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## Integrated Data System Report October 2017

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## Executive Summary

Since its 2010 launch Sistema.bio has installed over 3,500 biodigester systems in Latin America, Africa, and India. Multiple benefits accrue to small and medium sized farmers from these systems, including energy security, economic empowerment and health improvements, as well as significant reductions in undesired emissions and effluents. With established distributors in Mexico, Nicaragua, Colombia, and Kenya, Sistema.bio is currently extending its distribution and social, economic and environmental impact with pilots in other countries as well.

As demand grows and installations extend to more and different regions, Sistema.bio will increasingly be required to keep operations precise and training/reference material available and user friendly. Both demand growth and regional variations will challenge Sistema.bio to keep its attention focused on reaching more customers and maintaining a high quality of data and impact reporting. Data collection necessary for both individual installations and company-wide impact reporting will continue to be a mission critical part of Sistema.bio's operating model.

The objective of our research was to observe the data collection process, both in Mexico, at headquarters in Mexico City and the Puebla field office, and in Nicaragua, and to identify any weaknesses and corrective actions that can be taken, operationally and strategically.

Observations were gathered during ten interviews of Sistema.bio employees, eighteen field visits to test new survey formats, translating and improving five user manuals, and an analysis of the Salesforce database. This report represents our findings and recommendations with respect to each step of the integrated data system in the broader context of scaling.

In order to analyze each step of the data collection process and illustrate how functions are connected, we have identified five key components.

1. Source of data
2. Collection
3. Storage
4. Retrieval
5. Analysis & reporting

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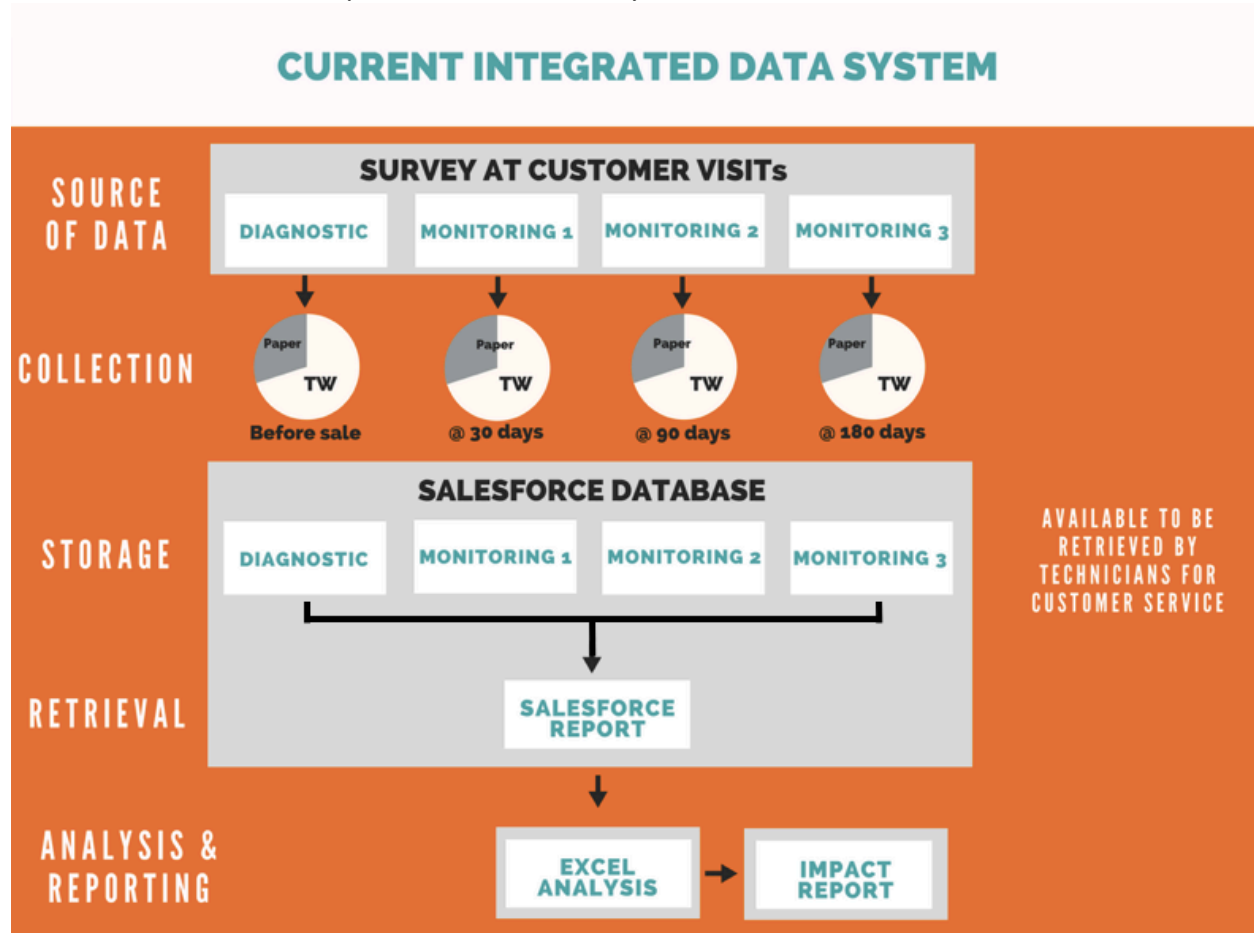


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## Current Integrated Data System

The following flowchart depicts the system with the five key components based on current observations. The system is integrated, making it efficient and allowing data to be utilized to its fullest potential. However, the dependability of later functions on previous processes also makes it vulnerable. Our recommendations are intended to allow Sistema.bio to reduce vulnerabilities for a more precise and efficient system.



**Figure 1. Current Integrated Data System.**

This flowchart depicts the Integrated Data System based on observations made during our time spent in the field in both Mexico and Nicaragua.



Sistema.bio collects data from customers through surveys administered by technicians and salespeople via smartphone or paper survey. Sistema.bio currently uses an application called TaroWorks which enables the collection of data in the field and the customer relationship management platform Salesforce to aggregate storage and retrieval. This information is then used to inform the sales and installation process and facilitates impact measurement and reporting.

Data collection occurs during a pre-sale diagnosis, and 30, 60, and 180 days following installation. The data collected during each survey serves a particular purpose. The data collected before the sale of the biodigester, or the “long diagnostic,” helps to identify the system which will best suit the customer’s needs based on their livestock, energy requirements, and other criteria. The first and second monitorings, occurring at 30 and 60 days after installation respectively, help to ensure that the system is functioning properly and to diagnose any problems. The third monitoring, combined with data from the long diagnostic, allows Sistema.bio to measure impact and to gain valuable feedback from the customer about system functionality and customer satisfaction.

Prior to July 2016, these four surveys were conducted on paper and were manually uploaded to the Salesforce database. As of July 2016, surveys are being conducted using TaroWorks via an Android smartphone, and collected data is now able to be synchronized with the Salesforce database when an internet connection is available. Surveys are still conducted on paper in some cases, however, for example, when training new employees.

The data that is collected is also used to generate impact reports. Impact is currently measured by extracting a report from Salesforce, which is then exported to an Excel sheet “impact calculator.” In Excel, calculations can be completed and presented in the form of an impact report. Figure 1 illustrates the current method of data collection and use, which we will refer to as the “integrated data system.”

## Potential for Scaling

Aside from everyday operations, the data collection process can enable or handicap the scaling potential of Sistema.bio. By ensuring that data collection is occurring efficiently and accurately, customer service and impact reporting can also occur efficiently and accurately in new locations.



Survey testing in Nicaragua highlighted the critical importance of adapting surveys for more than linguistic differences. Addressing cultural differences is also essential. By doing so, a local field office can increase its ease of survey administration and gather more accurate data. To do this, prior to opening a new field office, a focus group of potential customers could be organized to reveal important issues of cultural context that need to be addressed in local operations and data collection. In addition, it may be worthwhile to conduct a pilot for testing surveys, with a subsequent period of revision and testing of surveys in each new region. These two actions would allow for more efficient operations and data collection, and accelerate scaling. Subsequent to the first draft of this report, Sistema.bio has undertaken several initiatives to address cultural differences in new field operations.

Using employee surveys and continued feedback can also be helpful in understanding how the data collection process is functioning in new settings. This can uncover obstacles, including cultural differences and misunderstandings of policies and procedures. From a distance, it can be difficult to understand how well procedures and policies are being followed. In-person interviews are ideal as they are more personal than a video-conference. Additionally, it could be helpful to have an independent group conduct these interviews. Employees who are worried about job-evaluation might not be as forthcoming to supervisors.

Limiting the use of paper surveys can also produce more accurate data in new regions, because this allows the TaroWorks survey developer more control over how the technician conducts the survey. Paper copies may be helpful during training or in probationary settings, but moving away from them as soon as possible is advised.

Another issue that arises during scaling is the accessibility of technical support. With a small number of offices, it can be feasible for headquarters to address each occurrence of technical problems with the CRM tools. As Sistema.bio expands, this will take a great deal of time from employees at the Mexico City office. Establishing a protocol for requesting technical support can create a hierarchy of resources and ensure that time is used efficiently. Interviewing employees on their level of satisfaction with this protocol can also be helpful after opening a new office. Understanding what employees like and dislike about the technical support resources can reveal areas for improvement.

Last, but not least, an accurate and thorough translation and localization of all database functions, surveys, manuals, and all other materials ensures that new offices can work as



independently and efficiently as possible. Failure to localize resources can lead to confusion and ultimately will require more time and resources to address problems as they arise.

## Integrated Data System

### 1. Survey Questions

During July 2017, Sistema.bio was in the process of revising the survey questions from the diagnostic and monitoring 3, the two surveys crucial for impact reporting. The first round of revisions was informed by current knowledge and understanding of impact reporting practices from Sistema.bio's and our recommendations based on our analysis of the Salesforce database. New questions and survey formats for the diagnostic and monitoring 3 were created. We then tested these new survey formats in Mexico, in the state of Tlaxcala, and in Nicaragua and found important cultural differences between Mexico and Nicaragua that even within the Mexican context were not reflected in the wording of the question or response options. Subsequently, Sistema.bio has undertaken several initiatives to address these challenges, including addressing cultural and country differences (see "Potential for Scaling" above), and improving the diagnostic and monitoring 3 to take different unit measures and addresses into consideration, and revising the full database of GPS coordinates to map clients. Taken together, these initiatives substantially address the recommendations emerging from our field observations, below.

#### Addresses in Nicaragua

One such area of difference was addresses. In Nicaragua, farms usually have a name. This helps the technician to locate the farm, but there is no field in TaroWorks to input a farm name. Instead, technicians record the farm name in fields intended for other responses. This could potentially inhibit quick and accurate data analysis.

Additionally, Nicaraguan addresses are essentially directions. They begin with a reference point and note direction and distances in blocks relative to a reference point. The current survey also includes the questions "how to arrive by car" and

“how to arrive by public transport.” In Nicaragua, these questions are redundant as the address itself states how to arrive.

The fields “address” and “other address” can also be a source of confusion and inconsistency. In many cases in Nicaragua, the farm owner does not live at the farm. The survey does account for two addresses, but it is unclear whether the farm or the place of residence should be the primary address”.

One possible solution would be to simply create an optional field for farm name. Another option would be to include a question that asks if the farm owner lives at the farm. If so, it could become the standard procedure that only this address is needed. If not, a conditional question (triggered by the answer ‘no’) should ask for farm owner’s residence.

### Units of Measurement in Nicaragua

Another area of difference between the Mexican and Nicaraguan context relates to units of measurement. For example, the survey asked for firewood used in kilos, but most Nicaraguans are not familiar with the weight in kilos of the firewood they use. When asked for an estimate they could not make a guess. Instead, they measure the wood in “*rajas*” or branches. The current solution to this problem is for the team of technicians to decide upon a standard conversion ratio. It became the rule for the surveyor to convert each *raja* to 1.5 kg. This seems like an adequate solution, as long as the conversion is constant among all technicians. A note specifying the conversion ratio included in the survey would help ensure consistency.

The survey also asks for LP gas consumption in kilograms. In Nicaragua, the most common way for clients to measure gas usage is in tanks. Tanks come in measurements of 10, 25, and 100 lbs. One solution would be to include a note specifying a conversion ratio of pounds to kilograms. Another solution would be to have two different versions of each survey, one to be used in Mexico and one to be used in Nicaragua. However, this may become inefficient as Sistema.bio opens offices in more countries.

### Units of Measurement in Tlaxcala, Mexico



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Other differences we noted between what was reflected in the survey and how clients in Tlaxcala responded. For example, they usually used liters, tons or *bultos* to measure fertilizer rather than kilograms.

In regards to electricity usage, most customers are not familiar with how many kWh they use, only how much they pay. A note encouraging the surveyor to ask them to check their bill could help. Additionally, most customers mentioned that they pay for electricity only every two months, while the survey asks for monthly cost. Recording the amount with an incorrect frequency leads to inaccurate monthly cost. In this case, a reminder to clarify frequency of payment could be helpful.

About half of customers think of their water storage in cubic meters rather than liters. Additionally, some customers in Tlaxcala have access to potable water, but only every third day. It may be worthwhile to add a conditional question about the how often the customer has access to potable water.

#### Changing the filter (Mexico & Nicaragua)

When asked when the filter on the gas line was last changed, many customers responded that they had never changed it. In most cases, when it was clarified what exactly the filter was, they were surprised. It turned out that most clients had changed the filter at least once. Adjusting the question to describe what the filter is and where it is located could clarify confusion.

## 2. Training and Reference Materials

We translated the TaroWorks and Salesforce user manuals to English for use in non-Spanish speaking countries, and improved the both Spanish and English versions by adding screenshots of specific steps in procedures and filling in missing steps and details. This process helped us gain familiarity with the tools used in the data collection process as well as the supplementary materials available to the users.

While using the existing manuals to work through the procedures on TaroWorks and Salesforce, our unfamiliarity with the process, similar to that of a new employee, allowed us to notice gaps in information. We also noticed that some of the nuances of

the applications were not all addressed in the manuals. Without screenshots, the manuals were text heavy and the steps were sometimes unclear. We added screenshots and filled in missing steps to improve the usability of the manuals.

While it is feasible now for employees at headquarters to be the main resource in addressing the questions of Salesforce and TaroWorks users, this will become less efficient as Sistema.bio continues to expand and more Salesforce and TaroWorks users are added. Therefore, we recommend that Sistema.bio focus its efforts on improving the manuals to the point that they can serve as effective tools users feel comfortable referring to in solving problems on their own.

At the Nicaragua and Puebla field offices, we conducted interviews of the employees in order to better understand their data collection methods, and their use and level of satisfaction with the manuals. In general, employees did not currently use the manuals, even when they knew they should or thought that it might be helpful. They mentioned that instead, they prefer to ask a coworker or contact headquarters for help. Other employees mentioned that they did not have a copy of the manual or had a digital copy “somewhere”. Those who did have copies of the manual and had used them before mentioned that they were not particularly useful. In regards to TaroWorks, some employees reported that the app was so simple that a manual was not necessary. In regards to Salesforce, they mentioned that the steps were unclear, missing altogether, or needed more detail. Others asked for a more comprehensive coverage of topics, including how to run Salesforce reports.

In general, we found that the user manuals were not being used to their full potential. This caused employees at the Mexico City office to spend unnecessary time providing technical support. Improving the usability of the manuals was the first step in improving this situation. We have since translated and re-formatted manuals in various areas. It would be worthwhile for Sistema.bio to test these manuals and gather additional feedback for further improvement.

A solution that was suggested by Sistema.bio was to designate a TaroWorks and Salesforce “champion” at each location. This champion would be someone who uses and is familiar with each tool and can serve as a resource for technical support for the rest of the team. Training employees to first refer to the manuals, and second, consult a TaroWorks or Salesforce champion, and as a last resort, contact the Mexico City office,



the process of troubleshooting technical problems will become more systematic and efficient.



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### 3. Data Collection

Through our analysis of the Salesforce database, we found the biggest determinant of how complete each survey was whether the survey was completed on paper or using TaroWorks. We also drew observations about the use of paper surveys through our own testing of surveys and interviewing employees who had conducted surveys using a paper form or were involved in processing these surveys.

Pre-TaroWorks, surveys were completed on paper and were manually uploaded to the Salesforce database for reference. TaroWorks allows data to be collected offline via smartphone and can later be synchronized with the Salesforce database when an internet connection is available. Surveys that were completed after the switch to TaroWorks as the survey medium were much more complete than the surveys completed before the switch.

Certain functions of TaroWorks e.g. “required” questions, conditional questions and specified answer input types increase the quantity and quality of data. The questions appear one question at a time, which is less distracting and reduces confusion about question order. Questions can be set to “required” status and in this case, an answer must be recorded before moving on to the next question. Logical question mapping also includes certain conditional questions based on previous answers, reducing the quantity of unnecessary questions and saving time. An answer input type (text, numerical, date, photo) is specified; answers can only be recorded in the specified format.

Before going out to the field, we assumed that all surveys were being conducted on TaroWorks since the adoption of the application. However, in Nicaragua we discovered through interviews with employees that almost all diagnostic surveys conducted by salespeople were being done on paper. This is because most of the salespeople do not own smartphones, so they conduct the survey on paper and send photos to the head salesperson who then inputs the data into Salesforce. In general, these paper surveys were completed fairly thoroughly. Problems do occur, however, when the surveyor forgets a question or records an unclear or invalid response. Someone from the Managua office then has to call the client or salesperson to collect the missing data. This delays data collected in Nicaragua being uploaded to the company-wide Salesforce database.

Another issue that arises with the use of paper surveys is that a GPS location is not recorded as it can be in TaroWorks. This problem can be solved by including a “job” on TaroWorks which contains only GPS coordinates so that they can be updated on subsequent visits.

Paper surveys are also used by potential hires. Candidates are allowed to use paper surveys rather than TaroWorks during a probationary period. Paper surveys are also used in the case of a technical issue with TaroWorks, though this is rare.

Through analyzing data from both before and after the adoption of TaroWorks we found that using TaroWorks significantly improved the completeness of the surveys. In addition, we interviewed employees regarding their experiences, and employees were generally very satisfied with the application, stating that it was efficient and looked professional. In general, dissatisfaction with TaroWorks came from technical issues such as the application being slow or freezing, but this was limited. There was also a desire for additional capabilities within TaroWorks, though generally, employees expressed that they received timely and adequate technical support and, as a result, were very understanding of technical issues.

Due to the ease of use, efficiency, and integrity of data, we recommend working towards eliminating the use of paper surveys as much as possible. In Nicaragua this can be facilitated by providing salespeople with company-issued smartphones or providing incentives such as additional commissions or a subsidy for employees who obtain one on their own.

#### 4. Data Storage & Retrieval

While Salesforce, as used by Sistema.bio, is relatively intuitive, one issue arose due to the differences in languages used. The labels in Salesforce that are automatically translated when the language setting is changed don’t always translate properly. In addition to this, some labels such as the opportunity “Procesos de Venta” are difficult to change to different languages in Salesforce and could potentially be confusing as Sistema.bio expands to other non-Spanish speaking countries. As more and more Sistema.bio employees begin to use Salesforce, in at least two different languages, the more these errors will be amplified.



For these reasons, it would be best to correct these small errors as soon as possible so that as more and more users are introduced to Salesforce they won't have to learn as many nuances in the terminology. This will allow them to focus on learning how to use the application to accomplish what they need to do and complete tasks as efficiently as possible.

In our interviews with employees, some people expressed dissatisfaction with not having access to all accounts in the field. They also expressed a desire for the capability to search for records by city and community in TaroWorks. After syncing to Salesforce, employees are no longer able to access survey data from TaroWorks. Because they expect needing this data later, there is a deliberate delay in syncing the data with Salesforce. Additionally, separate excel sheets are often used by employees without Salesforce accounts to track information even once the data is synced with Salesforce. This could potentially lead to important bits of customer information staying in the excel sheet and never being uploaded to Salesforce.

Part of TaroWorks effectiveness comes from its ability to store data efficiently after collection. For this reason, practices that reduce the efficiency of this process can reduce the accuracy of the database as a whole. By giving Salesforce access to TaroWorks users who might want to retrieve data, e.g. technicians, independent record keeping can be avoided. Another solution would be to create a way for past jobs to be viewed from TaroWorks.

## 5. Data Analysis & Impact Reporting

Currently, impact is calculated by exporting Salesforce reports to Excel where the impact calculator, a sheet containing specific formulas, is used to calculate impact. This method is effective but could be improved by taking advantage of the impact dashboard capabilities of Salesforce.

The table below serves as a blueprint for an Impact Dashboard, that will be generated within Salesforce. This dashboard will show the business's impact real time. Therefore, impact calculations will no longer have to be done manually in Excel, saving time and energy. We have chosen powerful metrics to measure six key areas that Sistema.bio's biodigesters affect. We have mapped which survey questions each metric will draw data



from, and we have chosen representations of the metrics which will resonate with both customers and potential investors.

Impact reporting is the final step in the integrated system in which the data can have the greatest impact. An efficient impact reporting system that produces a powerful representation of the business's impact has the potential to generate more sales, interest partner institutions, and attract investors enabling Sistema.bio to further increase its social impact.



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## Impact Dashboard

Area of Impact	Metric	Comparative Frame	Data Source (Surveys & Questions)
Economic Empowerment	Savings (fuel and fertilizer)	Secondary school tuitions	Long Diagnostic: E4 Monitoring 3: D6, F8 (if yes, then exclude E4)
Waste Treatment	Tons of manure treated by biodigester	Aztec stadiums	Long Diagnostic: None Monitoring 3: C10
Food Security	Hectares of cropland with increased productivity	Area of Mexico City	Long Diagnostic: E2 Monitoring 3: F10 (only E2 if any of F10 has been checked)
Energy Independence	Reduction in hours of dependence on traditional fuel sources	Energy needed to cook X amount of meals	Long Diagnostic: None Monitoring 3: D2, D3
Health	Reduction in indoor pollution from firewood use	Packs of cigarettes	Long Diagnostic: D2 Monitoring 3: D5
Environmental Quality	Tons of CO <sub>2</sub> from propane and firewood displaced by biogas	Cars	Long Diagnostic: D2, D7 Monitoring 3: D5

**Figure 2. Impact Dashboard Framework.**

This table depicts the impact dashboard (Area of Impact and Metric) as well as a comparative frame and the survey questions each metric will draw data from.





## Description of Columns (for Figure 2)

**Area of Impact:** The area of impact defines which of the six key areas (Economic Empowerment, Waste Treatment, Food Security, Energy Independence, and Environmental Quality) of which the metric aims to quantify impact.

**Metric:** The metric is the quantifiable measurement that is used to represent the impact the biodigester has had upon each specific area of impact.

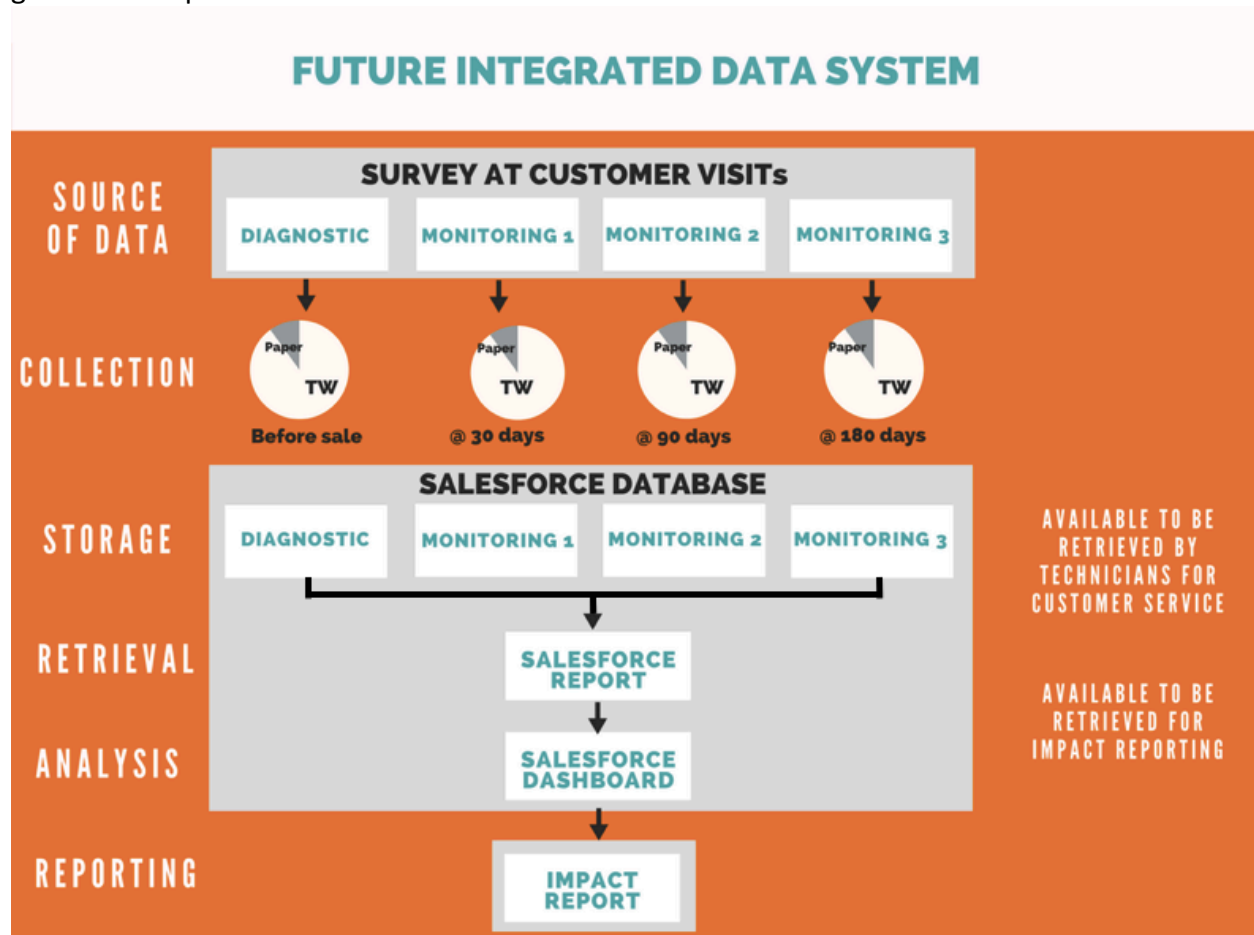
**Comparative Frame:** The comparative frame is the terms under which the metric is understood and how impact can be graphically represented. The comparative frame adds meaning to the metric by communicating impact in terms of something easily recognized and understood.

**Data Source:** The data source indicates the specific questions from both the long diagnostic and the monitoring 3 survey that each metric draws data from. Additional calculations may be necessary depending on the metric.



## Future Integrated Data System

The changes proposed in this report will improve the efficiency and scalability of Sistema.bio's integrated data system by addressing specific weaknesses occurring at different steps throughout the process. The above flowchart represents the functioning of the integrated data system after these changes are made. The most significant differences in the process are as follows; reduced occurrence of paper surveys, and adoption of the use of a Salesforce-generated impact dashboard.



**Figure 3. Future Integrated Data System.** This flowchart depicts the Integrated Data System based on recommendations, including reducing the occurrence of paper surveys and utilizing the Salesforce Impact Dashboard.