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# Report on Social Network Analysis

Deliverable 5.1

# Report on Social Network Analysis

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# 1 Executive summary

The overall aims of WP 5 are to optimize adoption and acceptance of the emerging food safety risk framework developed in HOLiFOOD to identify barriers to, and facilitators of, policy adoption, The WP aims to ensure effective knowledge exchange with the public regarding emerging food safety risk identification.

Deliverable 5.1 is focused on understanding who our key stakeholders are, both in general and, at a greater level of granularity, within the three HOLiFOOD supply chains under consideration in the research programme. To this end Social Network Analysis (SNA) has been used to identify key players in the food systems being considered. The resulting visualisation will show how they relate to and influence each other. Whilst this activity is the focus of deliverable 5.1, we will continue to update the stakeholder database through the course of HOLiFOOD project as the Social Network mapping will provide a resource for activities in T1.1, T3.1, WP 4, and in relation to the dissemination activities in WP 7.

The work reported here used semi-structured interviews, MIRO board supply/value chain mapping workshops, online surveys, and preliminary SNA. This included expert information from project partners on risk assessors, managers, communicators and stakeholders and representatives of consumers, from industry, and civil society. This report provides a “snapshot” of relevant stakeholders and institutions at the time of submission. The authors recognize that this may change as the project mapping of actors, dynamics, relationships, and interactions in the food system will continue. Nevertheless, the research methodology develop in WP5 have been described in details in this report, to support the opening workshops that are complete and the surveys, SNA and visualisation that will follow.

Further work in WP5 will include further semi-structured interviews, MIRO board supply/value chain mapping workshops, online surveys, and SNA using visualisation tools such as Gephi. This phase will directly contact risk assessors, managers, communicators and stakeholders and representatives of consumers, from industry, and civil society; and ensure systematic representation from relevant SMEs sectors are included.

# 2 Introduction

## HOLiFOOD

The overall objective of HOLiFOOD is to improve the integrated food safety risk analysis (RA) framework in Europe to i) meet future challenges arising from Green Deal policy driven transitions in relation to climate driven changes, ii) contribute to the UN's Sustainable Development Goals and iii) support the realization of a truly secure and sustainable food production system. HOLiFOOD will apply a systems approach, which takes the whole environment into account in which food is being produced in relation to both drivers and impacts of emerging food risks, including not only human health but also the economic, environmental, and social aspects. Three supply chains will be considered (i.e., cereals [maize], legumes [lentils] and poultry [chicken]). Artificial Intelligence (AI) and big data technologies will be used in the development of early warning and emerging risks prediction systems for known and unknown food safety hazards. In addition, tools, methods, and approaches will be developed for hazard detection, will be targeted, and non-targeted, and new holistic risk assessment methods will be developed in which food safety risk will be embedded in a comprehensive cost-benefit analysis of the food system including positive and negative health, environment, and economic dimensions. An effective impact pathway will be developed and implemented through integration of the HOLiFOOD outputs into the legal framework associated with the food risk analysis process. The impact pathway will be supported by an electronic data and knowledge sharing platform aiming at the full digitalization of food (safety) systems and supporting transparency and impact for all stakeholders. To align with stakeholder priorities, preferences, and user requirements, the HOLiFOOD innovations will be designed and tested in a multi actor approach (i.e., Living Lab) involving all stakeholders (e.g., authorities, food producers, citizens, and consumers).

## Introduction to this document

The overall aims of WP 5 are to optimize adoption and acceptance of the emerging food safety risk framework developed in HOLiFOOD in order to identify barriers to, and facilitators of, policy adoption, The work package aims to ensure effective knowledge exchange with the public regarding emerging food risk identification.

Deliverable 5.1 is focused on understanding who our key stakeholders are, both in general and, at a greater level of granularity, within the three HOLiFOOD supply chains under consideration in the research programme. To this end, Social Network Analysis (SNA) has been used to identify key players in the food systems being considered, and how they relate to and influence each other.

Whilst this activity is the focus of deliverable 5.1, we will continue to update the stakeholder database through the course of HOLiFOOD project as the Social Network mapping will provide a resource for activities in T1.1, T3.1, WP 4, and in relation to the dissemination activities in WP 7.

The work reported here used semi-structured interviews, MIRO board supply/value chain mapping workshops, online surveys, and preliminary SNA. This included expert information from project partners on risk assessors, managers, communicators and stakeholders and representatives of consumers, from industry, and civil society.

This report details the mixed methods research methodology develop in WP5, to support the opening workshops that are complete and the surveys, SNA and visualisation that will follow.

This report provides a "snapshot" of relevant stakeholders and institutions at the time of submission. The authors recognize that this may change during the project mapping of actors, dynamics, relationships, and interactions in the food system will continue. As such, this report should be considered a 'living document', and iterative, updated versions will be uploaded in the near future as more information is gathered and analyses conducted.

Further work in WP5 will include further semi-structured interviews, MIRO board supply/value chain mapping workshops, online surveys, and SNA using visualisation tools such as Gephi. This phase will directly contact risk assessors, managers, communicators and stakeholders and representatives of consumers, from industry, and civil society; and ensure systematic representation from relevant SMEs sectors are included.

# 3 Methodology

## 3.1 Purpose: WHY

The overall aims of WP 5 are to optimize adoption and acceptance of the emerging food safety risk framework developed in HOLiFOOD to identify barriers to, and facilitators of, policy adoption, The WP aims to ensure effective knowledge exchange with the public regarding emerging food risk identification. To that end we adopted social network analysis at the proposal stage and have refined that further in the opening months of the project.

Social network analysis (SNA) (Simpson and de Loë, 2017; Suyo *et al.*, 2020; Hobson *et al.*, 2021) is the study of social structures using networks and graph theory. It involves analysing and understanding the relationships and interactions between individuals, groups, organizations, or other entities within a social network. This can include analysing the structure of the network, the patterns of connections and communication, and the properties of individual nodes within the network. SNA is used in a wide range of fields, including sociology, anthropology, computer science, marketing, and national security. It's also used in many business and organizations to help understand the relationships between employees, customers, and other stakeholders.

SNA is being used to identify key players in the food systems being considered, and how they relate to and influence each other. Experts and outputs from this Task 5.1 work will be used in Tasks 5.2, 5.3, 5.6, 7.4, and will feature in 'Pathways to Impact' activities.

One way to use SNA for food safety is by mapping out the relationships and interactions between different actors in the food supply chain, such as growers, processors, distributors, and retailers. By analysing these networks, it may be possible to identify potential points of failure or areas where food safety risks are concentrated. Additionally, by identifying key actors and activities within the network, such as major suppliers or central hubs, it may be possible to target food safety interventions or monitoring efforts to these locations.

## 3.2 Key activities: WHAT

We decided to run interactive workshops online about using MIRO with a simple supply chain model to elicit data about relationships between actors is to have participants create a visual

representation of the supply chain using MIRO's digital whiteboard and sticky notes. The facilitator then guided the discussion and asked questions about the relationships between different actors and activities in the supply chain, such as: suppliers, manufacturers, distributors, and retailers; inbound logistics, primary production, outbound logistics, processing, final distribution, and sales. The participants used the visual representation to identify potential points of failure or vulnerabilities in the supply chain and discussed ways to mitigate these risks. This approach allowed a more interactive and visual way to collect data and facilitated discussion and collaboration amongst the participants.

We planned 4 such workshops, a pilot and three more, one for each supply chain: legumes, poultry, and maize. The pilot workshop was designed for the development of the methodology and is reported here.

### Pilot Workshop: Generic Value Chain

This workshop was run online on the 12th of December 2022 with the WP5 leaders and the co-ordinators trialling the approach. The workshop became focused on a generic value chain and as such generated much on food risk. We learnt from the pilot that the structure of the workshop needed to focus more explicitly on activities and actors.

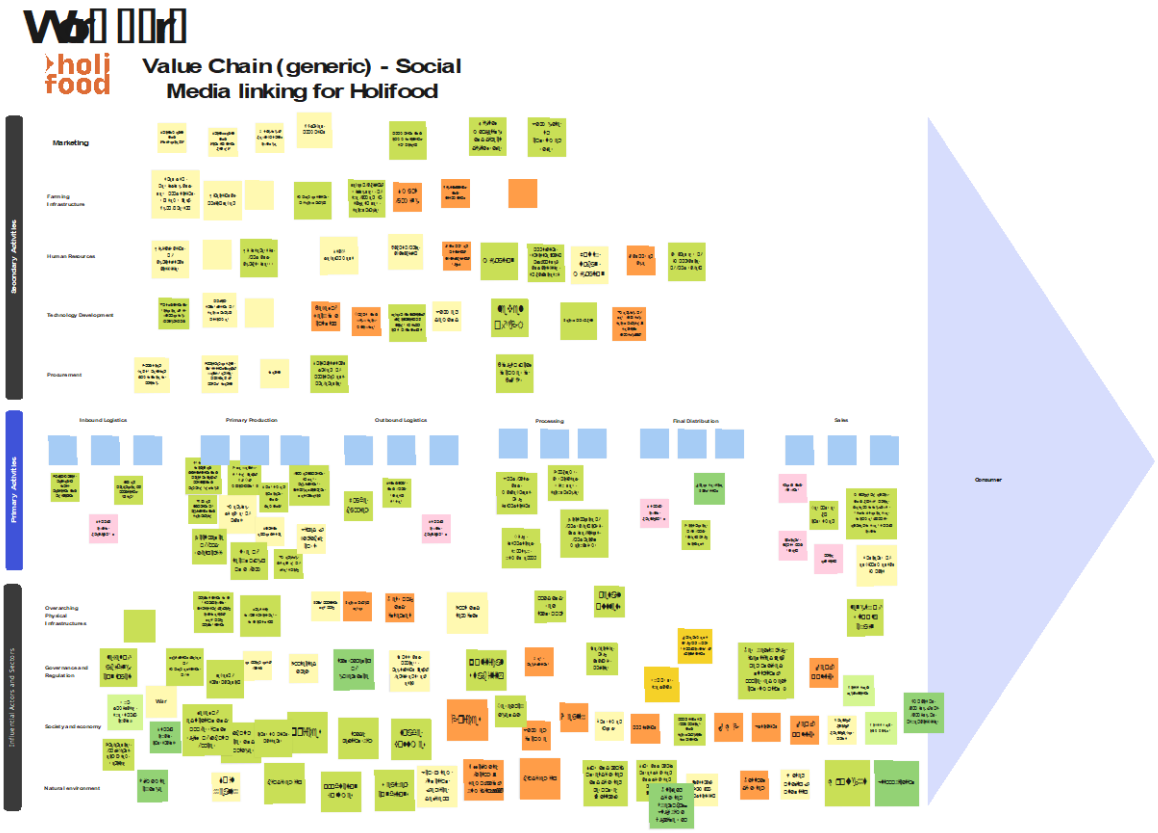


Figure 1: HOLiFOOD Generic Supply-Value Chain Mapping Workshop 12/12/22

The pilot itself generated ideas and a more common understanding of the process and the wider risk issues associate with these supply/value chains and added value. A full version of the MIRO board output can be found in Annex A, and these will be analysed in more detail in the next steps. The MIRO board can be queried here: https://v.gd/hfgenericchain

A new version of the MIRO board that explicitly used colours on 'post-it' notes to distinguish between activities (blue) and actors (pink) was designed and the main workshops proceeded. This is reported in Sections 4 and 5 below.

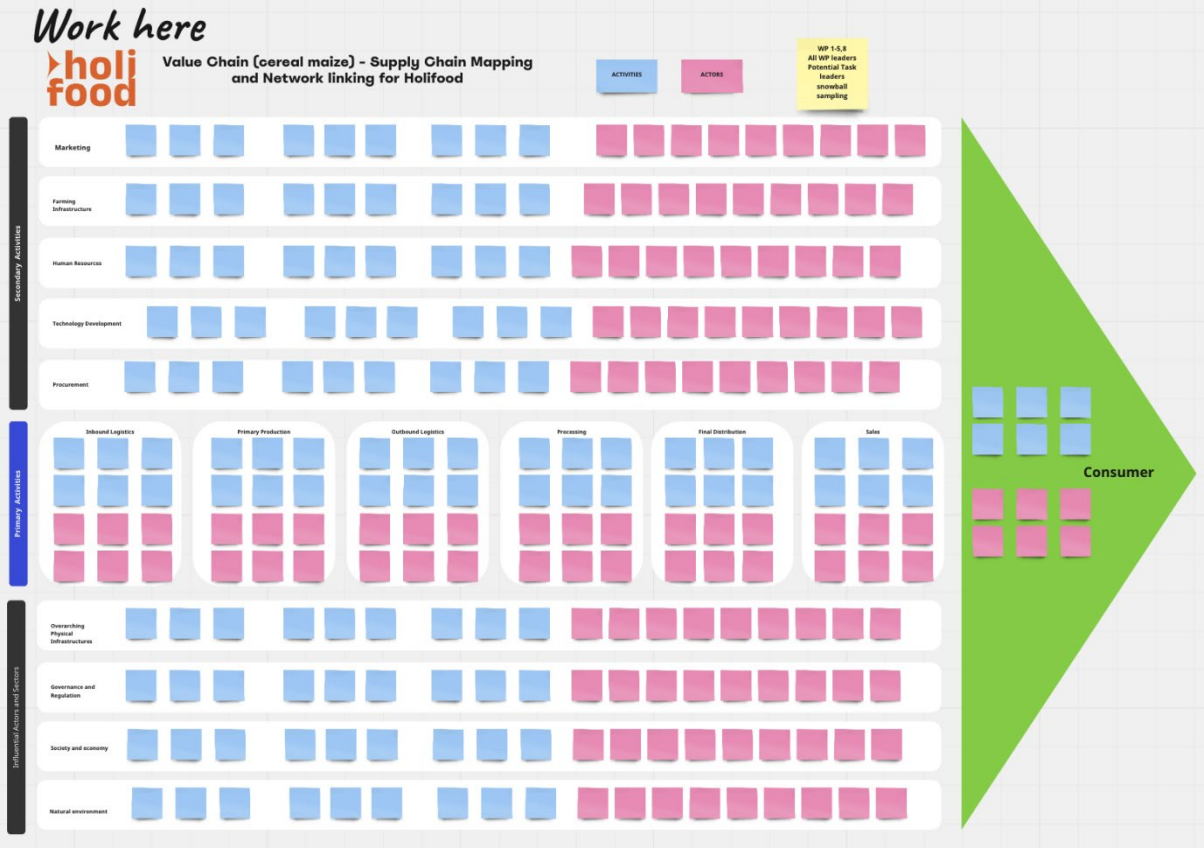


Figure 2: Value/Supply Chain Mapping (blank) for HOLiFOOD

## Online Survey

Using the information from the workshops above, we shall use the network of actors (nodes) and processes (activities) identified as a supply chain to develop questions about power and influence among the actors (nodes) in the food safety community. We have identified the key actors in the supply chain and their respective roles and responsibilities. Then, shall use this information to identify potential points of power and influence within the supply chain. For example, we may ask questions such as:

- Who are the key decision makers in the supply chain and how do they exert their influence?
- How does the flow of information and resources affect the distribution of power among the actors?
- Are there any actors who have a disproportionate amount of power or influence in the supply chain?
- How do actors collaborate and share power in order to make decisions and address food safety risks?

An online survey is an effective way to elicit answers to the questions raised in the text above. The survey has been designed using our preferred option, the Online Surveys platform from JISC (JISC,

2022). The survey included a combination of multiple-choice, rating scale, and open-ended questions that aligned with the questions raised above. For example:

- Identification of representative stakeholder that the participant belongs to
- Details of stakeholder – e.g., location, oversight, area of activity, key responsibilities etc.
- Multiple-choice questions asking the participants to identify key actors in the supply chain and their respective roles and responsibilities.
- Rating scale questions asking participants to rate the degree of power and influence of different actors in the supply chain.
- Open-ended questions asking participants to elaborate on how actors collaborate and share power to make decisions and address food safety risks.

The survey will distribute to both a representative sample of participants, identified in the MIRO workshops, as well as further snowball sampling (Biernacki and Waldorf, 1981; Noy, 2008; Geddes, Parker and Scott, 2018) via phone and email. This will include different actors in the supply chain such as suppliers, manufacturers, distributors, and retailers. This will gather a broad range of perspectives on the power and influence dynamics within each HOLIFOOD supply chain. Online surveying will facilitate the collection of data from many participants in a relatively short time, which helped increase the representativeness and generalizability of the findings.

### Visualising the SNA

Visualizing the SNA using a tool like Gephi (Rajagopal, Prasanna Venkatesan and Goh, 2017) can aid interpretation by providing a visual representation of the relationships between the nodes (or actors) in the network. This can make it easier to identify patterns, clusters, and central nodes in the network, which can provide insights into the structure and dynamics of the network. Gephi offers various layout options, node size and colour options, and other features that can be used to highlight different aspects of the network and make it more informative. It can also be used to filter and select subgroups of nodes and edges which can be further analysed.

We plan to parse the data from the online survey and import it into Gephi. Using Gephi's customization visualization tools, we intend to create visually informative representations of the HOLIFOOD supply chain networks . These representations will display the stakeholders (nodes) and their relationships (edges) based on power and influence from online survey questions. Stakeholders or groups will be presented as different colours/sizes, and relationships as different lengths or weights depending on the level of influence.

We have adopted the "ForceAtlas2" layout algorithm (Jacomy *et al.*, 2014) since it produces the most visually informative relationships. Our plan was to use dynamic filtering tools, to focus on subsets of data and detect distinct communities (closely linked stakeholders), with the Modularity and Louvain algorithms to uncover structural patterns in the network.

## 3.3 Stakeholders: WHO

This work will continue to directly contact risk assessors, managers, communicators and stakeholders and representatives of consumers, from industry, and civil society; and ensure systematic representation from relevant SMEs sectors are included.

### 3.4 Channels & tools: HOW

| Key activity | Channels | Tools |
|---|---|---|
| **Stakeholder engagement** | Email<br>MIRO<br>Online Surveys<br>Phone | Snowball Sampling<br>Online Surveys<br>Gephi<br>ForceAtlas2 |

Table 1: WP5 Channels and Tools

### 3.5 Timing: WHEN

- The methodology development, pilot workshop, value/supply chain workshops were completed by middle February 2023.
- Further snowball sampling, and online surveys shall be continued into mid 2023.
- SNA and visualisation shall be completed in about Q3/Q4 2023.
- Exploitation, dissemination, and incorporation into peer reviewed journal papers shall carry out throughout the project.

# 4 Public engagement formats

- Email
- MIRO
- Online Surveys
- Phone

# 5 Activities

## 5.1 MIRO Workshops

Interactive workshops about food safety risks was conducted online using a tool called MIRO and a basic supply chain model. The participants created a visual representation of the supply chain using MIRO's digital whiteboard and sticky notes. The facilitator led the discussion and asked questions related to the connections between various actors in the supply chain such as suppliers, manufacturers, distributors, and retailers. The visual representation helped identify weaknesses or potential issues in the supply chain, and participants worked together to come up with solutions to mitigate those risks. This method of data collection was more engaging and allowed for visual understanding and better collaboration among the participants.

The MIRO workshops were carried out as follows:

| Event | Date | Link to MIRO board |
|---|---|---|
| Legume Supply Chain Mapping | 2023/02/7 | https://v.gd/holilegumes |
| Cereal Supply Chain Mapping | 2023/02/09 | https://v.gd/holimaize |
| Poultry Supply Chain Mapping | 2023/02/09 | https://v.gd/holipoultry |

Figure 3: HOLIFOOD WP5.1 MIRO Value/Supply Chain Mapping Workshops

The individual mapping are shown in greater detail in Annex A. The workshops yielded good understanding of the chains, the activities, and the actors. However, concerns about privacy and the disclosure of named individuals their contact details prevented a detailed contact list for the online survey proceeding immediately and further snowball sampling by phone will be required and shall commence Q2 2023. Such phone-based work will be time consuming and labour intensive.

### 5.2 Online Survey

As detailed above, we shall use the network of actors (nodes) and processes (activities) identified as a supply chain to develop questions about power and influence among the actors (nodes) in the food safety community. When we have identified the key actors by name and email in the supply chain and their respective roles and responsibilities, we shall use this information to identify potential points of power and influence within the supply chain.

### 5.3 Gephi Analysis

We shall use the dataset from the online survey work above and parse it for import into Gephi. Once imported into Gephi, we used the customization visualization tools detailed above to produce a visually informative representation of the different HOLIFOOD supply chain networks.

# 6 Summary

The overall aims of WP 5 are to optimize adoption and acceptance of the emerging food safety risk framework developed in HOLiFOOD to identify barriers to, and facilitators of, policy adoption, The WP aims to ensure effective knowledge exchange with the public regarding emerging food risk identification. To this end, Social Network Analysis Social (SNA) is being used to identify key players in the food systems being considered and will show how they relate to and influence each other.

Deliverable 5.1 has focused on understanding who our key stakeholders are, both in general and, at a greater level of granularity, within the three HOLiFOOD supply chains. under consideration in the research programme. This report details the mixed methods research methodology develop in WP5, to support the opening workshops that are complete and the surveys, SNA and visualisation that will follow. D5.1 provides a “snapshot” of relevant stakeholders and institutions at the time of submission. The authors recognize that this may change during the project mapping of actors, dynamics, relationships, and interactions in the food system will continue.

The work reported here used semi-structured interviews, MIRO board supply/value chain mapping workshops, online surveys, and preliminary social network analysis (SNA). This included expert information from project partners on risk assessors, managers, communicators and stakeholders and representatives of consumers, from industry, and civil society.

The methodology has been developed, piloted, and detailed. The value/supply chain mapping on MIRO has been completed. A problem with privacy has meant the methodology shall now require an additional and time-consuming snowball sampling by phone to capture named individuals for the online survey.

It is too early to perform analysis or draw any systematic or insightful analysis, this remains a working document. Further work in WP5 will include further semi-structured interviews, MIRO board supply/value chain mapping workshops, online surveys, and social network analysis (SNA) using visualisation tools such as Gephi. This phase will directly contact risk assessors, managers, communicators and stakeholders and representatives of consumers, from industry, and civil society; and ensure systematic representation from relevant SMEs sectors are included.

# 7 Annex A

This annex shows the supply chain mapping from the MIRO workshops. They are simply too large and detailed to easily view at A4 so we recommend following the links to the MIRO boards or asking for PDFs which can be zoomed in and out of.

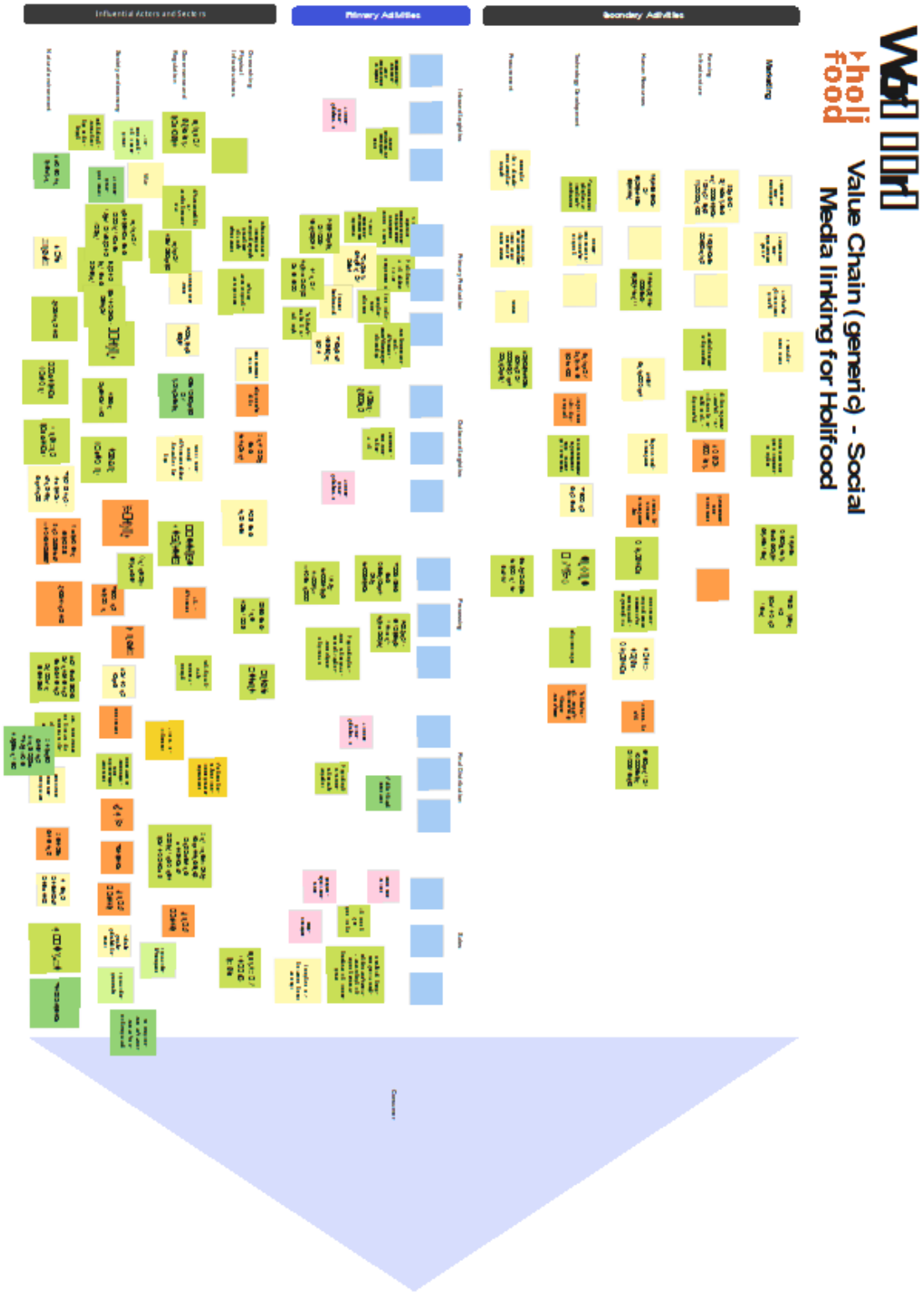


Figure 4: HOLIFOOD Generic Value/Supply Chain Mapping [https://v.gd/hfgenericchain]

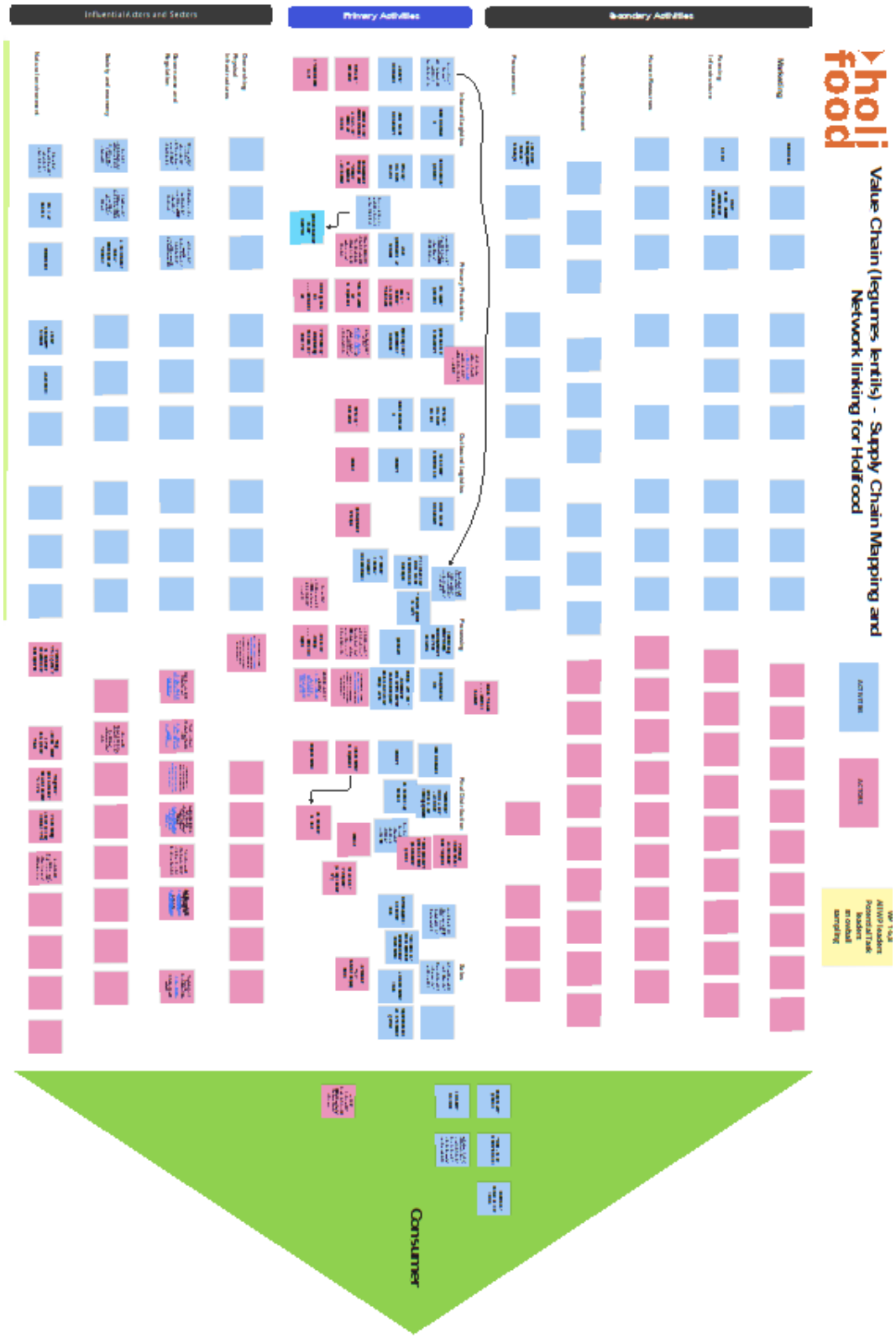


Figure 5: HOLIFOOD Legume Value/Supply Chain Mapping [https://v.gd/holilegumes]

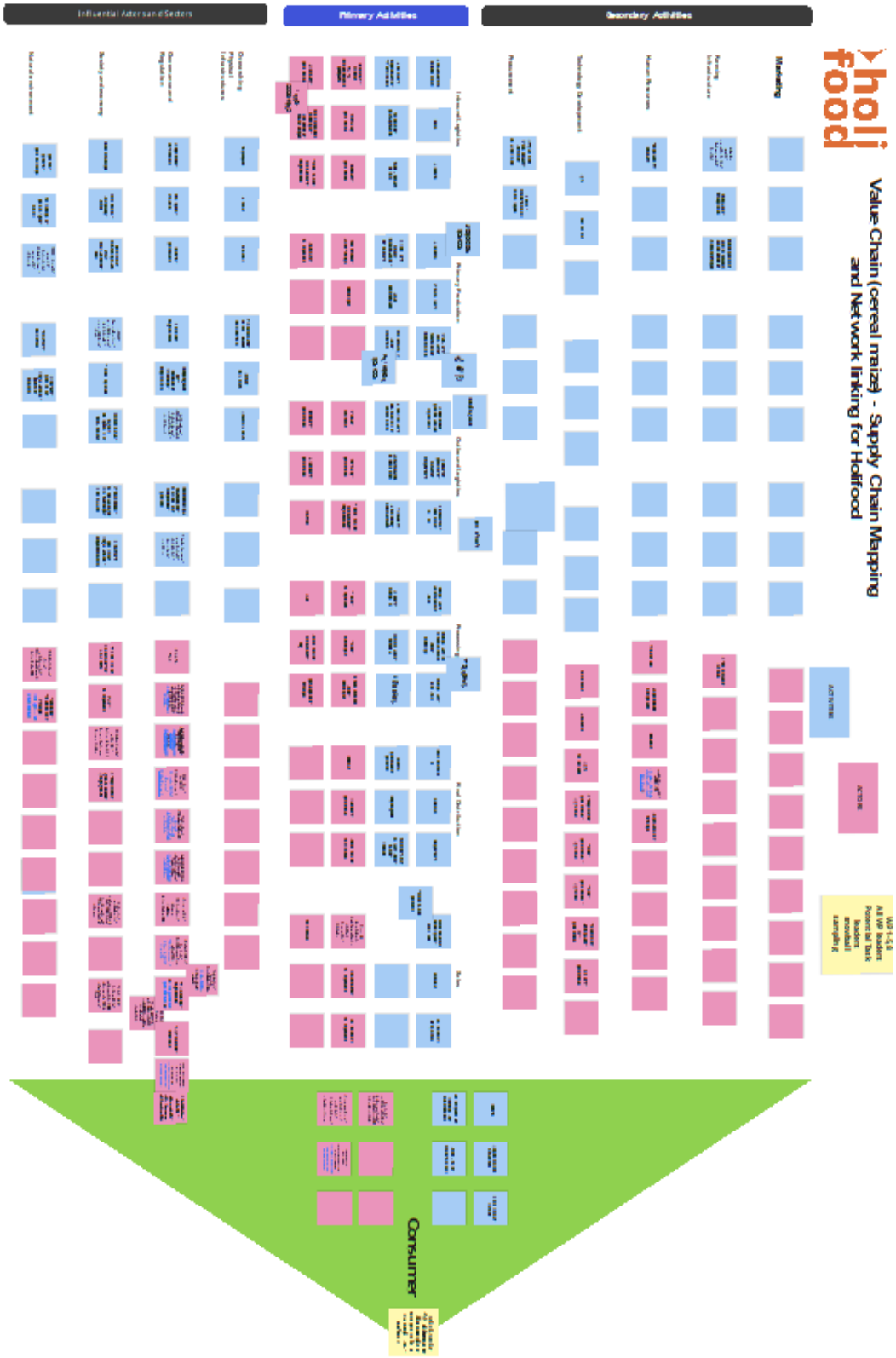


Figure 6: HOLIFOOD Maize Value/Supply Chain Mapping [https://v.gd/holimaize]

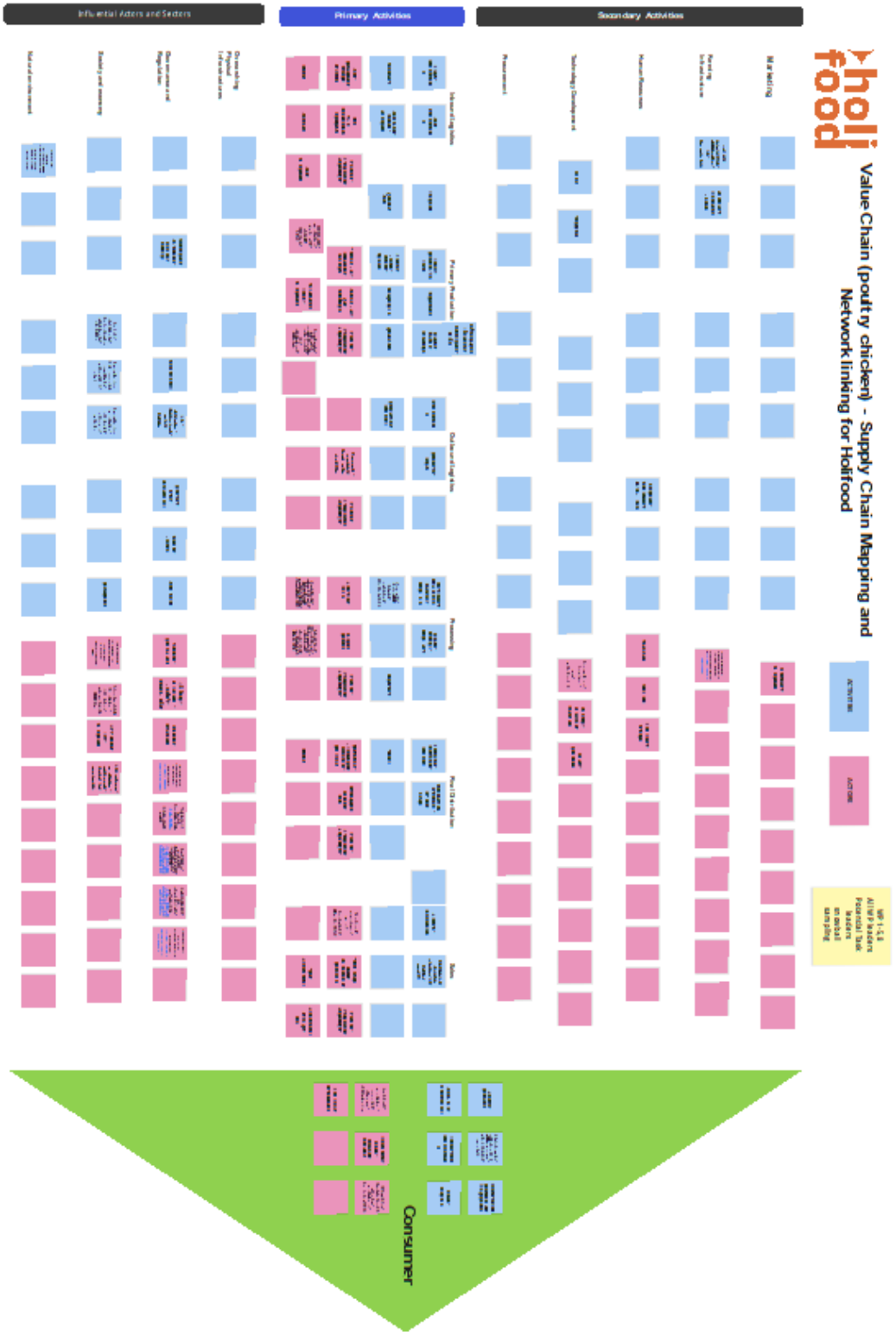


Figure 7: HOLIFOOD Poultry Value/Supply Chain Mapping [https://v.gd/holipoultry]

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