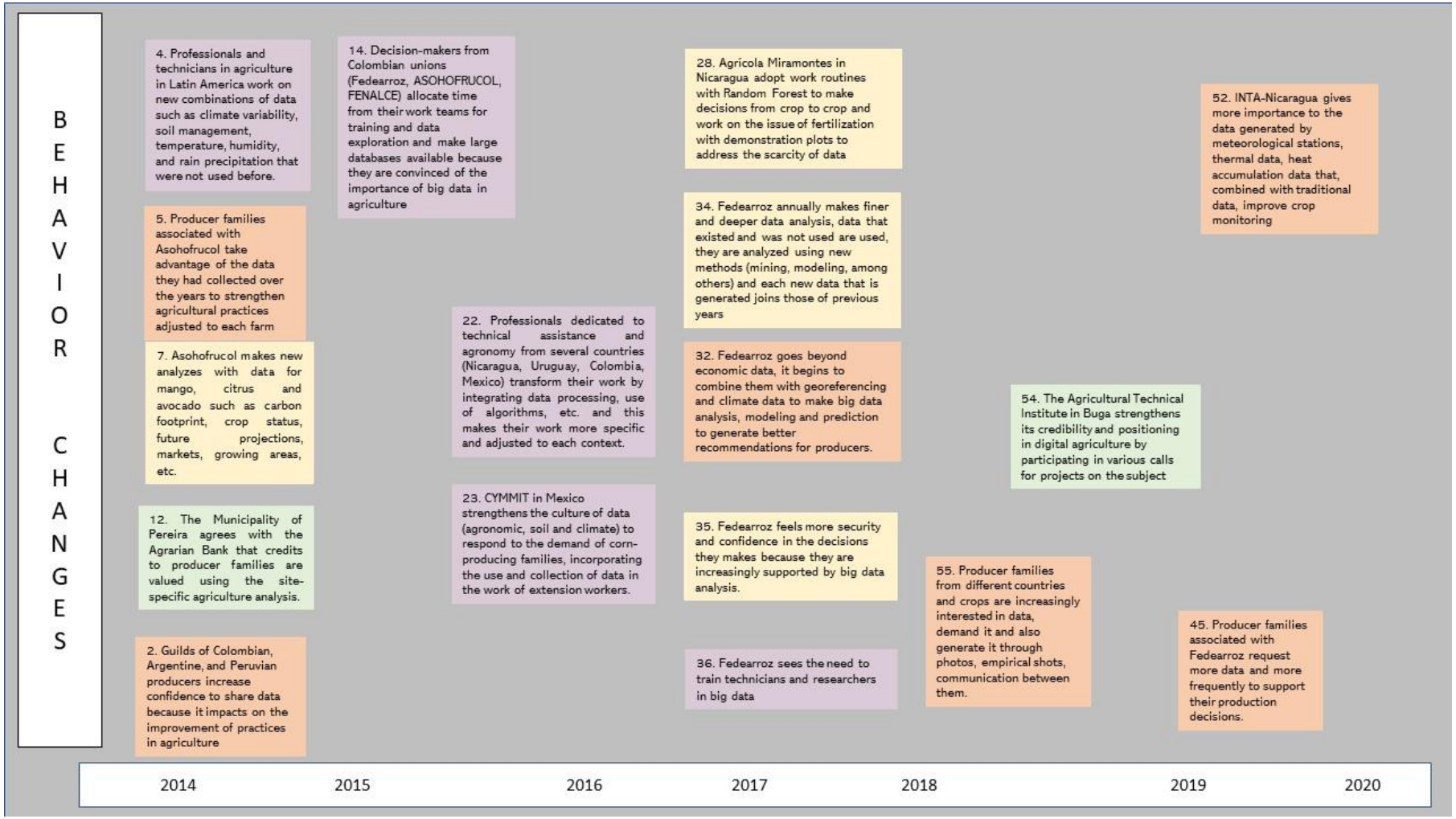
Once the final harvest has been prepared following the steps indicated in the previous chapter, the analysis of what emerged is carried out. A first analysis is made from what is called the Scope Line, which allows to visualize the evidence of the transformations generated by the execution of the Project in a timeline and from 4 types of changes:

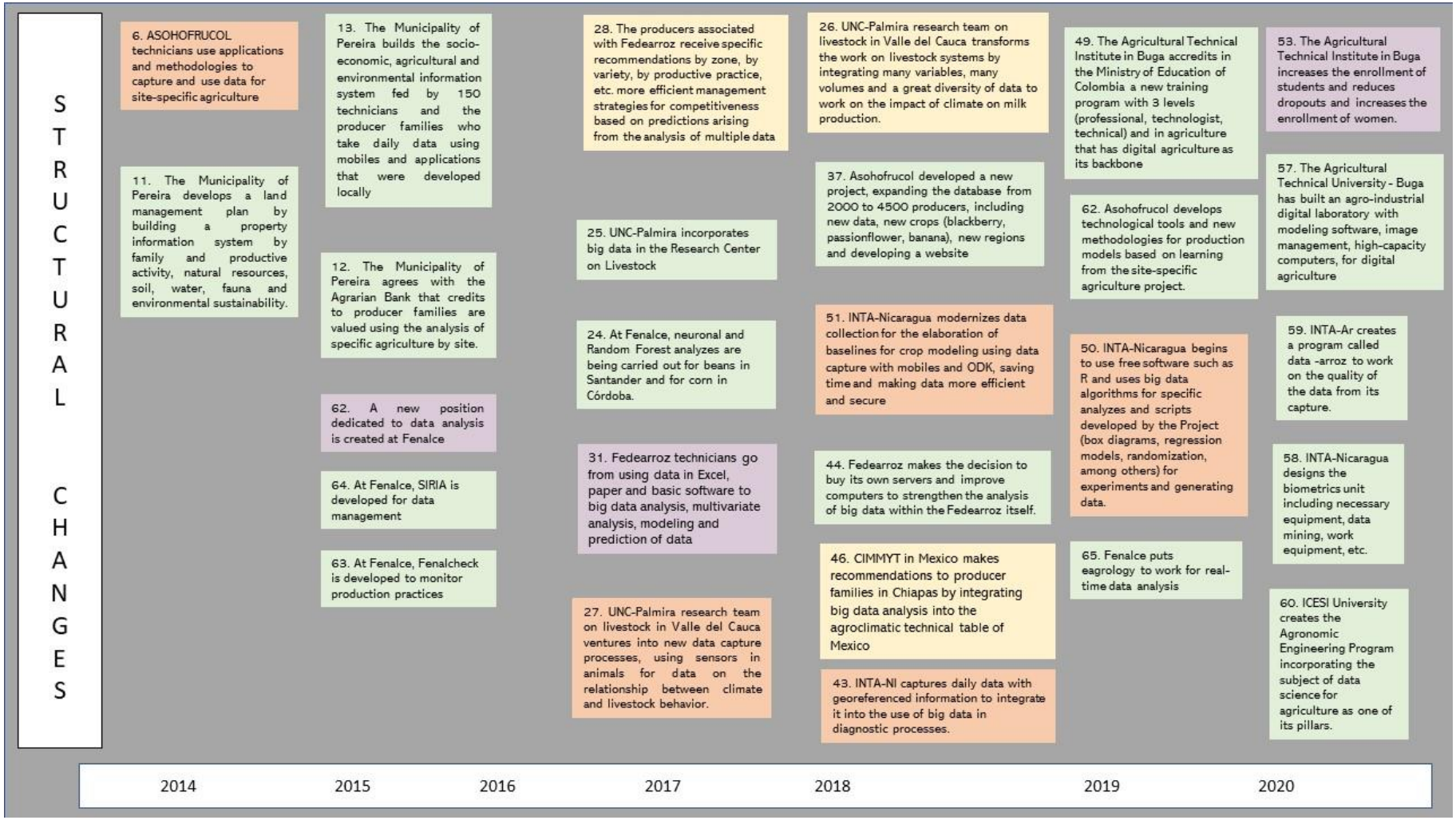
a. Inputs: these are first-level changes that are supported by all the transformations that are generated.
b. Milestones: These are changes that represent a turning point or key point, but do not necessarily remain over time.
c. Behavioral changes: These are very important changes because they involve modifications in the ways of thinking and approaching a problem. They refer to changes in attitudes and practices.
d. Structural changes: These changes are fundamental because they imply a long-term transformation since it refers to changes in processes, infrastructures, projects, programs, among others.

Graph 1 below shows the line of achievements (in 3 pages due to the difficulty of integrating all the evidence in a single table).

Graph 1: Scopes Line
Own elaboration from the Outcomes Harvesting




BEHAVIOR CHANGES
4. Professionals and technicians in agriculture in Latin America work on new combinations of data such as climate variability, soil management, temperature, humidity, and rain precipitation that were not used before.
5. Producer families associated with Asohofrucol take advantage of the data they had collected over the years to strengthen agricultural practices adjusted to each farm
7. Asohofrucol makes new analyzes with data for mango, citrus and avocado such as carbon footprint, crop status, future projections, markets, growing areas, etc.
12. The Municipality of Pereira agrees with the Agrarian Bank that credits to producer families are valued using the site-specific agriculture analysis.
2. Guilds of Colombian, Argentine, and Peruvian producers increase confidence to share data because it impacts on the improvement of practices in agriculture
14. Decision-makers from Colombian unions (Fedearroz, ASOHOFRUCOL, FENALCE) allocate time from their work teams for training and data exploration and make large databases available because they are convinced of the importance of big data in agriculture
22. Professionals dedicated to technical assistance and agronomy from several countries (Nicaragua, Uruguay, Colombia, Mexico) transform their work by integrating data processing, use of algorithms, etc. and this makes their work more specific and adjusted to each context.
23. CYMMIT in Mexico strengthens the culture of data (agronomic, soil and climate) to respond to the demand of corn-producing families, incorporating the use and collection of data in the work of extension workers.
28. Agrícola Miramontes in Nicaragua adopt work routines with Random Forest to make decisions from crop to crop and work on the issue of fertilization with demonstration plots to address the scarcity of data
34. Fedearroz annually makes finer and deeper data analysis, data that existed and was not used are used, they are analyzed using new methods (mining, modeling, among others) and each new data that is generated joins those of previous years
32. Fedearroz goes beyond economic data, it begins to combine them with georeferencing and climate data to make big data analysis, modeling and prediction to generate better recommendations for producers.
35. Fedearroz feels more security and confidence in the decisions they makes because they are increasingly supported by big data analysis.
36. Fedearroz sees the need to train technicians and researchers in big data
52. INTA-Nicaragua gives more importance to the data generated by meteorological stations, thermal data, heat accumulation data that, combined with traditional data, improve crop monitoring
54. The Agricultural Technical Institute in Buga strengthens its credibility and positioning in digital agriculture by participating in various calls for projects on the subject
55. Producer families from different countries and crops are increasingly interested in data, demand it and also generate it through photos, empirical shots, communication between them.
45. Producer families associated with Fedearroz request more data and more frequently to support their production decisions.
2014
2015
2016
2017
2018
2019
2020


STRUCTURAL CHANGES
6. ASOHOFRUCOL technicians use applications and methodologies to capture and use data for site-specific agriculture
11. The Municipality of Pereira develops a land management plan by building a property information system by family and productive activity, natural resources, soil, water, fauna and environmental sustainability.
13. The Municipality of Pereira builds the socio-economic, agricultural and environmental information system fed by 150 technicians and the producer families who take daily data using mobiles and applications that were developed locally
12. The Municipality of Pereira agrees with the Agrarian Bank that credits to producer families are valued using the analysis of specific agriculture by site.
62. A new position dedicated to data analysis is created at Fenalce
64. At Fenalce, SIRIA is developed for data management
63. At Fenalce, Fenalcheck is developed to monitor production practices
28. The producers associated with Fedearroz receive specific recommendations by zone, by variety, by productive practice, etc. more efficient management strategies for competitiveness based on predictions arising from the analysis of multiple data
25. UNC-Palmira incorporates big data in the Research Center on Livestock
24. At Fenalce, neuronal and Random Forest analyzes are being carried out for beans in Santander and for corn in Córdoba.
31. Fedearroz technicians go from using data in Excel, paper and basic software to big data analysis, multivariate analysis, modeling and prediction of data
27. UNC-Palmira research team on livestock in Valle del Cauca ventures into new data capture processes, using sensors in animals for data on the relationship between climate and livestock behavior.
26. UNC-Palmira research team on livestock in Valle del Cauca transforms the work on livestock systems by integrating many variables, many volumes and a great diversity of data to work on the impact of climate on milk production.
37. Asohofrucol developed a new project, expanding the database from 2000 to 4500 producers, including new data, new crops (blackberry, passionflower, banana), new regions and developing a website
51. INTA-Nicaragua modernizes data collection for the elaboration of baselines for crop modeling using data capture with mobiles and ODK, saving time and making data more efficient and secure
44. Fedearroz makes the decision to buy its own servers and improve computers to strengthen the analysis of big data within the Fedearroz itself.
46. CIMMYT in Mexico makes recommendations to producer families in Chiapas by integrating big data analysis into the agroclimatic technical table of Mexico
43. INTA-NI captures daily data with georeferenced information to integrate it into the use of big data in diagnostic processes.
49. The Agricultural Technical Institute in Buga accredits in the Ministry of Education of Colombia a new training program with 3 levels (professional, technologist, technical) and in agriculture that has digital agriculture as its backbone
62. Asohofrucol develops technological tools and new methodologies for production models based on learning from the site-specific agriculture project.
50. INTA-Nicaragua begins to use free software such as R and uses big data algorithms for specific analyzes and scripts developed by the Project (box diagrams, regression models, randomization, among others) for experiments and generating data.
65. Fenalce puts eagrology to work for real-time data analysis
53. The Agricultural Technical Institute in Buga increases the enrollment of students and reduces dropouts and increases the enrollment of women.
57. The Agricultural Technical University - Buga has built an agro-industrial digital laboratory with modeling software, image management, high-capacity computers, for digital agriculture
59. INTA-Ar creates a program called data -arroz to work on the quality of the data from its capture.
58. INTA-Nicaragua designs the biometrics unit including necessary equipment, data mining, work equipment, etc.
60. ICESI University creates the Agronomic Engineering Program incorporating the subject of data science for agriculture as one of its pillars.
2014
2015
2016
2017
2018
2019
2020

As can be seen in the Scope Line, after the filtering and verification process, 60 evidence of change, generated with the execution of the Project actions, have been identified.

By mapping the evidence on the timeline, structural and behavioral changes have been overloaded in recent years. This is quite frequent in projects that aim to develop innovations, such as the Digital Agriculture Project.

The colors that the evidence have will be useful later to organize the harvest from transformation areas. Each color represents an area of transformation.

2.2 Input changes

There is a type of change that is called input and that is identified as having the function of unleashing other transformations that the projects produce. In this case, the following changes have been identified as input changes for the Digital Agriculture Project:

a. **The personal and professional growth of the interns who join the Digital Agriculture Project.** The role of the interns in the Project has been fundamental for them and for the group. They always consider themselves included in the work, as another member of the team, and appreciate being given high-level responsibilities, as well as the possibility of exploring. Everyone indicates that their growth in terms of knowledge was key. Interns are essential to spread what the Project is doing to other national and international spaces.
b. **Professionals in the sector take an interest in digital farming and create champions**: As can be seen later, this is one of the great transformations that the Project achieves, it has been put as input evidence because the transformations that have been generated have largely depended on these champions, mainly after the first contacts with the Project team. These champions have also spread their knowledge in other institutions and entities, especially when they are consultants.

c. **The CGIAR Big Data community of practice space**: The evidence that the practice community has generated changes has been marked as an entry point, since it functions as a space for the exchange of knowledge to discuss results, receive feedback, acquire new knowledge, exchange with other interested people, and build opportunities, which are actions that directly feed the Project from other CGIAR initiatives and elsewhere.

d. **The CGIAR changes to a data approach and the CCAFS positions itself with an innovative proposal**: These changes have also been identified as an entry point that support the actions of the Project. The Project has had an impact within the CGIAR

by starting to work with data in agriculture. It was constituted as an avant-garde project at the beginning, and it was consolidated with the positioning that the international awards have granted it.

From the evidence gathered, these are the changes that have been considered as entry points because they support the transformations that the Project has produced, and which are discussed below.

2.3 The transformations produced by the Digital Agriculture Project.

In the previous chapter, the methodological process of the Outcomes Harvesting has been detailed. As it has been emphasized, it is a methodology that allows the great areas of transformation, generated by the Project, to emerge from the evidence of change produced by its actions.

From the analysis of these great transformations and their interrelationships, what will be called the Emerging Theory of Change is built, which seeks to represent the way in which the analyzed initiative generates a change in reality. It is an expression of what has happened since the execution of the Digital Agriculture Project during these 8 years.

From the assessment of the work carried out by the Digital Agriculture Project, 4 major areas of transformation emerge:

1. Recommendations to improve agricultural practices are more sustainable and climate-smart.
2. A new data practice is incorporated into regional agriculture.
3. The agronomy professional changes his profile.
4. Institutions are modified to strengthen the practice of digital agriculture.

Each of these emerging transformation areas is discussed in the following sections.

2.3.1. Transformation Area 1: Recommendations to improve agricultural practices are more sustainable and climate-smart.

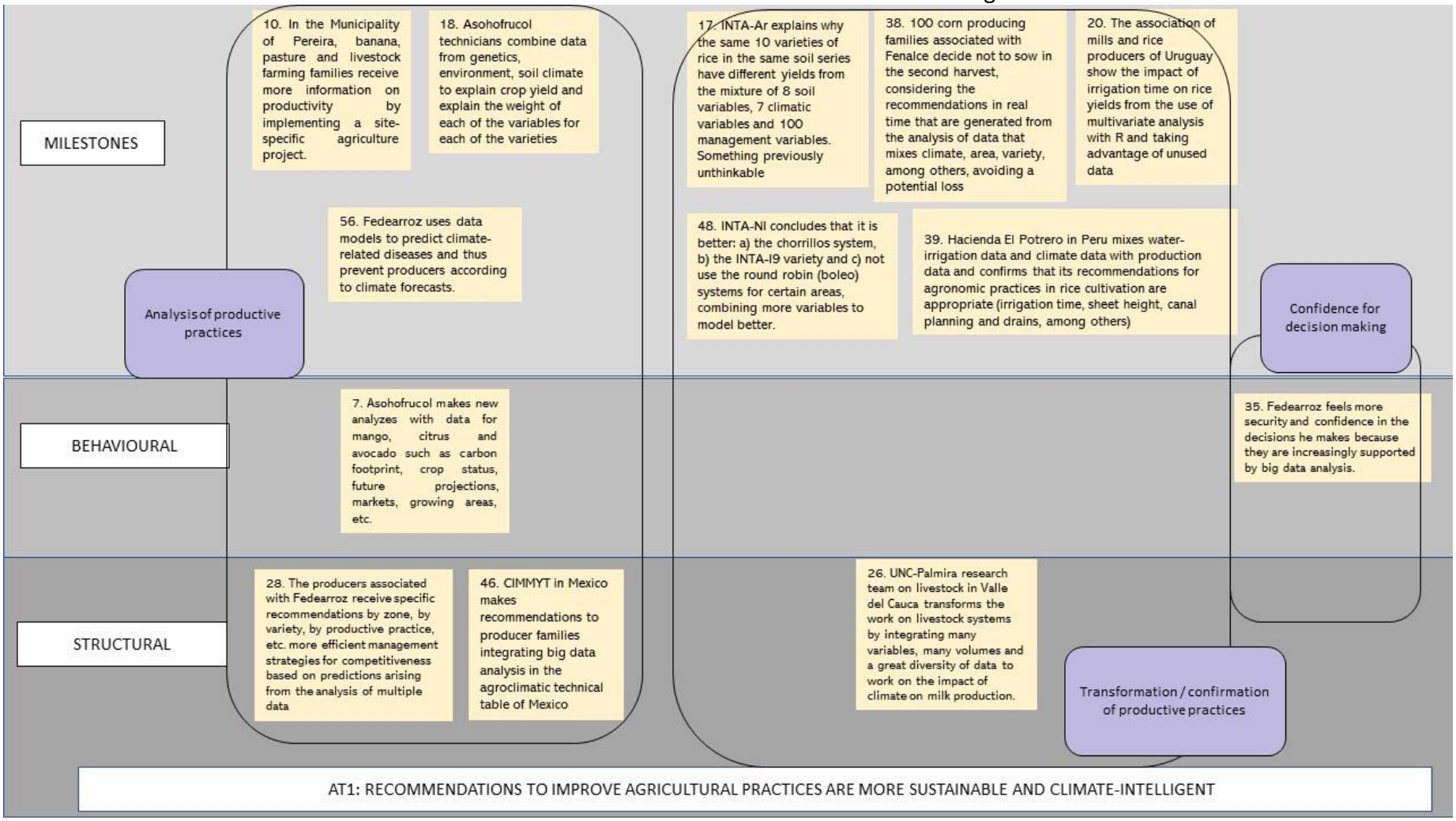
The analyzes carried out by the entities that have participated in the Digital Agriculture Project integrate types of data that had not been previously contemplated, data analysis that had not been carried out previously, and innovative technological tools that support the prediction, prevention, and confirmation of the agricultural practices. The results of this new approach generate greater confidence and security in the recommendations issued and in decision-making.

Three types of evidence of change are identified related to the proposals for improving agricultural practices made by the different entities with which the project works:

a. The study of agricultural practices is done with variables that were not previously included in the analysis.
b. Data mining analysis has improved production practices.
c. Decisions are made with higher levels of confidence.

The evidence that this is a large transformation area and that it has been compiled from the scope harvest is organized in the following table.

Graph 2: Evidence from the First Area of Transformation
Own elaboration from the Outcomes Harvesting



Three types of evidence of change are identified related to the proposals for improving agricultural practices made by the different entities with which the project works:

a. **The study of agricultural practices is done with variables that were not previously included in the analysis**: One of the most relevant aspects are the combinations of variables and data that are developed for the analysis of various productive practices and that were not carried out before the Project. This transformation is expressed very well by INTA-Argentina:

> *"Unifying different climatic variables with soil variables was previously unthinkable for any technician at that time, adding 8 soil variables, with 7 climatic variables, with 100 management variables was an impossible thing for a common analysis. That is, the possibility of crossing several variables to explain returns could not be imagined." INTA-Argentina.*

The integration of more quantity and greater diversity of variables in the analysis of practices has also influenced structural changes, as is the case of the livestock research team at the National University of Colombia-Palmira, which modifies the work on livestock systems.

Another aspect that emerges from the evidence is how it has been possible to identify variables that are determinant to explain some behavior (for example, the relationship between climate and diseases in Uruguay) from multivariate analysis or, in the INTA-Nicaragua, with thermal data for irrigated rice cultivation.

> *"Historically we have used traditional data, now we include new parameters such as heat accumulation. We are taking data from thermal recommendations; all this we did not know existed and that it could be considered." INTA-Nicaragua*

b. **Data mining analysis has improved production practices**: Evidence shows that data analysis using data mining has influenced decisions on production practices that had not previously been discovered or considered, such as the incidence of irrigation times on rice yield.

> *"We took data that had normally been working in research, but we applied multivariate analysis and began to discover things, for example, that we had not noticed the impact of risk time on yields, it was considered if it was watered or not, but not the time that irrigation lasted, it was a very critical variable." FLAR and INTA-Argentina*

c. **Decisions are made with higher levels of confidence**: The use of data mining has generated an increase in the confidence of the analyzes carried out by technicians in the agriculture sector, and this has an impact on those who make decisions, as they feel more secure because they are better supported.

> *"Having more complete data analysis gives us a lot of security in the research results we obtain; it gives us a lot of peace of mind when we make decisions." Fedearroz*

The evidence confirms that it has been possible to generate more complete and accurate information to make recommendations aimed at productivity or competitiveness for producers through technical assistance from their unions or public institutions. This has been achieved through context-specific analysis and in the analysis of big data combinations, prediction, and modeling.

It is then observed that:

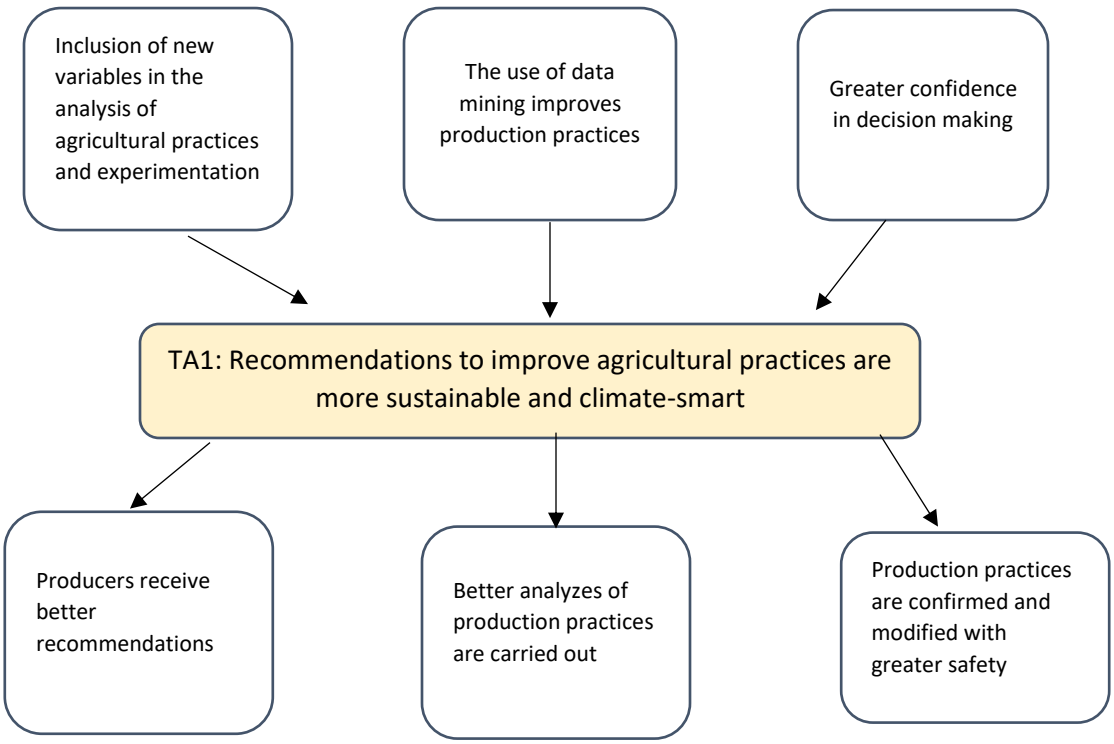
1) Producing families receive better recommendations.

2) Productive practices are analyzed in greater depth because they integrate more quantity and diversity in the variables that are used.

3) Productive practices are confirmed and modified based on data mining results.

The changes that emerge from the evidence in this first major area of transformation are represented as follows.

Graph 3: How the change in recommendations for agricultural practices occurs



2.3.2 Transformation Area 2: New Data Practices for Agriculture.

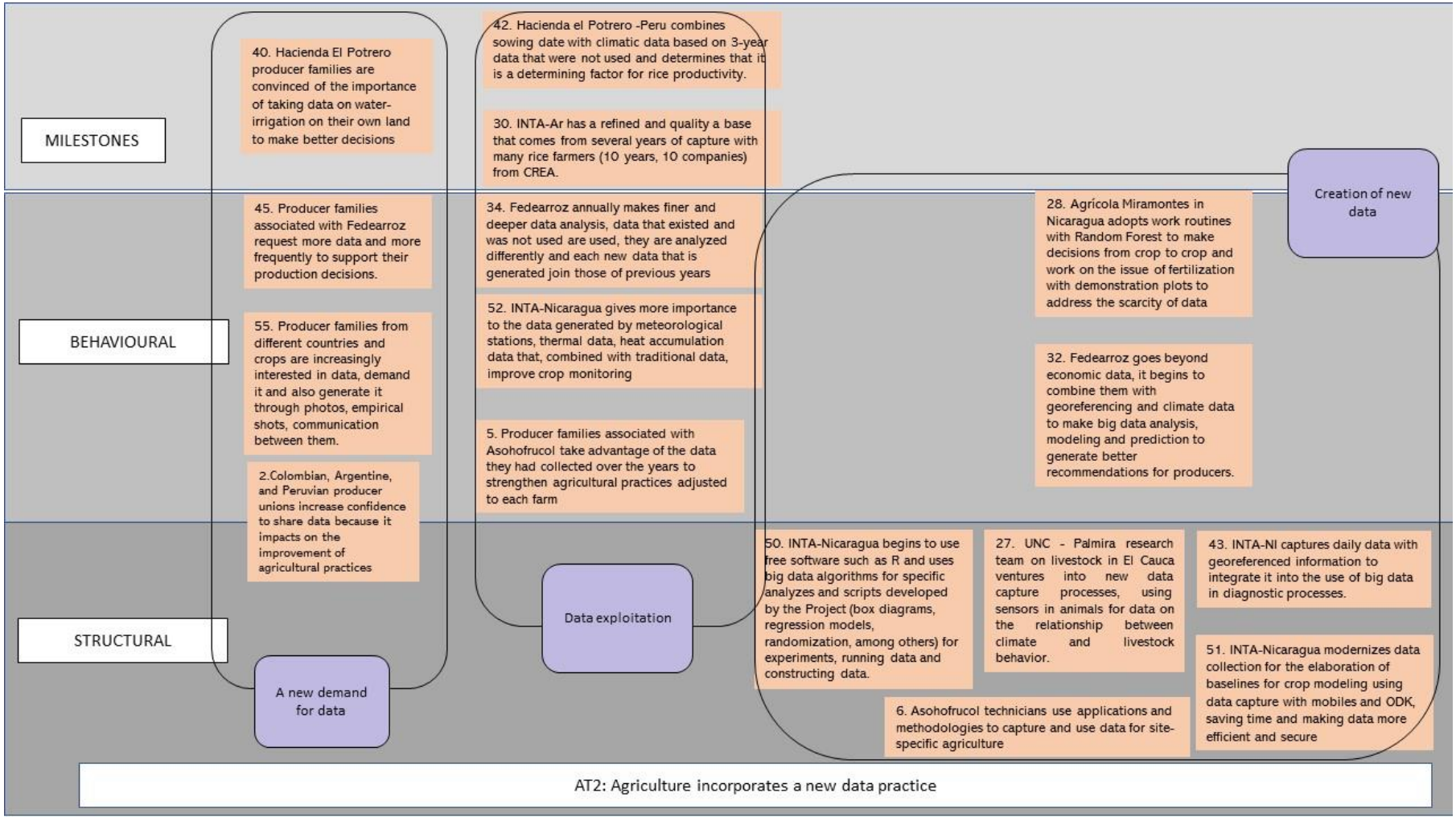
Agriculture has always used data to track yields and do experimentation. Statistical analysis and data series related to productive practices have traditionally been used. The Digital Agriculture Program proposes and executes other ways of generating, using, and analyzing data in agriculture that influence a new data practice in this sector.

The evidence that has been collected in the Outcomes Harvesting has been organized into 3 changes that feed the transformation produced:

a. Increased demand for data.
b. Use of previously unused data.
c. Creation of new data for agriculture with digital technologies.

The evidence that a transformation has been generated in the different actors, that relate to the Project in terms of their data practice, is expressed as follows:

Graph 4: Evidence of the Second Area of Transformation
Own Elaboration from the Outcomes Harvesting



a. **Increased demand for data**: It is very interesting to observe that one of the results of the harvest is a new relationship between the data and the producers. Evidence has been generated about an increase in the demand for data, to have more, better, and more frequent data. Furthermore, they have become convinced of the need to collect data in their cultivation places for subsequent analysis of agricultural practices that generate more adjusted recommendations to their production processes. Digital agriculture gives a new meaning to the resource of data in the field.

> *"The producers attach great importance to the data, the producers know how to take photos anywhere, they know how to communicate, they look for data, they consult information, wherever one goes, there are farmers who call me and talk to me on WhatsApp, it has become a platform to communicate data." Consultant.*

Related to this demand, a very important change in behavior is also evident since producers are more willing to share data since they receive tangible benefits for their production processes.

b. **Use of previously unused data**: Another group of evidence refers to the use of different data that have been collected for a long time and that had not been used previously (climatic data, productive practices, historical data, among others). With the Digital Agriculture Project, databases that were stored have been recovered and that have been enhanced to improve their quality to be used in data mining analyzes combined with other data.

> *"There was a problem with the data, the methodology needed the climate data, but it was very ugly. There were huge gaps of information, the most amount of data we had were 2 campaigns, we did not have historical data, and there had to be a pairing between production data and climate data. The Project team helped us a lot in that the data could be used, they helped us make a script to debug the database." INTA -Argentina.*

c. **Creation of new data for agriculture with digital technologies**: A third block of evidence is focused on the creation and use of new data for agricultural processes. On the one hand, those that are captured from the use of digital tools previously not incorporated in agriculture; for example, sensors in livestock, soil moisture sensors, images with drones, data from weather stations, ODK for mobile phones, among others. And, on the other hand, those that are generated from data mining analyzes using various programs and equipment for processing big data such as modeling, scripts, multivariable, regression, randomization, among others.

The change from the use of proprietary software (Excel and SPSS, for example) to R, which is free software, and which performs much more powerful analyzes, is also mentioned as a change by the stakeholders consulted in the harvest.

The Project has integrated a new culture of data in the actors and allies. This is exemplified in the work with CIMMYT in Mexico.

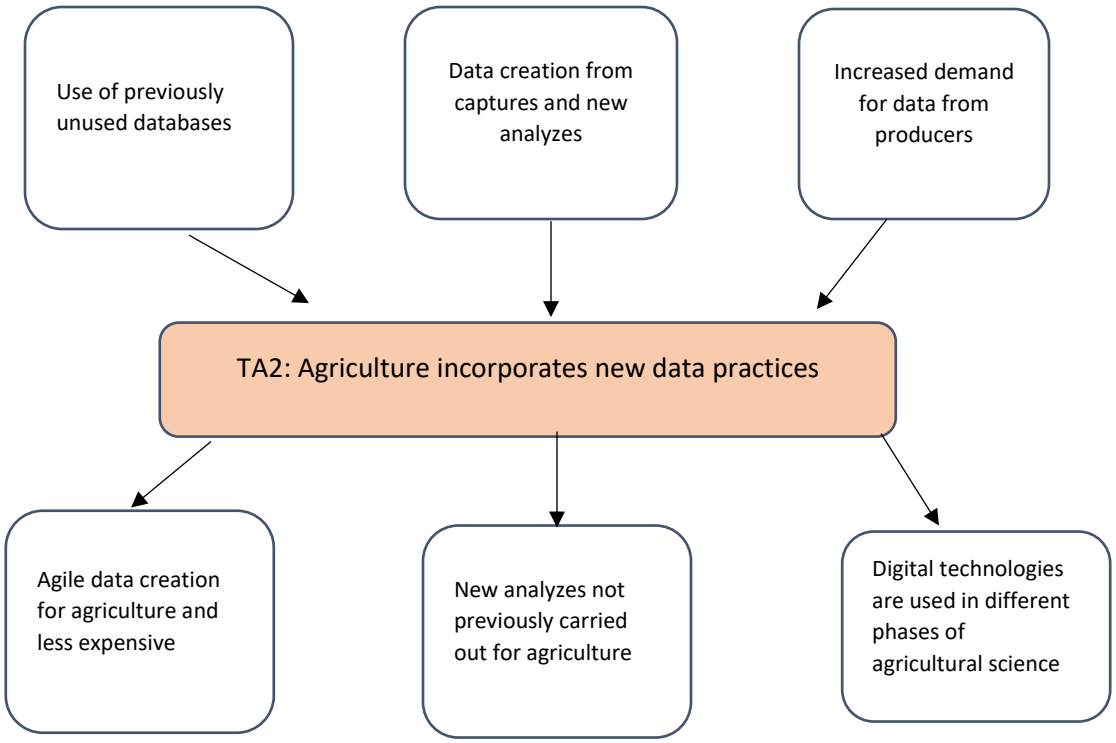
> *"Each one came with their background when we met, but we complemented each other, we understood the main objective: to generate information products of added value for the producer and the conscious use of the data. We have taken solid steps in innovation, analytics, and in data culture.*
>
> *It is an advantage to have a certain capacity for analysis, interest, and understanding that the data can be used from another logic, and the recommendations that can be made with new analyzes. Few people saw value in data, especially those coming from producers." CIMMYT, México*

These practices and data culture have allowed digital technologies to be incorporated into agriculture for new analyzes that take advantage of unused databases and create new data in the field. This generates a qualitative leap in the science of agriculture from the generation of:

a) New data for agriculture that previously could not be generated or was much more expensive to obtain.
b) New, more complex, more complete analyzes, using multiple and large data that were not previously exploited.
c) New digital-based technologies that can be used in the different stages of agricultural science (in the field, for experimentation, for analysis of practices, among many).

The changes that emerge from this second area of transformation are represented as follows.

Graph 5: How new data practices are produced in agriculture



2.3.3. Transformation Area 3: A new professional profile for agriculture.

Professionals, extension workers, and technicians in agriculture have acquired new capacities in digital agriculture through the Project and a part of them have taken leadership in the subject and have opened spaces in their entities to continue developing initiatives with big data for the sector. This has generated enthusiasm, has spread to other spaces, and has resulted in a growing demand for training that has an impact on the creation of a new professional profile in agriculture.

> *"A new generation of young people must be trained with skills other than traditional education." ICESI*

The third group of evidence that has been gathered refers to the contribution that the Project gives to the construction of a new professional profile for agriculture that works with data science, data mining, and digital technologies.

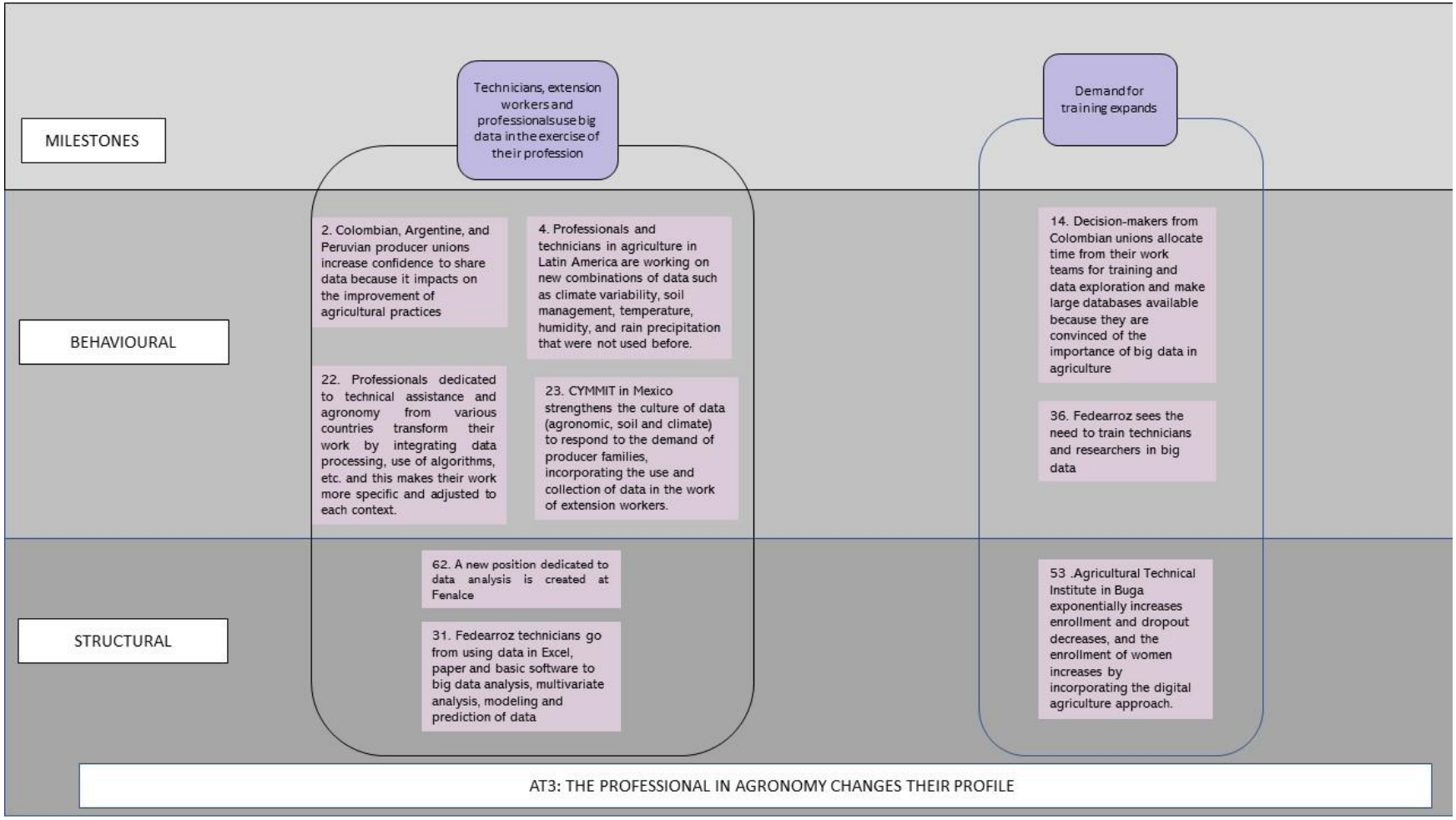
The evidence generated by the harvest that has been grouped under this transformation area was organized in:

a. Technicians, extension workers, and professionals use data mining for the exercise of agriculture.
b. The demand for training in the public, private, and academic sectors is expanding.

The evidence of this fourth area of transformation have been organized in graph 6.

Graph 6: Evidence from the third area of transformation

Own elaboration from the Outcomes Harvesting



a. **Technicians, extension workers, and professionals have skills to use data mining for the exercise of agriculture**: The Project has worked on capacity development processes in the region, which have generated groups of professionals ("data champions") who have a strong interest in continuing to advance on the issue.

> *"In the collaborative work between CIMMYT and the Project, we took solid steps in innovation, analysis, and in culture. The profile of extension workers has changed since much responsibility falls on them for the collection and quality of the data that is collected with digital technologies. It is a new way of doing extension." CIMMYT*

Also, from the demonstrations of the use of large and multiple data, confidence in data analysis for agricultural processes has been increased. This is important because it has been shown that it is possible to use data other than those traditionally used in agriculture.

b. **The demand for training in digital agriculture is increasing:** As a result of the processes carried out by the Project, the demand of the participating institutions and of others that have known the results to strengthen training has been expanding. This is evidenced by the fact that unions and public institutions dedicate time to this area of training and exploration with data.

The demand for training is also evident in a need from the new generations of professionals and the supply from higher education centers.

> *"The career begins in the first semester of 2019, the percentage of men and women is almost 50-50, many more women are becoming interested in the subject of agriculture. It started with 14 students in the first enrollment, today we have 304 students, and we have a first class of professional technicians and professional in agribusiness with data mining as the backbone". ITA-Buga*

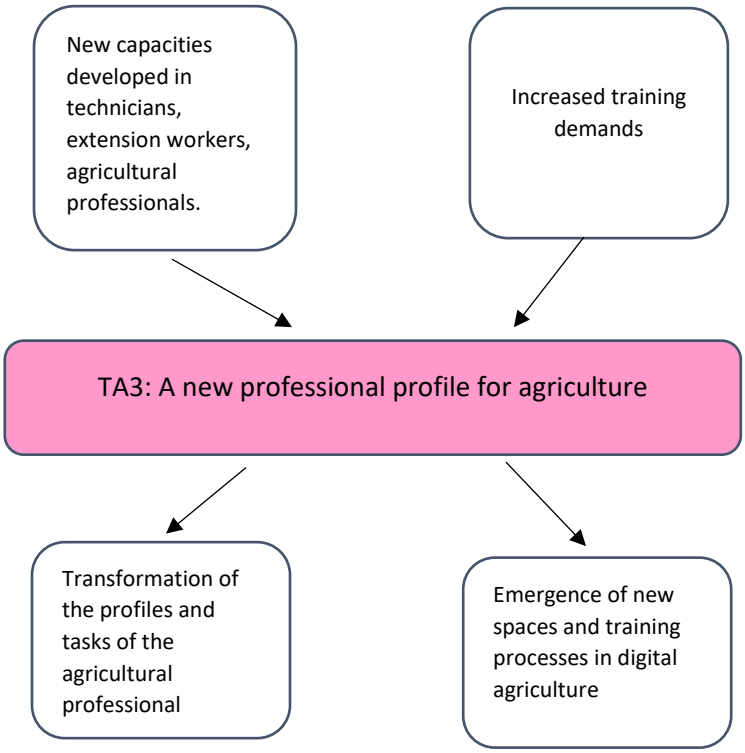
There is a significant increase in the interest of agricultural professionals for the incorporation of data mining analysis, data mining, data capture with digital technologies, among others. This is not only a personal interest, but also an institutional one, especially in unions, academia, and the public sector as evidenced by this study. For this reason, time is being devoted to training, exploration, and creation of training spaces in digital agriculture.

The changes affect:

a. The transformation and profiles of the professionals in agriculture.
b. Emergence of new training spaces in digital agriculture.

The change in this area can be summarized in graph 7.

Graph 7: How the change in the professional profile in agriculture occurs.



2.3.4 Transformation Area 4: Modification of institutions to strengthen the practice of digital agriculture with digital technologies

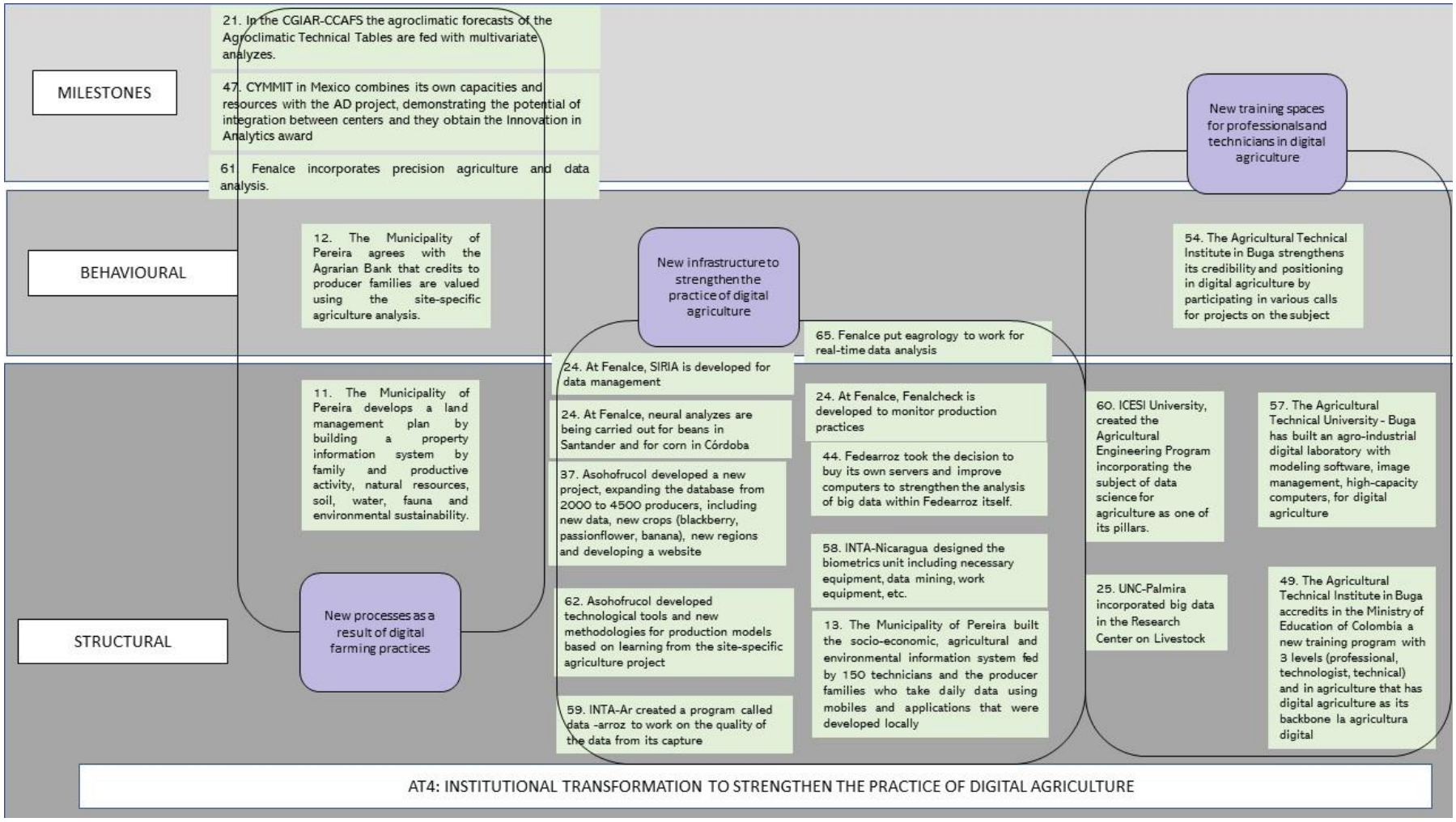
A fourth group of evidence is grouped into the fourth major area of transformation, which refers to how different agricultural institutions have been transformed, either from the academy, the public sector, and the private sector to strengthen the practice of digital agriculture. New profiles, new infrastructure, new departments, new courses that have been promoted with the contribution of the Project are evidence of this group of achievements.

The fourth group of evidence has been grouped into 3 types of changes produced by the Project:

a. Changes in processes due to the incorporation of data mining in agricultural institutions.
b. Changes in infrastructure for the practice of data mining in agricultural institutions.
c. Changes in the training offered by educational institutions for a new professional profile in agriculture.

The evidences of this transformation area have been organized as shown in graph 8.

Graph 8: Evidence for the fourth transformation area
Own elaboration from the Outcomes Harvesting



a. **Changes in processes due to the incorporation of data mining in agricultural institutions**: The implementation of the accompanying, capacity building project has prompted institutions to make changes to incorporate digital technologies and new methods of working with data for agriculture. This has been generated from the union of efforts, knowledge, resources under a common purpose.

A very good example of this evidence of change occurs in the relationship between the project and CIMMYT in Mexico, where the meeting of knowledge that produces an institutional transformation is evident.

> *"We have known each other for about 6 years, we contacted each other through a third party. He asked us what we wanted to do with the data we had collected 8 years ago, we were told the CGIAR Digital Agriculture Project had won an award. So, we met, we had the data, and they had the methodologies, we formed a work team together between the two centers, 6 years ago.*
>
> *We have the data, and the opportunity in Mexico, they had the knowledge to share, it is very important that we share the philosophy and the way of thinking. We have done several collaborations, and together we won the Analytics in 2020. We applied to show that we had an innovative analysis model for producers*." CIMMYT

In several of the institutions consulted, as explained in transformation area 2, what happens in CIMMYT, in the sense that there are more or less organized data collections that have not been used. The relationship with the Project allows to take advantage of them. But in this case, we want to highlight the institutional transformation of CIMMYT by uniting, for more than 6 years, mutual capacities that transform institutions. In this case, CIMMYT, but also the Project.

Other evidence that supports this scope refers to the incorporation of data mining analysis to strengthen another CGIAR project, such as the Agroclimatic Technical Tables. Likewise, the influence of the Project in new ways of doing business is detected in the Municipality of Pereira, by establishing a Territorial Organization Plan based on analysis of big data and the negotiation that is achieved with the banking system, so that the granting of credit is done from the analysis generated by site-specific agriculture.

> *The contribution of the Project was all the technical support in terms of the tools that it has developed to define the agro-ecological zones, and the tools that they use in the climatological part for the articulation of climate-soil variables. The important thing was not to build the variable or the data, but to understand how we applied it to the productive life of the farmer.*
>
> *The support was one on one with the two of us, we did many trainings: to use RASTA, they provided us with the material to do field surveys with guide tape, etc. This allowed us to do a one-to-one mapping in Pereira. The support allowed*

us to give a greater focus to the usability of the information and this had a strong impact on different planning instruments at the territorial level. " Consultant Municipality of Pereira.

b. **Changes in infrastructure for the practice of data mining in agricultural institutions:** Another group of evidence of change refers to changes in infrastructures to continue strengthening the work in big data analysis in the institutions with which the Project has had work in common.

"In the technological part, we are going to have cutting-edge equipment. We have a laboratory of everything digital, modeling software, precision agriculture models, site agriculture, image management, etc." UTA-Buga

These infrastructures are expressed in new equipment and tools, as in the case of INTA-Nicaragua, which is building a biometric unit with all the equipment required for data mining, multivariable, and data mining analysis in general. It is the same case of Fedearroz, which after several years of working with big data decides to compare their own servers that allow them to handle data in their own data centers. The same is stated by the UTA in Buga, which has created a large agro-industrial digital laboratory.

"The need for an infrastructure also arose as a result of working with the Project. For some time, we had to rent a server, as a result of the project we decided to have our own 2 servers and also, we have changed computers to some people for data management." Fedearroz

The new projects and programs that are developed in the institutions to do data mining are also contemplated within the infrastructures, such as, the analysis of neural systems that is beginning to be implemented in Fenalce or INTA-Argentina with the project Datarroz.

"In our group of crazy cats in rice, we are putting together a local project called Datarroz to begin to instill the issue of how to take data, standardized spreadsheets and then as a professional, always trying to instill that the quality of the data does a lot for the results." Inta-Argentina

c. **Changes in the training offered by educational institutions for a new professional profile in agriculture**: An important group of evidence demonstrates the change that, through contact with the Project, has produced in academic institutions that train agricultural technicians and professionals.

These changes are expressed in the Colombian academy from the creation of new careers such as the ICESI and the UTA in Buga.

> *"With the Project, we have realized that it is necessary to strengthen the curriculum, the study program in the universities, I began to soak up the curricula and we realized that data science was lacking.*
>
> *In the end, the study plan opened the way for me to work at ICESI. The university has different faculties. Within engineering, the agronomic engineering program was created. It is a new program that will be different from the others because it comes to fill the gaps that we see in professionals in analytics and data management, not only to collect, but also to do. This program has an emphasis on digital farming. This has allowed this university to position itself as innovative educational centers and increase the interest of the new generations in agriculture." ICESI*

This has allowed these universities to position themselves as innovative education centers and increase the interest of the new generations in agriculture.

> *"We at this moment have the first promotion. We seek to change the center of the Cauca Valley with our graduates. Everyone aspired to go to Cali, now we extend an academic offer with technology in the rural area, which drives growth towards the land.*
>
> *Five years ago, we said this discourse of rural development with technology, and they did not believe us. The Project did believe us." UTA- Buga*

It has also been relevant for research centers such as the National University of Colombia in Palmira, at the Livestock Research Center.

> *"We came from a traditional school, from statistical designs, when we face this new methodology we say that there are new things, many variables, volumes of information, different types of data, we know that these livestock systems depend on multiple interactions, on many variables, the climate, the biological and they present us with this methodology that integrates everything, it is very interesting, we are applying it in several things." UNC-Palmira*

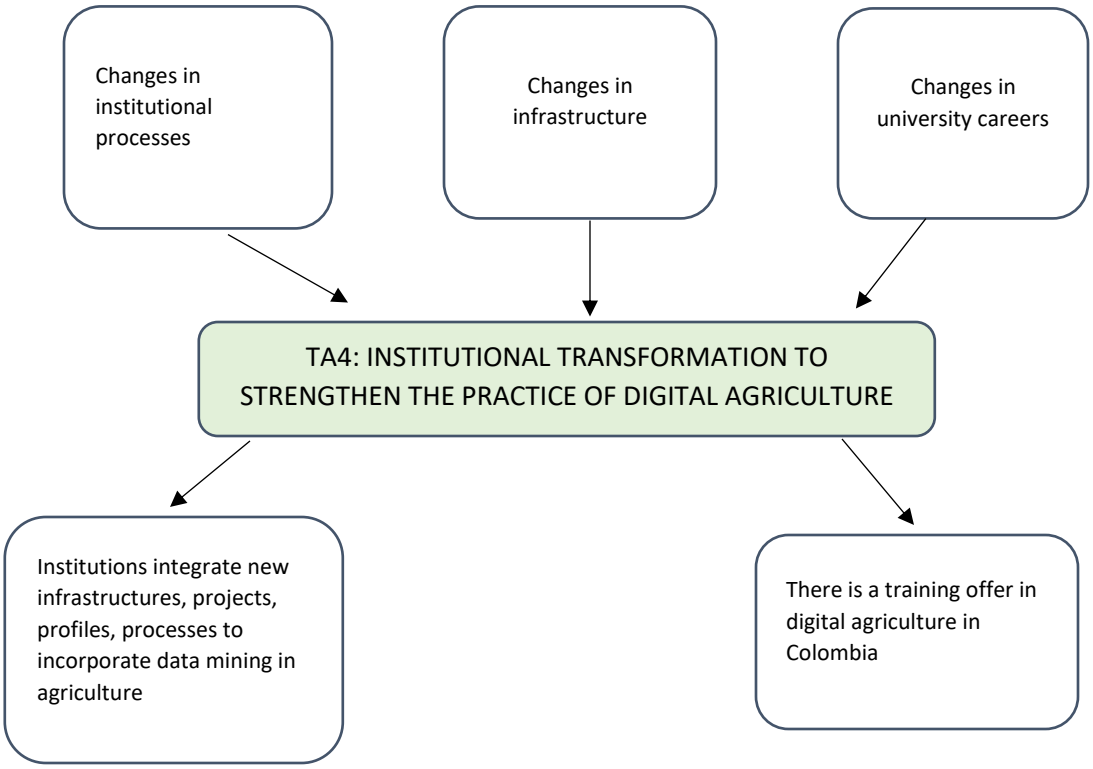
Substantive and structural changes are foreseen in the institutions that have participated in the actions of the Project, which have as a consequence:

a. That institutions are beginning to integrate new structures, profiles, and processes to respond to a shift towards digital agriculture.

b. An academic offer begins to be generated in universities to train professionals and technicians in digital agriculture in Colombia.

This transformation area 4 can be summarized in the following table:

Graph 9: How institutions are transformed to incorporate digital agriculture.



2.4 The Construction of the Emerging Theory of Change.

The purpose of the Outcomes Harvesting approach is to understand what are the transformations that are being generated from the actions that are executed in a specific reality. For this purpose, an emerging theory of change is built, that is, it is created from the evidence of transformation that has been obtained in the investigative process. It describes which strategies have been implemented and based on them, and which have been the major transformations that have occurred.

In this case, the Outcomes Harvesting identifies that 4 large areas of transformation have been generated, which are developed from 11 strategies that contribute to achieving the development objective (impact) of the Digital Agriculture Project.

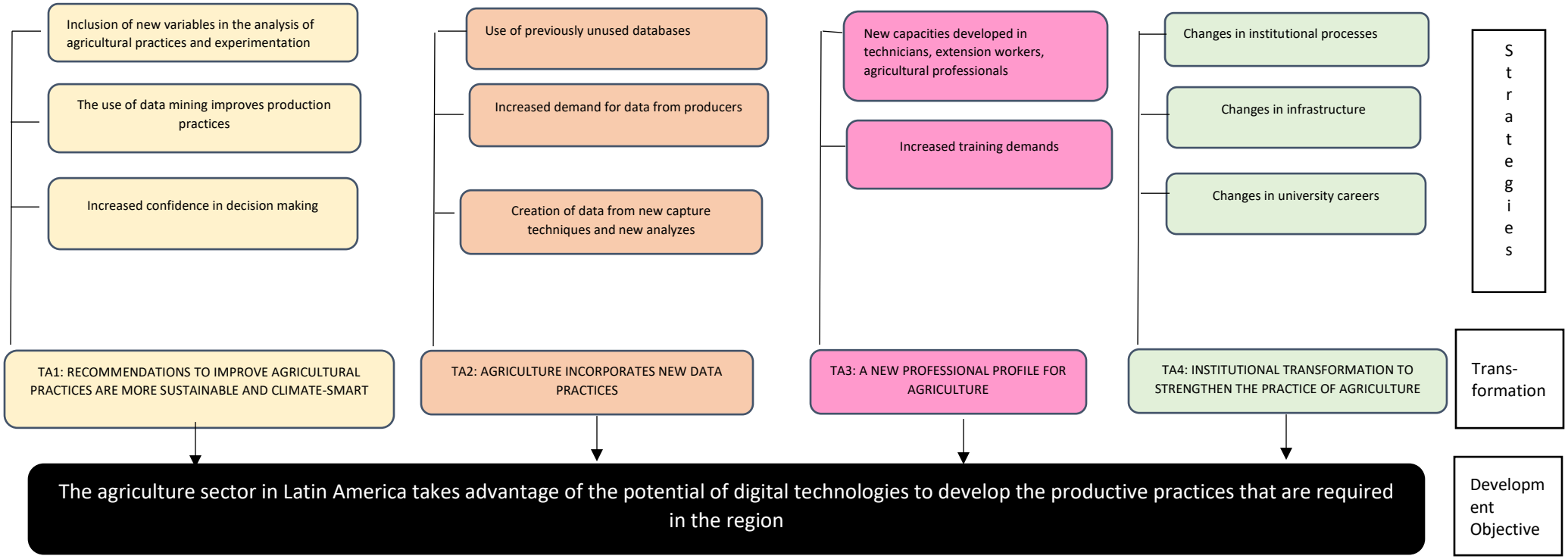
Graph 9 outlines the Theory of Change that emerges from the Outcomes Harvesting at this moment in the project's history.

As can be seen, the implementation of the Project has generated, a) that the recommendations made for agricultural practices are safer and more reliable, b) that the practice of data in the agriculture sector has been modified, c) that a new profile of agricultural professionals begins to be developed, and d) institutions have made substantive and structural changes to work in digital agriculture.

These great transformations have been achieved through the implementation of 11 strategies that have been built from the evidence:

a. The inclusion of new variables in the analysis of agricultural practices.
b. The incorporation of data mining improves production practices.
c. Increased confidence for decision-making by having better analysis.
d. The use of databases and data collections that had not been used previously.
e. Increased demand for data from producers.
f. The creation of new data using diverse digital technologies (from cell phones to IoT devices).
g. The development of new capacities in professionals, technicians, and extension workers in the sector.
h. The increase in the demand for training in digital agriculture.
i. The transformation of some institutional processes to strengthen digital agriculture.
j. The development of new infrastructure in institutions to strengthen digital agriculture.
k. Changes in university careers to develop a new professional in agriculture.

Graph 10: Emerging Theory of Change
Own elaboration from transformation areas



As can be seen in the summary graph of the theory of change, it has been identified as a development objective that emerges from the analysis: **The digital agriculture sector in Latin America takes advantage of the potential of digital technologies to develop the productive practices that are required in the region.**

As is well known, this development objective is presented as an impact that the Project contributes, but for which it is not fully responsible.

2. 6 The role of the Digital Agriculture Project Team

The role of the Digital Agriculture Project can be described as follows: there is a knowledge management space that strengthens agriculture in the Latin American region with the use of digital technologies for the development of new forms of data analysis for the sector.

The Project constitutes a knowledge management space for digital agriculture in the region. It maintains constant exploration and research, regularly presents results in diverse areas of both agriculture and technology, and above all, it supports entities in the region that request it to generate digital agriculture practices, whether academic or productive.

With the evidence generated in the harvest, it is shown that the Project has contributed to open spaces for the exploration of digital agriculture in different instances of the sector, mainly unions, public instances, and academic entities.

> *"The group is very human, has a lot of knowledge, they are always willing to share and transmit the experience, we hope to continue working with them." UNC-Palmira*

Based on the results of the analysis, it is identified that the Project uses 3 strategies that contribute to it acquiring this role of knowledge management and contributes to the opening of this new field of knowledge for agriculture, which are described as:

- **Demonstrate**: The Project carries out practical applications in alliance with other instances of the sector at a national and international level, from which it demonstrates the potential of big data analysis for the specific case of each context and crop.
- **Convince**: The Project keeps presenting its progress through presentations, publications, contests, among others, in spaces of the highest global level in agriculture and digital technologies. At this point, the competitions won (UN-Climate Change (2004), Syngenta-Data Mining (2008), and Analytics (2008)) stand out, which

has allowed us to position ourselves as a high-level team about data mining and agriculture.

- **Training**: One of the most outstanding aspects in the results of this assessment is the role of trainer that the Project has had. Not only from the formal training activities that are inserted in the projects that it executes as well as those that are carried out regularly, but also from the permanent accompaniment.
- **Support**: The entities and people who have participated in the Project's activities show that from that moment on they receive constant support and advice, adjusted to their needs, at a high level from the Project's work team.

> *"Another thing is the inquiries, we always receive a response, they respond to us with reinforcement, it makes the use of knowledge more reinforced. The most recent was to support the biometrics unit, we began to ask them for their support so that they could see what we had and give us suggestions, especially for the implementation of data mining, how the mining team should be made up, some of the teams that we would need, and they expressed willingness to support us with a workshop." INTA-Nicaragua.*

Based on practical applications developed by the same Project, the importance that digital technologies can have for agriculture is demonstrated, it is possible to convince the agricultural sector to explore digital agriculture.

2. 7 Stakeholder Analysis

This stakeholder analysis is performed based on the people and entities that participated in this study. Although it is not the total of the entities that have been related to the Digital Agriculture Project, which are many, it can be said that they represent the social actors with whom it has worked through the 8 years of analysis.

The only actor that is underrepresented are the ministries and local governments with whom it was not possible to speak directly, but their experience is recovered from conversations with people (consultants and interns) who have supported them.

Table 1: example of type of actors
Own elaboration from interviews

Entity	Sector	Country	Relationship with the project
Fenalce	Association	Colombia	Project with the Ministry of Agriculture of Colombia
Asohofrucol	Association	Colombia	Project with the Ministry of Agriculture of Colombia
Fedearroz	Association	Colombia	Project with FLAR
Flar	Association	Regional	Common project
INTA-Argentina	Public	Argentina	Project with FLAR
INTA-Nicaragua	Public	Nicaragua	Project with FLAR
Seeds El Potrero	Private	Peru	Project with FLAR
CIMMYT	Academia	Mexico	Alliance between CIAT centers
ICESI	Academia	Colombia	Alliances
UNC-Palmira	Academia	Colombia	Alliances
Agricultural Technical Institute - Buga	Academia	Colombia	Alliances
CCAFS	Cooperation	International	Project Location
CGIAR	Cooperation	International	Project Location
Interns	Individual	Several countries	Internship space in the project
Consultants	Individual	Several countries	Integrated in various actions

As can be seen in this table of actors, the Project has worked in the Latin American region, starting in Colombia during the first years and expanding rapidly through training and support processes for agricultural actors, supported mainly by the Latin American Irrigation Rice Fund (FLAR).

The Project has worked with diverse actors: unions of various agricultural products, academia, the private sector, the public sector, and other CIAT research centers. Likewise, it has built a network of people who have carried out internships with the work team and who have dispersed to different countries, but who remain close to work. It is important to mention the important role that these internships have had in the proliferation of the topic of digital agriculture in other contexts. Another important actor has been the consultants who have been integrated in different entities that have contributed to the growth of the project and who have grown with the experience offered.

The project has developed its work on data mining in agriculture, in different contexts, different actors and different crops. This gives it a very relevant field of experience and input.

It can also be seen that work has been done from projects as a financing strategy for the Digital Agriculture Project. This, as is known, implies a beginning and an end of the actions with the

consulted actors. For this reason, it is important to observe the scopes that have been achieved beyond the execution during a certain period of time, which is what this work seeks to carry out.

Chapter 3

Conclusions and recommendations

3. 1 Conclusions.

As a conclusion and considering all the findings that have emerged from the assessments and that have been exposed in this document, the following design proposal of the Digital Agriculture Project (September 2021) is presented in accordance with the actions carried out and analyzed.

The analysis of the transformations that it has been generated in the region is produced thanks to the fact that the Project is constituted in a knowledge management space on data, digital tools, and agriculture. It is characterized by constant exploration and research, by presenting the results of its work constantly and in various places, training technicians and professionals in the agriculture sector of the region and accompanying key institutions to incorporate big data analysis as part of their practices.

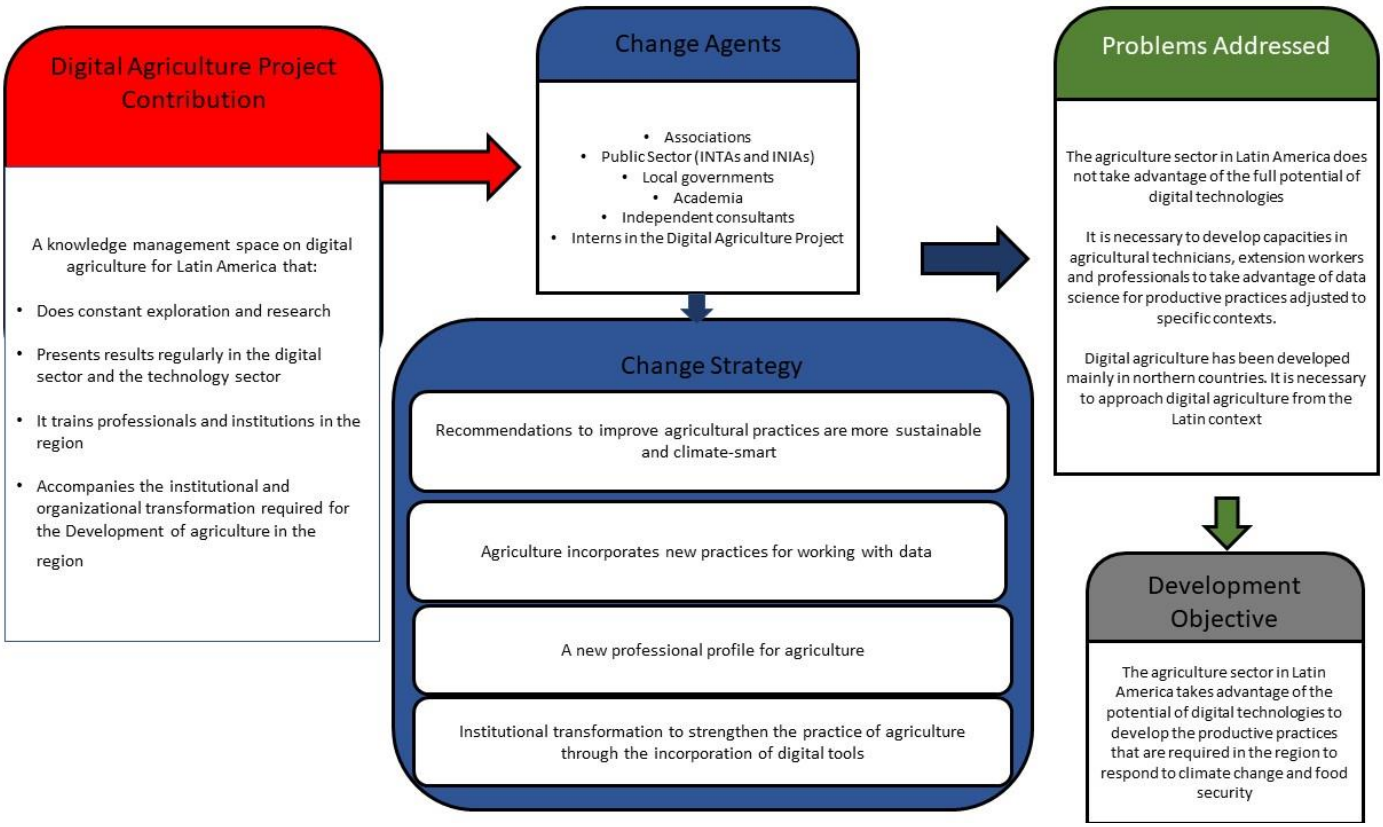
Until the moment of this analysis, the key actors that have produced transformations thanks to the work together with the Project are the unions, mainly in Colombia, public institutions in the region that work in agriculture, local governments, interns, and consultants who have been linked to the Project.

The Project addresses 3 important aspects of the agriculture sector in the region. In the first instance, the need to better exploit the full potential of digital technologies. Second, the opportunity to develop capacities for data science of technicians, professionals, and institutions in the agricultural sector. And thirdly, the opportunity to develop digital agriculture with a Latin American focus.

For this, the Project has contributed by developing 4 major areas of transformation: the recommendations for the improvement of practices are more sustainable and climate-smart, a new data practice in agriculture, the increase in the demand for a professional with new capacities in the use of data for the exercise of agriculture and substantive institutional changes to integrate data science as part of their development strategies.

All this has resulted in a contribution of the Project to a Latin American agriculture that takes better advantage of digital technologies to strengthen the productive practices that the region requires to respond to climate change and food security.

Graph 11: Emerging Design of the Digital Agriculture Project as of September-2021
Own elaboration from the Outcomes Harvesting



3.2 Recommendations.

There is a unanimous recommendation from all the stakeholders consulted in the sense that this is an indispensable Project for the Latin American region. His contribution has been substantive and very necessary, especially because it has proposed not only to work with data mining in agriculture, but to develop this discipline from the Latin American region.

There are very interesting recommendations from the people participating in the Harvest that are discussed below.

On the continuity of the actions: Although it is true that all the stakeholders consulted highlight the great support that the Project gives them if they have questions or wish to carry out new projects on data and agriculture, there is also a perception of discontinuity or interruption of the processes

once the financing ends. This is very frequent when working from project financing since it unfortunately interrupts processes that are generating results. *"It is important that there are longer projects, it takes time to start implementing. It seems to me a very interesting job, my recommendation would be that you do not abandon this type of project, continuity is important, if there is no continuity, it is like how beautiful it worked and without impact we do a lot. " Technicians.*

As its director tells me, *"We try to put together a blanket from scraps, that is to say that each project contributes as a whole"* and the effort shows in the results. Despite this, the recommendation to generate strategies for the continuity of the processes was generalized among the actors.

It may be advisable to review the exit strategies of the projects in such a way that are strengthened the ones that reduce the sensation of interruption that has been detected. It could also be advisable to establish continuity of support as is currently done in practice, but define it as an exit strategy that is integrated into the same projects and resources are generated to consolidate it. The latter, especially considering that the greater the demand for continuity of support, the more difficult it will be to satisfy it.

"That the support to the consultations be maintained as it has been until now, that they do not leave us now that we are already making changes to advance with the analysis of big data and hopefully that we can continue with permanent training. " Technicians.

Better communication of the Project and its results: The issue of continuity and exit strategies is also reflected in the communication of the Project. Above all, in relation to maintaining contact with allies and partners after the executions and who may be interested in continuing to work and present proposals together. *"When we had a specific project, it was handled very well, very organized, super tidy, but when it was finished, I no longer know with whom to communicate. There have been opportunities to work with them, but I don't know to whom to talk."* Intern.

It is also recommended to strengthen the communication of the project to position it more and obtain more support resources since the quality of the work that is done is not known. *"For CIAT to support the Project with a dissemination campaign, so that more is known, there are many tools that can help the territories, it is very important that local governments know the unique capacities of this team"* Consultant.

On the complexity of the subject of data mining, modeling, etc.: Some actors highlight the complexity of the subject and how difficult it is to master it and incorporate it into agricultural practice. This has the consequence that few people are willing to deepen and handle the knowledge, tools, and techniques that are required to master it. *"The methodology is excellent, but they require a very high technical level to be able to use it, it generates a lot of dependency, it generates dependency on the Project to be in operation."* Technicians.

This is part of the strategy for the democratization of knowledge, digital technologies, and data. It is clear that a specialization is required, and it is very likely that the work that is being carried out with the academy (at least in Colombia) will have an interesting impact on the domain of data science for agriculture.

All stakeholders recognize the knowledge and specialization that the Digital Agriculture Project team has. An area of educational mediation for professionals, extension workers, and technicians could

be interesting to achieve the purpose of developing a Latin American digital agriculture. *"Keep doing what they do. Making the digital agriculture inclusive, find more opportunities in human centered design for digital agriculture" CGIAR.*

Expansion of the Project through alliances: There are several recommendations on the importance of the expansion of the Project in the region due to the relevance of the experience of the stakeholders consulted. There are suggestions related to expansion with local governments and national governments that are considered to have been little explored. Also, towards the region from alliances that would have significant potential for the Project, as well as towards other agricultural and livestock sectors.

There is also a demand from the academy to expand the work that has been done in the design of new curricula, new careers, laboratories, and research centers, there is an important potential to expand this experience beyond Colombia.

Another aspect to explore in terms of expansion refers to working with other CIAT centers throughout the world. The experience with CIMMYT has been very successful and there is much interest in developing similar ones within the same institution. *"I hope that we reap the fruits of the good work between centers. Not as a competition, but as a collaboration, it is a very good example for CG. We have not yet found large projects in terms of money, but we are an example of collaboration" CIMMYT.*

About costs: Some stakeholders have mentioned the need to do a cost-benefit analysis of digital farming and working with big data. This is because the relationship between investment and the impact of the transformation it produces on the profitability of crops is not known.

On the one hand, it is early able to carry out this study, since it is very incipient and is in the exploration phase where it is mainly investment in R + D + I. But, on the other hand, it would be interesting to develop models to verify the return on investments.

Digital agriculture, for whom? Asking this question and answering it clearly by the Project is one of the most substantive recommendations of the Harvest. This is overseen from different approaches:

a. How producers who have little access to technology and who have fewer resources for their training are integrated into the digital agriculture processes developed by the Project. These are not generally associated with the unions, which is the one with whom they have worked mainly in Colombia.
   An experience to follow up is the work in the alliance with CIMMYT that has the network of extension agents and the direct work with small producers based on action research processes. *"We have transformed action research with our network of producers through working with data."* Although we know that there is a person from the Project team dedicated to this issue, it is important to continue reflecting on it from the design of the projects ("Ethic by design, Inclusion by design" in data science). That digital agriculture does not become an elite science that is justified in the technical complexity to become a tool more exclusion and increasing gaps.

b. The other aspect mentioned is that it is urgent to integrate socio-economic, socio-environmental, socio-cultural data in the variables that are being mixed in data mining for

agriculture, not only based on national data but also located data, coming from the daily lives of producers. To achieve this, it is necessary to turn to other knowledge in data models, such as social science, gender, intersectionality. It is recommended that the Project team in its next phase diversify in terms of the knowledge that comprises it.

c. **The inclusion of producers** from the design of data projects will lead to other approaches. These are probably not that strong technically, but probably more relevant in the territory. It is an issue to be considered by the Project. However, there is always the option for the project to focus on institutions that work with producers. It is important that the Project is clear about it and communicates it, although in any of the cases it is highly recommended to have an inclusive approach and not just a technical approach.

d. **Other observations**: Not very often, but some of the stakeholders consulted have indicated that it is necessary to improve the practice of returning results, especially when data has been taken from producers or institutional data have been used. An effort must be made not only to comply with the mandates of the projects but also with the delivery of results to those who provided information.

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Anexo 1: Tabla de la Cosecha de Alcances Definitiva							
Número	Cuándo	A quién	Qué cambió	Por qué es importante	Cuál fue la contribución del proyecto	Tipo de alcance	Transformación
1.	Desde 2010	Estudiantes y pasantes de CGIAR	Crecen personal y profesionalmente aprendiendo técnicas de análisis de datos que no conocían previamente.	Se va diseminando en Latinoamérica talento con especialización datos y agricultura	Acceso a equipos tecnológicos con mucha potencia, software especializado y personas entusiastas y con mucha experiencia que trabajan de forma horizontal y en un marco de confianza.	hito	Capacidad instalada
2.	En 2014	Gremios de productores colombianos, argentinos, peruanos	Aumentan la confianza para compartir datos porque se evidencia como impacta en el mejoramiento de las prácticas en agricultura	Ha habido un esfuerzo de recopilación de datos por muchos años por parte de los gremios que no eran utilizados en su totalidad. La apertura a compartir los datos generaba una preocupación en los gremios.	El proyecto logra construir la confianza necesaria para que los datos sean compartidos y demuestra un uso ético de los mismos y sobre todo usos útiles para los procesos agrícolas con procesos de formación y aplicación para los gremios.	Cambio comportamiento	Generar confianza/Nueva área de conocimiento

62	En 2014	Fenalce	Incorpora la agricultura de precisión y las metodologías de análisis de datos para fortalecer sus procesos productivos	Se incorporan nuevos métodos para el trabajo con granos	Desarrolla un proyecto para el análisis de datos y la modelación de cosechas que demuestra la importancia de los datos para la producción de granos (maíz)	hito	Transformación institucional
61	Desde 2014	Fenalce	Crea una posición para el análisis de datos en su estructura organizacional	Se transforma la estructura organizacional para institucionalizar el análisis de grandes datos en Fenalce	Desarrolla un proyecto para el análisis de datos y la modelación de cosechas que demuestra la importancia de los datos para la producción de granos (maíz)	Cambio estructural	Nuevos perfiles profesionales
	Desde 2014	Profesionales de la agricultura en Latinoamérica	se interesan y especializan en agricultura digital una vez que han tenido contacto con el proyecto.	Se amplía la capacidad instalada en diferentes cultivos e instituciones	Desarrolla capacidades en técnicos, investigadores y agricultores-as sobre manejo de minería de datos para agricultura	Cambio comportamiento	desarrollo de capacidades/capacidad instalada
	Desde 2014	Profesionales y técnicos de la agricultura de latinoamérica	Trabajan nuevas combinaciones de datos por ejemplo de variabilidad climática, manejo de suelo, temperatura, humedad,	Se va fortaleciendo el uso de la ciencia de datos en agricultura	Desarrolla capacidades en técnicos, investigadores y agricultores-as sobre manejo de minería de datos para agricultura demuestra su utilidad	Cambio estructural	datos

			precipitación que antes no se utilizaban en este sector productivo				
	En 2013-2014	Familias productoras asociadas a Asohofrucol-Colombia (frutas, aguacate, mango, cítricos, plátanos)	Aprovechan los datos que habían recopilado por años para fortalecer las prácticas agrícolas ajustadas a cada finca	Gremios y familias productoras tienen resultados de los diversos esfuerzos de toma de datos que han realizado.	Desarrolla, junto con Asohofrucol, el proyecto de agricultura específica por sitios combinando datos con procesos participativos para alimentar sus prácticas con los resultados que van generando los datos	Cambio estructural	datos
6.	En 2013-2014	Técnicos de Asohofrucol	Exploran aplicativos y metodologías para captura y uso de datos para la agricultura específica por sitios	Los gremios van descubriendo y comprendiendo cómo se puede utilizar el análisis de minería de datos diversos para el mejoramiento de la productividad	Desarrolla análisis combinando datos de clima y producción, utiliza datos que se han recopilad por mucho tiempo y no habían tenido uso, demuestra cómo se pueden limpiar y utilizar esto satos, crea modelos y aplicativos.	Cambio estructural	capacidad instalada
	en 2014	Asohofrucol	hace nuevos análisis con datos para mango, cítricos y aguacate como huella de carbono, estado actual de cultivos, proyección	Con el modelaje y predicción de datos se logran tomar decisiones con más seguridad para mejorar las prácticas productivas	Desarrolla un proyecto de agricultura específica por sitios con el apoyo del Min de Agricultura para Asohofrucol	Cambio estructural	datos

			de futuro, mercados nacional e internacional, mejores zonas de cultivo, etc.				
	En 2014	El Ministerio de Agricultura de Colombia	fortalece su acercamiento a la agricultura especifica por sitios y el análisis de minería de datos a partir del trabajo del proyecto con Asohofrucol.	Se incide en los tomadores de decisión de política pública	Desarrolla un proyecto de agricultura específica por sitios con el apoyo del Min de Agricultura para Asohofrucol	Cambio de comporta miento	Nueva área de conocimiento
9.	Desde 2014	El CCAFS-Proyecto de Agricultura	se posiciona con una propuesta innovadora de mucha calidad en agricultura digital a nivel internacional	Se demuestra a nivel internacional el desarrollo del tema desde Latinoamérica	Gana el premio de Minería de datos y Cambio Climático de ONU y el Primer lugar Premio Syngenta de Minería de datos para Agricultura	Entrada	Nueva área de conocimiento
63	En 2015	Fenalce	Crea Fenalcheck, una herramienta basada en datos para dar seguimiento a prácticas productivas	Se crean herramientas propias del gremio basada en los aprendizajes basada en gremios	Desarrolla proyecto de agricultura de precisión y específica por sitios con Fenalce	estructura l	Transformación institucional

64	En 2015	Fenalce	Desarrolla SIRIA un sistema automatizado de datos de campo desarrollado para el análisis de grandes datos	Se integra la práctica de análisis de grandes datos en granos con FENALCE	Desarrolla proyecto de agricultura de precisión y específica por sitios con Fenalce	hito	datod
65.	Desde 2015	Fenalce	Modifica la asistencia técnica a partir de la transformación de prácticas de recolección y modelación de datos	Se pasa a una práctica sistemática de recopilación de datos que antes no se realizaba	Desarrolla proyecto de agricultura de precisión y específica por sitios con Fenalce	comporta miento	datos
10.	En 2015	El Municipio de Pereira	las familias agricultoras de plátano, pastos y ganado reciben más información sobre productividad implementando un proyecto de agricultura específica por sitios	el Municipio aborda el tema de agricultura con datos, análisis multivariable, modelación y predicciones.	dio soporte técnico al municipio definiendo zonas agroecológicas, aportando las herramientas para la articulación de múltiples variables, sobre todo suelo y clima. Realizaron los análisis y presentaron los resultados al municipio.	Hito	Nueva área de conocimiento

	En 2015	El Municipio de Pereira	desarrolla un plan de ordenamiento del suelo construyendo un sistema de información predial por familia y actividad productiva, recursos naturales suelo, agua, fauna y sostenibilidad ambiental	Se hace la planeación de municipio con base en criterios técnicos y combinación de múltiples datos para 55.000 hectáreas del municipio de las 60.440 hectáreas totales, se actualiza el que se había realizado en 2011-2012 con proceso científicos	provee soporte técnico en cuanto a herramientas para definir zonas agroecológicas, articulación de variables de clima y suelo, análisis de datos. Además, desarrolló las capacidades de los técnicos municipales.	Cambio institucional	Gestión de conocimiento
	En 2015	El Municipio de Pereira	acuerda con el Banco Agrario que los créditos a familias productoras se valoran utilizando el análisis de agricultura específica por sitio.	generaba confianza en las familias productoras ya que se respaldaba su actividad productiva con datos y se logró implementar un programa de propiedad rural para el banco.	provee soporte técnico en cuanto a herramientas para definir zonas agroecológicas, articulación de variables de clima y suelo, análisis de datos. Además, desarrolló las capacidades de los técnicos municipales.	Cambio institucional	Nueva área de conocimiento
	En 2015	El Municipio de Pereira	construye el sistema de información socioeconómico agropecuario y ambiental alimentado por los 150 técnicos y las	Los datos se mantenían constantes y al día, se hacían análisis de datos cotidianamente para toma de decisiones	el proyecto dio soporte técnico permanente a estos procesos	Cambio institucional	Gestión de conocimiento

			familias productoras que hacen tomas de datos cotidianas utilizando móviles y aplicaciones que se desarrollaron localmente				
	En 2015	Jefes y decisores de gremios colombianos	destinan tiempo de su equipos de trabajo para capacitación y exploración de datos y empiezan a ceder bases de datos porque se evidencia la importancia del big dats en agricultura	Se abren las posibilidades para empezar a explorar con datos, fortalecer lo que se ha hecho y aprovechar lo que se ha recopilado	Demuestra por medio de diferentes estrategias, como capacitación, experimentación conjunta asistencia técnica cómo se hace y puede aprovecharse el análisis de datos en la agricultura	Cambio de comporta miento	Capacidad instalada
	En 2015	En los gremios colombianos	emergen campeones de datos que se capacitan y desarrollan el tema para su cultivo y contexto.	Se genera una capacidad instalada en los procesos productivos liderados por los gremios	El proyecto demuestra la importancia y la potencialidad que el análisis de datos tiene para el mejoramiento de los procesos agrícolas y capacita a técnicos que se convierten en referentes para otros.	Cambio estructura l	Capacidad instalada

	En 2015	En el CGIAR	cambia el abordaje del trabajo con datos, se introducen nuevos tipos de análisis que fueron bastante innovadores, se creó una ruptura a nivel de la disciplina de estadística y análisis de datos para agricultura	Se abre el campo e la agricultura digital en el CGIAR	Se empieza a trabajar desde el proyecto la agricultura específica por sitios y se hacen análisis más específicos y menos generales.	Hito	Nueva área de conocimiento
17.	En 2015	El INTA-Ar	explica porque las mismas 10 variedades de arroz en las mismas series de suelo tienen rendimientos diferentes a partir de la mezcla de 8 variables de suelo, 7 variables climáticas y 100 variables de manejo. Algo impensable previamente.	Se hacen análisis previamente impensables para el sector agropecuario y se descubren explicaciones que no se tenían	Capacita con abordaje práctico basado en datasets reales al equipo de INTA-Ar en un curso en URUGUAY	Hito	Capacidad instalada
18.	Desde 2015	Profesionales y técnicos de Asohofrucol	logran combinar datos de genética, ambiente, clima suelo para explicar el rendimiento de cultivos y explicar el	Se va fortaleciendo el uso de minería de datos en agricultura	Desarrolla, junto con Asohofrucol, el proyecto de agricultura específica por sitios combinando datos con procesos participativos	Hito	Capacidad instalada

			peso de cada una de las variables para cada una de las variedades.		para alimentar sus prácticas con los resultados que van generando los datos		
62.	Desde 2015	Asohofrucol	trabaja con nuevas metodologías para desarrollar modelos productivos y herramientas tecnológicas basadas en los aprendizajes del proyecto de agricultura específica por sitios	Los modelos anteriores eran muy genéricos, se desarrollan modelos específicos para cada sitio basados en datos de suelos, plantas, prácticas agronómicas, entre otros. Ahora se utilizan los datos de 14.000 productores que en 20 años significa datos de 200.000 productores y los combinamos con datos del UPRA que tiene a cargo las estadísticas agropecuarias.	Deja una capacidad instalada a partir del proyecto de agricultura específica por sitios en Asohofrucol	Cambio Estructural	Capacidad instalada
	Desde 2015	El CGIAR	le da más importancia de las tecnologías digitales para la agricultura, la importancia de utilizar los datos creativamente para	nos han enseñado a conectar datos y trabajar creativamente	a través de los resultados de sus proyectos y los distintos premios que han ganado han demostrado la importancia de este	Cambi comportamiento	Nueva área de conocimiento

			las decisiones, desarrollo de aplicaciones de fácil uso para productores-as.		trabajo para la agricultura		
20.	En 2016	El gremio de molinos y de productores de arroz de Uruguay	evidencian el impacto del tiempo de riego sobre los rendimientos de arroz a partir del uso de análisis multivariado con R y aprovechando datos no utilizados	Se aprovechan datos recopilados durante años y se pasa del uso de estadística básica a análisis complejos de minería de datos permitiendo nuevos descubrimientos	imparte un curso en Uruguay donde participan técnicos y agrónomos de distintos países dedicados al arroz	Hito	Capacidad instalada
21.	En 2016	En el CGIAR-CCAFS	se alimentan los pronósticos agroclimáticos de las Mesas Técnicas Agroclimáticas con análisis multivariables.	Se trabaja colaborativamente, desarrollando sinergias y resultaos conjuntos, aprovechando capacidades	Trabaja en conjunto con otros proyectos que están en ejecución	Hito	Nueva área de conocimiento
	En 2016	Profesionales dedicados a la asistencia técnica y agrónomía de varios países	transforman su trabajo al integrar procesamiento de datos, utilización de algoritmos, etc. y esto hace su trabajo más específico y ajustado a cada contexto.	La asistencia se hace más poderosa y más interesante, muchos de ellos y ellas se convierten en embajadores del tema de datos	Capacita equipos técnicos que realizan o dirigen asistencia técnica	Cambio estructural	Capacidad instalada

	Desde 2016	El CIMMYT en México	fortalece la cultura de datos (agronómicos, suelo y clima) para responder a la demanda de las familias productoras, incorporando el uso y recopilación de datos en el trabajo los extensionistas.	Se fortalece el trabajo de los extensionistas integrando la cultura de datos	Conecta con el equipo de CIMMYT en términos del interés por los datos, su valor y sus potencialidades y hacen análisis en conjunto	Cambio estructural	Datos/Gestión de conocimiento
24.	En 2017	En Fenalce	se comienzan a realizar análisis neuronales para frijol en Santander y para Córdoba se hizo para maíz.	Se concluyo que el manejo de rastrojos, control de malezas, fertilización son practicas claves que determinan el cultivo de frijol. En maíz que la cantidad de fertilizante nitrógeno y potasio marcaban la diferencia.	Se desarrolla un convenio para realizar un análisis de integral de sistemas productivos para adaptación a cambio climático, un componente era el de agricultura digital. Esto con Min de Agricultura, Fenalce y CIAT. Se capacitan técnicos de Fenalce en este convenio.	Cambio estructural	capacidad instalada
25.	En 2017	En la Universidad Nacional de Colombia - Sede Palmira	se empieza a enseñar el tema de minería de datos en la universidad	Previamente no se conocía del tema, había interés por acercarse por parte de la Universidad	Desarrolla un curso intersemestral para la UNC-Palmira	Cambio estructural	nueva área de conocimiento

26.	En 2017	El equipo de investigación sobre ganadería en El Cauca de la Universidad Nacional de Colombia - Sede Palmira	transforma el trabajo sobre sistemas ganaderos integrando muchas variables, muchos volúmenes y mucha diversidad de datos	Se venía de una escuela tradicional trabajando con diseño estadísticos, el equipo de la universidad se enfrenta a nuevas metodologías de trabajo.	Acompaña y capacita a los equipos de investigación sobre ganadería en la UNC-Palmira en la integración de múltiples variables: clima, biológico, sistemas ganaderos, etc.	Cambio estructural	capacidad instalada
27.	En 2017	El equipo de investigación sobre ganadería en El Cauca de la Universidad Nacional de Colombia - Sede Palmira	incursiona en nuevos procesos de captura de datos, utilizando sensores en animales para datos de la relación entre clima y comportamiento del ganado.	Se empieza a tener datos continuos 24 horas del efecto del clima, con base en datos de CENICAÑA) en el comportamiento y las variables fisiológicas del ganado. Se deja de requerir de tiempo de familias ganaderas para la toma de datos, se utilizan sensores en la oreja y sensor con collar (el primero funciona muy bien el segundo no funciona)	Contribuye con el diseño y el acompañamiento al proyecto con Colciencias que presenta el UNC-Palmira, así como con el proyecto en alianza con una Universidad de Italia (nombre no facilitado).	Cambio estructural	datos

28.	En 2017	Las y los productores asociados a Fedearroz	empiezan a recibir recomendaciones específicas por zona, por variedad, por práctica productiva, etc. de manejo más eficientes para la competitividad a partir de predicciones que surgen del análisis de múltiples datos.	Se logra predecir con precisión y recomendar con certeza de forma muy específica logrando apoyar la eficiencia de los y las productores arroceros	Desarrolla un proyecto con Fedearroz y el apoyo del Ministerio de Agricultura que permite desarrollar modelación de datos para el gremio arrocero a partir de censos arroceros, otros datos recopilados durante de 8 años mezclados con datos de clima y datos de las estaciones meteorológicos de la Federación para construir modelos y lograr predicción y recomendaciones.	Cambio estructural	Capacidad instalada
	En 2017	Agrícola Miramontes en Nicaragua	adoptan rutinas de trabajo con Random Forest para la toma de decisiones de cultivo a cultivo y trabajan en el tema de fertilización con parcelas demostrativas para abordar la escasez de datos	evidencia la importancia de capacitar a ingenieros agrónomos que se interesan y se comprometen con el tema. En este caso, gracias a las características de esta persona se logran resultados.	capacita en análisis de minería de datos para la agricultura al ingeniero agrónomo de Agrícola Miramontes.	Cambio estructural	Capacidad instalada

30.	En 2017	El INTA-Ar y CREA	aprender a limpiar datos y dispone de una base depurada y de calidad que provienen de varios años de captura con muchas agricultores-as de arroz (10 años, 10 empresas)	Ayuda a comprender la importancia de los datos, su estandarización, la calidad del dato, entre otros	Acompaña y capacita al INTA- Ar y logra un convenio INTA-Ar. CREA-CIAT para poder utilizar bases de datos de CREA	Hito	Datos
31.	Desde 2017	Los técnicos de Fedearroz	pasan de utilizar datos en Excel, papel y software básico al análisis de minería de datos, análisis multivariados, modelación y predicción de datos	Fedearroz ha incorporado el análisis de minería de datos combinando datos que antes no había integrado.	Desarrolla un proyecto con Fedearroz y el apoyo del Ministerio de Agricultura que permite desarrollar modelación de datos para el gremio arrocero a partir de censos arroceros, otros datos recopilados durante de 8 años mezclados con datos de clima y datos de las estaciones meteorológicos de la Federación para construir modelos y lograr predicción y recomendaciones.	Cambio estructural	Datos/capacidad instalada

32.	Desde 2017	Fedearroz	va más allá de los datos económicos, los empieza acombinar con datos de georeferenciación y de clima para hacer análisis de minería de datos, modelación y predicción para generar mejores recomendaciones a productores-as.	Fedearroz ha incorporado el análisis de minería de datos combinando datos que antes no había integrado.	Desarrolla un proyecto con Fedearroz y el apoyo del Ministerio de Agricultura que permite desarrollar modelación de datos para el gremio arrocero a partir de censos arroceros, otros datos recopilados durante de 8 años mezclados con datos de clima y datos de las estaciones meteorológicos de la Federación para construir modelos y lograr predicción y recomendaciones.	Cambio de comporta miento	Datos/capacida d instalada
33.	Desde 2017	Más de 1000 personas de entidades y países diversos interesadas en agricultura digital	disponen de un espacio para fortalecer el intercambio de metodologías, fortalecimiento de conocimientos, innovación con datos para agricultura.	La comunidad de práctica ha permitido un trabajo más unificado a nivel regional y que construye alrededor de los posibles impactos de la agricultura digital, así como sus facilitadores e inhibidores en cada país.	El Proyecto, a través de su director, lidera y facilita esta comunidad de práctica que fortalece infraestructura para la construcción de conocimientos y repositorios de bases de datos abiertos para la investigación.	Entrada	Gestión de conocimiento

	Desde 2017	Fedearroz	anualmente hace análisis de datos más finos y profundos, se utilizan datos que existían y no se usaban, se analizan diferente y cada nuevo dato que se genera se une a los de años anteriores.	Esto es importante porque se supera el análisis general que se hacía previamente. Por ejemplo, se buscan factores climáticos específicos en zonas específicas donde hubo algún problema de producción.	Desarrollo las capacidades y el interés por la modelación de datos y el análisis de minería de datos para el arroz, a partir del proyecto ejecutado con Fedearroz y el Ministerio de Agricultura.	Cambios estructural	Capacidad instalada
35.	Desde 2017	Fedearroz	siente más seguridad y confianza en las decisiones que toma debido a que estas están cada vez más respaldadas por el análisis de minería de datos.	Se va desarrollando una nueva agricultura basada en el análisis de datos	Desarrollo las capacidades y el interés por la modelación de datos y el análisis de minería de datos para el arroz, a partir del proyecto ejecutado con Fedearroz y el Ministerio de Agricultura.	Cambio de comportamiento	Capacidad instalada
36.	Desde 2017	Fedearroz	ve la necesidad de capacitar a técnicos e investigadores en minería de datos	Se desarrolla una capacidad instalada que va especializándose en minería de datos y arroz	evidencia la necesidad de tener estas nuevas capacidades para una nueva agricultura	Cambio de comportamiento	Capacidad Instalada

	En 2018	Asohofrucol	continúa fortaleciendo la agricultura específica por sitios con un nuevo proyecto, ampliando la base de datos de 2000 a 4500 productores, incluyendo nuevos datos, nuevos cultivos (mora, pasiflora, plátano), nuevas regiones y desarrollando un sitio web.	Se incorpora la agricultura específica por sitios y el manejo de minería de datos en los gremios	Desarrolla un proyecto con Asohofrucol y deja capacidad instalada.	Datos	capacidad instalada
38.	En 2018	100 familias productoras de maíz asociadas a Fenalce	Deciden no sembrar en la segunda cosecha atendiendo las recomendaciones en tiempo real que se generan a partir del análisis de datos que mezcla clima, zona, variedad, entre otros evitando una potencial pérdida.	Es importante porque hay una toma de decisiones más acertada que impacta en la producción ya que se puede reaccionar a la variabilidad climática con más tiempo.	El proyecto estableció una respuesta de voz (voz response) basado en móviles dirigido a las familias productoras de maíz a partir del análisis de datos relacionando clima, tiempo, variedad de maíz y zonas geográfica.	Hito	Datos

39.	En 2018 datos	La Semillas El Potrero en Perú	mezcla datos de agua-riego y datos de clima con los datos de producción y confirma que sus recomendaciones para las prácticas agronómicas en cultivo de arroz son apropiadas (época de riego, altura de lámina, planificación de canales y drenajes, entre otros) .	La Semillas El Potrero no había combinado datos de clima ni de agua (riego, fuente de riego, por ejemplo) con datos de producción previamente, el proyecto demuestra toda la potencia de utilizarlos y combinarlos.	El proyecto combina datos de las estaciones meteorológicas con datos de producción y datos de agua como número de riegos, fuentes de riego, monitoreo de caudales así como levantamientos sobre germoplasma de Semillas El Potrero para generar recomendaciones para el mejoramiento de prácticas agrícolas en arroz de riego.	Hito	Gestión de conocimiento
40.	En 2018	Familias productoras de Semillas El Potrero	Se convencen de la importancia de la toma de datos sobre agua-riego en sus propios terrenos para tomar mejores decisiones	Se hace evidente la importancia de los datos de campo para el mejoramiento de prácticas agrícolas y estas son aceptadas por las familias productoras	Hace acuerdos con la Semillas El Potrero para establecer puntos de datos de agua y complementar los que ya se recopilaban en El Potrero	Hito	Datos
	En 2018	El CCAFS	demuestra los logros del trabajo coordinado entre centros de investigación del CGIAR a partir del	Uno de los mandatos del CCAFS es el trabajo coordinado entre centros	trabaja coordinadamente con el CIMMYT	Hito	Gestión de conocimiento

			ejemplo del proyecto y el CIMMYT				
42.	En 2018	La Semillas El Potrero en Perú	La Semillas El Potrero -Perú combina fecha de siembra con datos climáticos con base en datos de 3 años que no se usaban y determina que es determinante para la productividad del arroz	también es importante comprobar las prácticas que se están realizando apropiadamente	Desarrolla proyecto para contribuir con la competitividad del arroz de riego del Perú por medio de la implementación de agricultura climáticamente inteligente con Semillas El Potrero , FLAR, INIA-Perú para el caso de arroz de riego.	Hito	Datos/Gestión de conocimiento
43.	En 2018	El INTA-NI	hace capturas de datos cotidianas con información georeferenciada para integrarla en el uso de minería de datos en los procesos de diagnóstico.	Se empieza a generar nuevos datos de maneras más ágiles que se pueden utilizar cotidianamente	Desarrolla herramientas para la captura de datos sobre riego con información espacial.	Cambio estructural	Datos/capacidad instalada/gestión de conocimiento
44.	En 2018	Fedearroz	toma la decisión de comprar servidores propios y mejorar las computadoras para fortalecer el análisis de minería de datos dentro del mismo fedearroz	Se desarrolla capacidad instalada para el manejo de datos, antes se alquilaban servidores	demuestra la importancia del análisis de minería de datos para el sector y genera una necesidad	Cambio estructural	Gestión de conocimiento

45.	En 2018	Familias productoras asociadas a Fedearroz	solicitan cada vez más datos y con mayor frecuencia para apoyar sus decisiones de producción.	Se genera una cultura de datos y se ejerce el derecho al dato para la agricultura	demuestra la importancia del análisis de minería de datos para el sector y genera una necesidad en los productores-as	Cambio de comporta miento	Datos
	Desde 2018	El CIMMYT en México	hace recomendaciones a familias productoras integrando análisis de minería de datos en la mesa técnica agroclimática de México	Se trabaja colaborativamente con las mesas técnicas agroclimáticas	Apoya al CIMMYT en el trabajo de minería de datos y agricultura para fortalecer las recomendaciones a productores-as que hace la Mesa Técnica Agroclimática	Hito	Gestión de conocimiento
47.	En 2018	El CIMMYT en México	combina capacidades y recursos con el proyecto de AD demostrando el potencial de la integración entre centros y obtienen el premio de Innovación in Analytics.	Demuestra el valor de la integración de los centros del CGIAR, no se esperaba el premio porque se competía contra grandes empresas privadas	trabaja en conjunto con el CIMMYT utilizando datos recopilados por ellos mucho tiempo, se complementan muy bien como centros CIAT.	Hito	Capacidad instalada/gestió n de conocimiento
48.	En 2019	El INTA-NI	El INTA-NI concluye que es mejor: a) el sistema por chorrillos, b) la variedad INTA-I9 y c) no usar los sistemas por boleo	Se mejoran los procesos de producción sabiendo qué variedad, con qué sistema de siembras para qué zona a	Acompaña y desarrolla capacidades de los equipos del INTA-NI	Hito	gestión de conocimiento

			para determinadas zonas, combinando más variables para modelar mejor.	partir de análisis más complejos y menos empíricos			
49.	En 2019	El Instituto Técnico Agrícola en Buga	acredita en el Ministerio de Educación de Colombia un nuevo programa de formación con 3 niveles (profesional, tecnólogo, técnico) y en agricultura que tiene como columna vertebral la agricultura digital.	una universidad rural incorpora las tecnologías digitales como base de su carrera en agricultura generando oportunidades para la juventud de la región de adquirir nuevos conocimientos y propiciando el desarrollo rural basado en la tierra	Apoya el desarrollo de la nueva curricular y apoya a la UTA-Buga en la presentación de su nueva carrera. Le dan el apoyo generando credibilidad.	Cambio estructural	capacidad instalada
50.	Desde 2019	El INTA-Nicaragua	empieza a utilizar software libre y realiza análisis con R y utiliza algoritmos de minería de datos para análisis específicos y scripts desarrollados por el Proyecto (diagramas de caja, modelos de regresión, aleatorización, entre otros) para	Se integran análisis de minería de datos en Nicaragua	Capacita a técnicos del INTA en Nicaragua en minería de datos, R, multivariables, entre otros	Cambio estructural	Gestión de conocimiento/capacidad instalada

			experimentos, correr datos y construir datos				
51.	Desde 2019	El INTA-Nicaragua	moderniza la toma de datos para elaboración de líneas base para la modelación de cultivos utilizando captura de datos con móviles y ODK ahorrando tiempo y haciendo más eficientes y seguros los datos	Se hace más seguro y eficiente el análisis	Capacita a técnicos del INTA en Nicaragua en ODK	Cambio estructural	Datos/ gestión de conocimiento/ capacidad instalada
52.	Desde 2019	El INTA-Nicaragua	le da más importancia a los datos que generan las estaciones meteorológica, los datos térmicos, de acumulación de calor que combinados con datos tradicionales mejoran el monitoreo de cultivos	Previamente no se sabía hacer estas tomas de datos, ni la importancia que podían tener	Capacita a técnicos del INTA en Nicaragua en minería de datos, R, multivariables, entre otros	Cambio de comportamiento	Datos/ gestión de conocimiento /capacidad instalada

53.	Desde 2019	El Instituto Técnico Agrícola en Buga	aumenta exponencialmente la matrícula y se reduce la deserción, además aumenta la matrícula de mujeres.	Las personas jóvenes se están llendo hacia Cali que es la capital y además no quieren dedicarse a la agricultura. La UTA-Buga quiere apunta a atraer a la juventud de Buga hacia la agricultura y a permanecer en la zona a partir de la incorporación de las tecnologías digitales en la carrera de agricultura.	Apoya el desarrollo de la nueva curricula y apoya a la UTA-Buga en la presentación de su nueva carrera.	Cambio estrcutural	gestión de conocimiento/capacidad instalada
54.	Desde 2019	El Instituto Técnico Agrícola en Buga	fortalece su credibilidad y posicionamiento en agricultura digital participando en diversos llamados a proyectos sobre el tema	una universidad rural incorpora las tecnologías digitales como base de su carrera en agricultura generando oportunidades para la juventud de la región de adquirir nuevos conocimientos y propiciando el desarrollo rural basado en la tierra	El proyecto no solo le da el respaldo a la UTA-Buga, sino que presenta proyectos en conjunto e incluye a la universidad en diversas oportunidades.	Cambio de comportamiento	gestión de conocimiento/capacidad instalada

55.	En 2020	Familias productoras de diferentes países y cultivos	cada vez están más interesadas en los datos, los demandan y además los generan a través de fotos, tomas empíricas, comunicación entre ellos-as.	Hay una necesidad importante de fortalecer el derecho al dato de las familias agricultoras y un ambiente y condiciones propicias para la agricultura digital.	Ha generado datos que llegan a las familias productoras y que los entienden y necesitan	Cambio de comporta miento	datos
56.	En 2020	Fedearroz	utiliza el modelos de datos para predecir enfermedades relacionadas con clima y así prevenir a las y los productores de acuerdo a los pronósticos climáticos.	Se logra preparar para 12 enfermedades del arroz relacionadas con factores climáticos antes de que sucedan reduciendo así pérdidas y productividad.	ha desarrollado el interés de Fedearroz en el análisis, modelación y predicción de minería de datos	Hito	Capacidad Instalada
57	En 2020	La Universidad Técnica Agrícola - Buga	ha construido un laboratorio digital en un complejo agroindustrial con software de modelación, manejo de imágenes, computadoras de alta capacidad, para la agricultura digital.	una universidad rural incorpora las tecnologías digitales como base de su carrera en agricultura generando oportunidades para la juventud de la región de adquirir nuevos conocimientos y	Apoya el desarrollo de la nueva curricula y apoya a la UTA-Buga en diversas decisiones sobre la evolución de la carrera (visibilidad, adquisición de equipo y software, integrándolo a proyectos)	Hito	Capacidad instalada/gestió n de conocimiento

				propiciando el desarrollo rural basado en la tierra			
58	En 2020	el INTA-Nicaragua	diseña la unidad de biometría incluyendo equipos necesarios, minería de datos, equipo de trabajo, entre otros	El INTA- Nicaragua diseña su unidad de biometría con los más altos estándares de calidad	Apoya con sugerencias y recomendaciones para la creación de las unidad de biometría	Hito	Gestión de conocimiento
59	En 2020	El INTA-Ar	está creando un programa llamado data -arroz para trabajar en la calidad de los datos desde su captura.	Se da prioridad a la estandarización, limpieza y calidad del dato para tener mejores análisis	genera la experiencia de limpieza de datos y calidad del dato en los cursos de capacitación demostrando la importancia de esta áreas y esto impulsó esta idea de programa	Hito	Gestión de conocimiento/capacidad instalada
60.	Desde 2020	En la Universidad ICESI	crea el Programa de Ingeniería Agronómica incorporando el tema de ciencia de datos para agricultura como uno de sus pilares	Se cubre el vacío en analítica y manejo de datos para la agricultura desde recopilar datos, hasta su análisis y sus diferentes aplicaciones a la agricultura. Se busca contribuir a que las personas jóvenes vuelvan al campo.	Asesora el desarrollo de Programa. Junto con la comunidad de práctica desarrolla el perfil del extensionista del futuro que se utiliza para crear el programa de la nueva carrera.	Cambio estrcutural	Gestión de conocimiento/capacidad instalada

64	En 2020	Fenalce	Implementa eagrology para el análisis de datos en tiempo real	Los datos para la toma de decisiones son exactos, actualizados y complejos	Desarrolla SIRIA, un repositorio de datos que sirve de base para eagrology	Cambio estructural	Transformación institucional

Persona entrevistadas para la cosecha de alcances

Nombre	**representación**
Jesús Rivera	ASOHOFRUCOL
José Maya	Sector Público - Colombia
Santiago Jaramillo	Nicaragua (arroz)
Thibault Schowing	Estudiante Suiza
James Cock	CGIAR
Deissy Martínez	CGIAR - CCAFS
Bryan King	Líder de la plataforma de Big Data
Chris Miyinzi	Ex Asistente CIAT Kenya
Raul Andres Molina Benavides	Universidad Nacional de Colombia
Crista Davila	INTA - Nicaragua
Nicolas Martin	Universidad de Illinois
Andrea Gardeazabal	CYMMIT - México
Patricia Guzmán	Fedearroz
Eduardo Graterol	Fondo Latinoamericano de Arroz de Riego (FLAR)
Armando Tai	Inta - Argentina
Hugo Raúl Kruger	Inta - Argentina
Carlos Burzzone	Hacienda El Potrero (Perú)
Jaime Andrés Tigreros	ITA BUGA (educación universitaria)
María Camila Gómez	ICESI
Rodrigo Gosalez Trevisan	Pasantes (Suiza, Colombia, México, Francia EUU)
Alvaro Londoño	Consultor Independiente/secretario de agricultura de Rizaralda - Colombia
Juan Ariel Oporta Palacios	INTA - Nicaragua
Silvia Pineda - Adriana Varón	CGIAR - Comunicación
Oscar Estrada	Fenalce