

Optimizing Human Health and Nutrition: From Soil to Society

*Progress and Collaboration Survey
Report December 2023*

KANSAS STATE
UNIVERSITY

Office of Educational
Innovation and Evaluation

Optimizing Human Health and Nutrition: From Soil to Society

Progress and Collaboration Survey Report December 2023

Background

In 2021, the United States Department of Agriculture National Institute of Food and Agriculture (USDA-NIFA) provided funding for Washington State University (WSU) and its partners for an Agriculture and Food Research Initiative (AFRI) Sustainable Agricultural Systems (SAS) project, *Optimizing Human Health and Nutrition: From Soil to Society* (herein referred to as the AFRI SAS Soil to Society project). According to the project's proposal, the long-term goals are to create more nutritious, affordable, and accessible whole grain-based foods through: (1) the investigation of the contribution of novel, biofortified crop varieties and food products to human health through clinical and epidemiological evaluations, and (2) the development and deployment of nutritious food products made from improved crop varieties grown within sustainable cropping systems.

This multi-institutional and transdisciplinary project employs a Soil to Society pipeline strategy that addresses gaps in current knowledge and traces the flow of nutrients from agricultural systems and food production to human consumption. The strategy will culminate in the synthesis of more sustainable agricultural management strategies and healthy and affordable food products to meet the needs of diverse individuals and communities.

To address short-, medium-, and long-term goals, the project's key objectives are to:

1. Understand and apply the roles of environment, soil, and cropping system management on soil health, farm economics, and the nutritional content of the grain for each target crop (Soil Management and Cropping Systems).
2. Develop new varieties of barley, wheat, peas, lentils, quinoa, and buckwheat with enhanced health and nutritive value (Plant Breeding and Genetics).
3. Confirm the impact of nutritionally enhanced varieties on key indicators of human health and assess acceptance using consumer panels (Human Health and Nutrition).
4. Develop a diverse and innovative suite of flavorful, affordable, and nutritious food products that will be accessible to consumers from all income levels (Food Science and Product Development).
5. Conduct population studies to explore impacts on dietary quality by increasing target crop consumption in US diets and assess consumer acceptance and valuation of whole grain- and legume-based foods (Community-based Health and Nutrition).
6. Focus educational capacity on secondary student instruction, teacher professional development, and farmer training (Education).
7. Disseminate knowledge gained and products developed to stakeholders across agriculture, food and health sciences, and communities, schools, and underserved populations through a wide-reaching extension effort (Extension).

Purpose

As part of the project evaluation, the AFRI SAS Soil to Society project leadership contracted with the Office of Educational Innovation and Evaluation (OEIE) to conduct evaluation activities that assess the progress, implementation, and impacts of the project. Project leadership collaborated with OEIE to develop and conduct a web-based survey with project team members to learn about their perceptions of the progress made toward project objectives, implementation, collaboration within the project, and perceived benefits from being a part of the project. Please see Appendix A for a copy of the survey.

Methods

On September 26, 2023, OEIE sent survey invitations to 55 AFRI SAS Soil to Society project team members identified by project leadership. The email invitation provided each contact with a personalized link through which they could complete the survey, with a request that they submit their completed surveys by October 13, 2023. OEIE and project leadership periodically sent email reminders to encourage team members to complete the survey. When the deadline passed, OEIE extended it to October 20, 2023, to allow additional time for responses.

Respondents

OEIE received responses from 36 of 55 team members, with 31 complete and 5 partial responses; a 65.5% response rate.

- All project roles were represented to some degree by survey respondents. Project leadership represented the largest response category ($n = 10$; 32.3%), followed by non-leadership faculty ($n = 8$; 25.8%), with the remaining role categories represented by one to six respondents. The representation ratio of respondents to the actual percentage of each role in the project, however, may vary (i.e., while there were only three outreach and education respondents, there may be fewer outreach/education team members in the whole project, indicating a greater or appropriate representation relative to other roles).
- All seven project objectives were represented to some degree, with 8 participants (25.8%) indicating involvement in two or more objectives.
- Respondents' involvement varied across AFRI SAS Soil to Society project objectives. The most frequent selections were Objective 1 – Soil Management and Cropping Systems, and Objective 2 – Plant Breeding and Genetics ($n = 9$; 29.0% for each). Involvement in other objectives ranged from 1 to 6 respondents.

Analysis

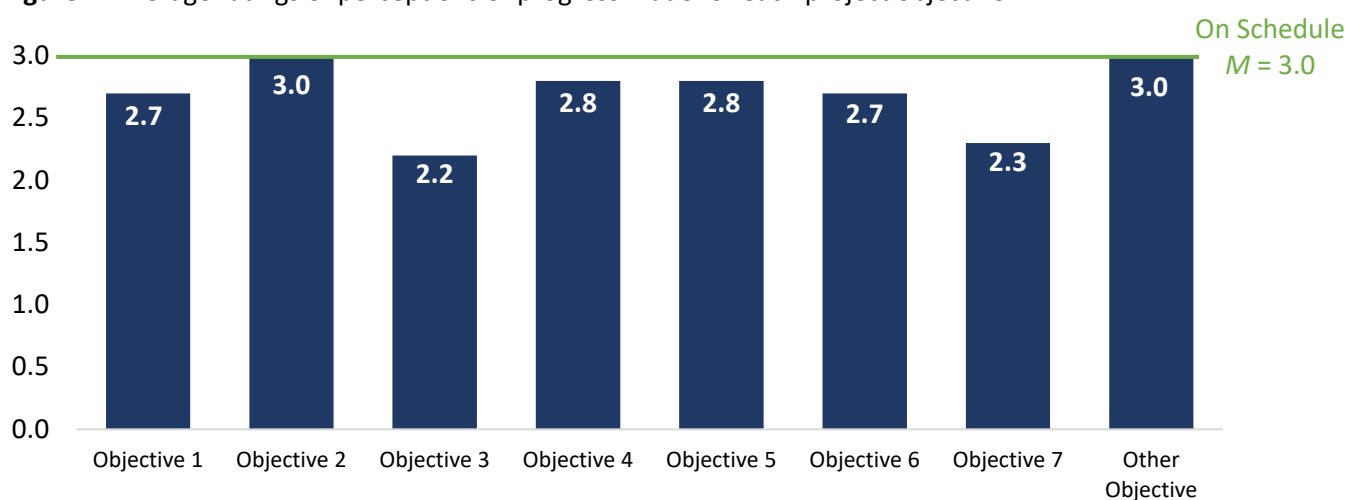
OEIE analyzed the survey data by: (1) calculating descriptive statistics on multiple choice and scaled items (i.e., frequencies [n], percentages [%], means [M], and standard deviations [SD]); (2) coding qualitative responses for themes (with individual responses coded to single or multiple themes as applicable); and (3) conducting a social network analysis (SNA) of respondents' primary project collaborations. Highlights of these analyses appear on the following pages. Full results are appended, including descriptive statistics for all survey items (Appendix B), lists of responses to qualitative items (Appendix C), and SNA results (Appendix D). For a copy of the survey, please see Appendix A. Please note that all quotations in this report have been edited to enhance readability and uphold confidentiality.

Highlights

Progress and Satisfaction

The team member survey began with several questions determining the team member's project role(s) and perceptions of satisfaction and progress with the objectives they identified as being a part of (see the Respondents section on the previous page for a description of the team member roles and objective memberships). **Participants rated the level of progress made toward each of the objectives on which they work** on a five-point scale (1 = "Significantly behind schedule" to 5 = "Significantly ahead of schedule"; See Figure 1). Mean ratings ranged from 2.2 and 3.0, with six of the seven (85.7%) mean ratings falling above the 2.0 level ("Somewhat behind schedule") but not quite approaching the 3.0 level ("On schedule"), while respondents reported progress for the remaining objectives as "On schedule" (Objective 2 and "Other Objective," which was specified as Population & Social Science).

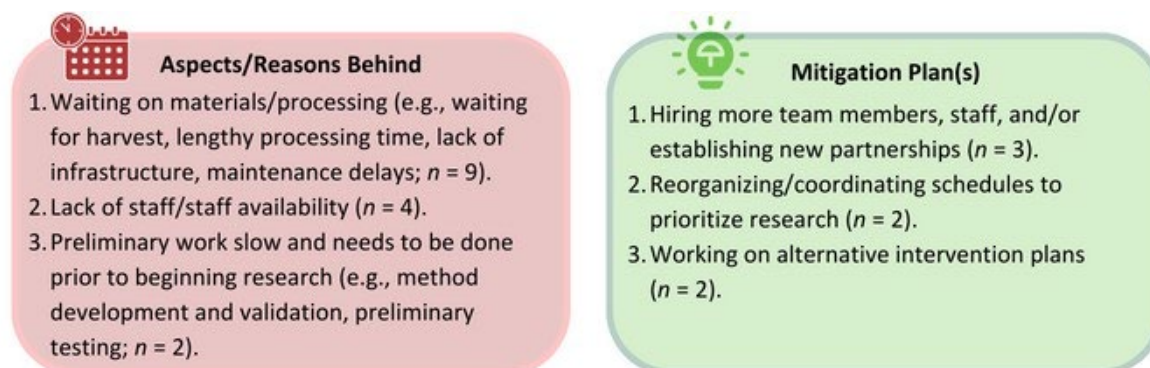
Figure 1. Average ratings of perceptions of progress made for each project objective.



Note. The full objective titles are the following: 1 = Soil Management and Cropping Systems; 2 = Plant Breeding and Genetics; 3 = Human Health and Nutrition; 4 = Food Science and Product Development; 5 = Community-based Health and Nutrition; 6 = Education; 7 = Extension; Other = Population & Social Science. Means were calculated on a five-point scale where 1 = "Significantly behind schedule" and 5 = "Significantly ahead of schedule." Please see Appendix B for more details.

Respondents who indicated work was behind schedule **identified several aspects/reasons as to why they felt work was behind schedule and identified mitigation plans** they have implemented or are planning on implementing. Figure 2 below depicts the top three responses for both (see Appendix B for more details).

Figure 2. Aspects/Reasons objectives are behind schedule and mitigation plans to get back on schedule.



Participants rated their **level of confidence that the AFRI SAS Soil to Society project will achieve its goals** on a five-point scale (1 = “Not at all confident” to 5 = “Completely confident”). **The mean rating was 3.7, with 30 of 31 respondents (96.7%) indicating they were at least “Confident.”** The one individual who indicated they were “Less than confident” that the project will achieve its goals explained that they “...think that the proposed work can be accomplished, but in terms of the ultimate impact, the project had very lofty goals that were always going to be difficult to fully achieve.” Additionally, **all respondents (n = 31, 100%) reported that they were at least satisfied (M ≥ 3.0 on a five-point scale where 1 = “Not at all satisfied” and 5 = “Completely satisfied”) with the implementation of the project (M = 3.6, overall).**

The survey asked respondents **to explain why they were satisfied or not with the project implementation.** Those who identified that they were “Completely satisfied” most frequently reported that their satisfaction **was due to their ongoing progress toward goals (n = 2).** Those who identified that they were “Satisfied” or “More than satisfied” listed several reasons as to why they were satisfied, most frequently being **the exceptional collaboration** (including monthly leadership and summer meetings; n = 10) and the **ongoing progress toward goals (n = 10).** However, these respondents **also identified a few reasons why they may have been less than “Completely satisfied,”** most frequently stating that **it can be hard to connect meaningfully or see progress across outcomes (n = 2).** No individuals indicated that they were less than satisfied, therefore no additional feedback was provided for the categories that were “Less than satisfied” or “Not at all satisfied.”

To gain a more granular perspective of project satisfaction, the survey asked respondents to indicate their level of agreement on a five-point scale (1 = “Strongly disagree” to 5 = “Strongly agree”) as to **whether they were satisfied with several aspects of the project. Most aspects (5 of 6; 83.3%) of the project received an average score of 4.0 or greater,** indicating that respondents at least agree that they are satisfied with those aspects of the project. The aspect with the highest mean score was “resources I have to support my work on the project” (M = 4.3), indicating that respondents were most strongly in agreement with their satisfaction of this aspect of the project. The aspect with the lowest score was “integration between objectives” (M = 3.8), indicating that respondents were in least agreement regarding their satisfaction of this aspect of the project.

Finally, the survey asked respondents two questions regarding project integration efforts and progress. When **asked what initial work was being done to integrate work from their objective into other objectives, respondents most frequently reported that research results/materials have been or will be integrated with other objectives** (e.g., processed treatment results, analyzed quinoa products, developed curricula that influenced others, developed foods for clinical trials, and produced phenotypic and nutritional data for new crops; n = 12) followed by efforts to collaborate and meet with other leads, team members, and partners (n = 9). The evaluation team also **prompted respondents to provide support and/or resources that they believe would help facilitate integration of work from their objectives with others’ objective work.** They most frequently stated that **they would like to increase collaborations among groups** (e.g., share progress through presentations, additional meetings, and social/collaborative activities, and create centralized collaborative platforms/research networks between team members and institutions to share data, findings, and best practices; n = 6).

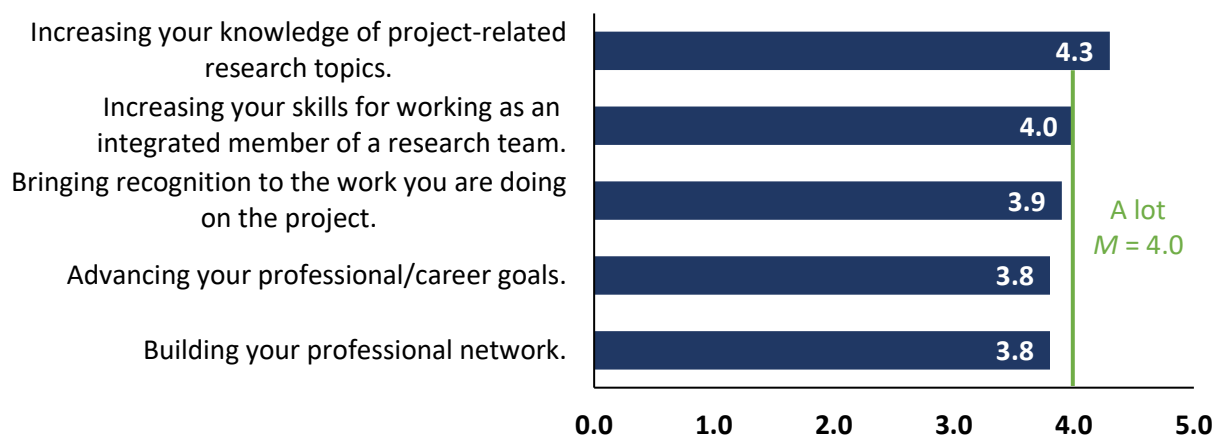
Graduate Students/Postdoctoral Researchers

The evaluation team asked graduate students and postdoctoral researchers (n = 9) a series of questions to gauge their perspectives on their participation in and the implementation of the project. First, respondents described how much they thought their **participation in the AFRI SAS Soil to Society project impacted five professional outcomes** on a five-point scale (1 = “None at all” to 5 = “A great deal”). **Two**

of the five outcomes (40%), increasing knowledge of project-related research outcomes and increasing skills for working as an integrated member of a research team, received a score of 4.0 or above, or “A lot.” This indicates that students and postdoctoral respondents felt that their participation in the project has had a lot of impact on those outcomes. The remaining three outcomes (60%) had mean scores that ranged from 3.8 and 3.9, nearing the “A lot” rating (Figure 3). **No respondents indicated that their participation had no impact** on any of the five professional outcomes and have thus made at least a little impact on each outcome.

When asked to further describe how their involvement in the project has helped advance their career, students and postdoctoral respondents most frequently stated that **they developed teamwork skills** (e.g., collaboration, communication, and networking skills, experience with large projects; $n = 6$), followed by **interdisciplinary benefits** (e.g., collaboration and communication with experts from other fields, knowledge, research, networking, and problem-solving; $n = 4$).

Figure 3. Average ratings of perceived benefits from participating in the project.



Note. Means were calculated on a five-point scale where 1 = “None at all” and 5 = “A great deal.”

Collaboration Network

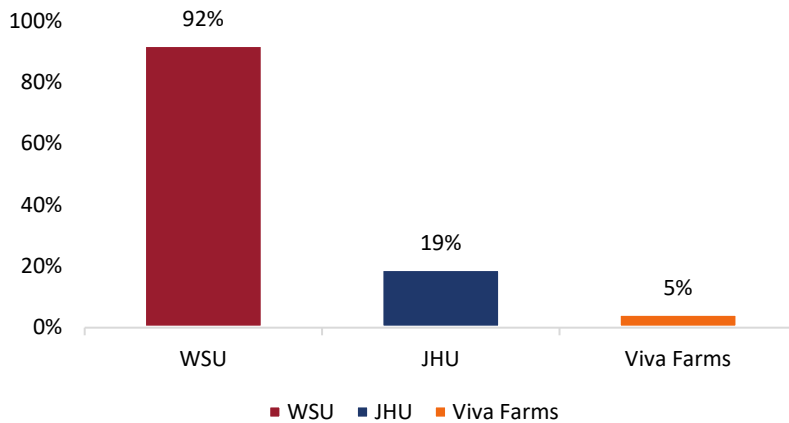
To monitor the development of the project’s network of collaborations, the annual Progress and Collaboration survey asked respondents to list their top five collaborators, their institutions, whether the collaborations were interdisciplinary, and whether the relationships were established prior to project participation or if they were new, forged through project efforts. The following provides highlights from the SNA and an overview of this year’s primary collaborators in the network. Please see Appendix D for full SNA results.

Social Network Analysis Highlights

The Soil to Society social network is based on the responses of 28 survey participants who shared a total of 89 unique collaborative relationships between 60 individuals across 14 institutions (with the exception of one individual whose institution was not identified).

The project’s social network includes institutions internal to the project and external partner organizations. Internal institutions include WSU, John Hopkins University (JHU), and Viva Farms. WSU dominates the project’s social network, followed by JHU and Viva Farms (see Figure 4).

Figure 4. Internal institutions represented in the Soil to Society social network.



Note. Percentages are calculated by the number of collaborations involving the given institution out of the total 89 unique collaborations. Since each collaboration involves two institutions, cumulative percentages will exceed 100%.

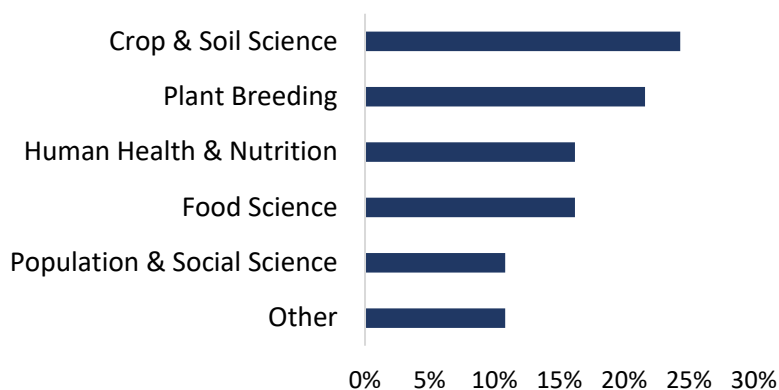
External institutions that team members are collaborating with include:

- Academic institutions: Hungarian Institute for Soil Sciences – Centre for Agricultural Research (ATK TAKI), Kansas State University (KSU), and University of Alabama (UA).
- Government organizations: USDA Beltsville Agricultural Research Center (USDA BARC) and USDA Agricultural Research Service, Pullman (USDA ARS).
- Industry: Agilent, ANKOM Technology, Ardent Mills, King Arthur Baking, and Malvern Panalytical.
- One external collaborator listed as “retired” was consequently not represented by an institutional affiliation.

The 60 individuals comprising the project’s social network include 37 internal partners (i.e., individuals who are a part of the official Soil to Society project team; 61.7%) and 23 external partners (i.e., individuals outside of the official project team; 38.3%). These individuals are engaged in 89 unique collaborative relationships.

- Project team members who completed the SNA section of the survey are predominantly affiliated with WSU ($n = 41$; 68.3%). Seven team members are affiliated with JHU (11.7%), and one is affiliated with Viva Farms (1.7%).

Figure 5. Team members by discipline in the social network.



• Team members represent several disciplines (see Figure 5). Note that some disciplines have been aggregated into an “Other” category to maintain anonymity of individuals in under-represented disciplines.

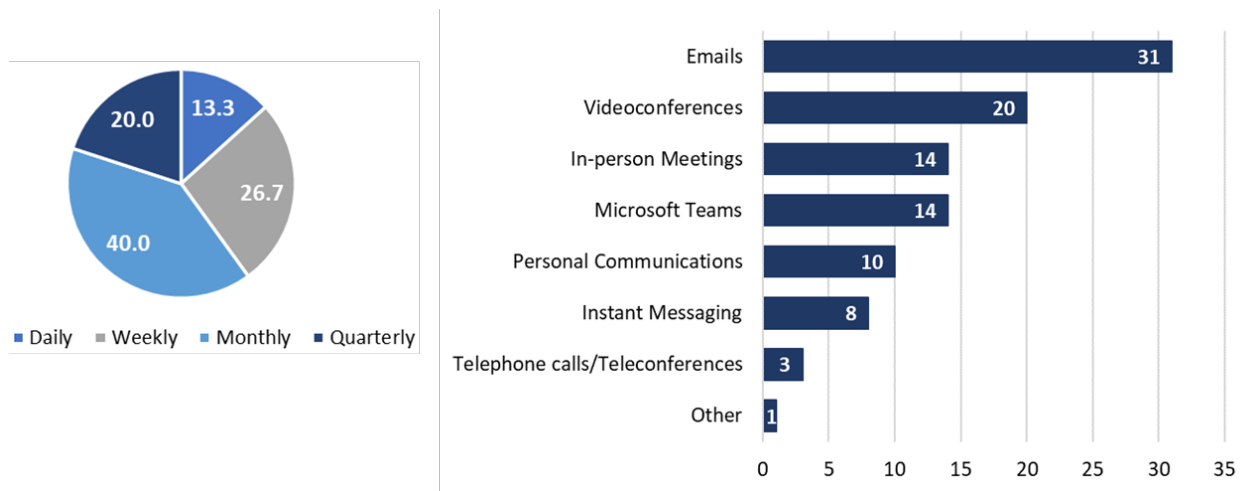
- Just under half of the relationships in the Soil to Society social network were newly established as a result of participating in the project ($n = 40$; 44.9%).

- Nearly two-thirds of relationships are transdisciplinary in nature ($n = 56$; 62.9%).

Overall Collaboration

In addition to the social network data, the evaluation team gauged overall collaboration efforts using a series of questions relating to the frequency and methods of collaboration, and questions on more specific collaboration experiences (see Figure 6). Regarding overall communication, respondents reported that **they most frequently collaborate monthly with others on the project** ($n = 12$ of 30; 40.0%), with the same number of respondents collaborating several times a month (when combining weekly and daily responses, $n = 12$ of 30; 40.0%), for a total of 80.0% of project members collaborating at least monthly, and the primary means of communication to do so have been **primarily via email** ($n = 31$) and **videoconferences** ($n = 20$).

Figure 6. Team member collaboration frequency and methods.



Note. The pie chart above to the left represents how frequently respondents collaborate with others on this project by percentage ($n = 30$). The bar graph on the above right displays the frequency that respondents use each method to collaborate with others about the project. Respondents could select multiple methods of collaboration, so the cumulative frequency will be greater than the number of respondents ($n = 31$).

To probe at a more granular level, the survey asked respondents to rate their level of agreement on a five-point scale (1 = “Strongly disagree” to 5 = “Strongly agree”) with five different statements **regarding their collaboration experiences with the project. All five statements received a mean score of 4.0 or above**, ranging from 4.0 to 4.3, indicating that respondents at least agreed that all statements were true, with only one statement receiving any degree of disagreement. This latter statement was, “I am included in brainstorming/planning with others working on the project,” which also set the lowest mean score of the range ($M = 4.0$, reaching the level of “agree”). The statements receiving the highest scores were, “Collaborating with others on this project is producing a higher quality product than working individually” and “I appreciate the contributions of others working on the project” ($M = 4.3$, for both).

Sustainability

This year’s survey also included a project sustainability section, which was only available to respondents who indicated that they were project leadership ($n = 10$). The survey asked project leadership to rate their level of agreement amongst a list of sustainability features whether the project had such features, and then requested they select the top three sustainability domains that will be most important for sustaining each component. For the first part, **respondents at least agreed ($M = 4.0$)** on a five-point scale (1 = “Strongly disagree” to 5 = “Strongly agree”) **that the project had four of the eight (50%) sustainability features**. These four sustainability features included environmental support, organizational capacity,

(cultivating) partnerships, and strategic planning. The other half of the sustainability features received mean scores of 3.6–3.8, nearing the “Agree” level. The item receiving the lowest mean score was program adaptation ($M = 3.6$), indicating that respondents were in the least agreement as to whether the project has taken action to adapt the project to ensure its ongoing effectiveness. For the second part, respondents identified the top three sustainability domains deemed most important for each component; **the component deemed most important for each sustainability domain is summarized below in Table 1.** (If multiple domains are listed, they tied for being the most important; see Tables 22–29 in Appendix B for more details):

Table 1. Top sustainability domains identified for each project objective.

Objective	Top Sustainability Domain
Objective 1: Understand and apply the roles of environment, soil, and cropping system management on soil health, farm economics, and the nutritional content of the grain for each target crop.	Organizational capacity: Having the internal support and resources needed to effectively manage your program and its activities. ($n = 7$ of 9; 77.8%)
Objective 2: Develop new varieties of barley, wheat, peas, lentils, quinoa, and buckwheat with enhanced health and nutritive value.	Funding stability: Establishing a consistent financial base for your program. Organizational capacity: Having the internal support and resources needed to effectively manage your program and its activities. ($n = 5$ of 9, 55.6%; each)
Objective 3: Confirm the impact of nutritionally enhanced varieties on key indicators of human health and assess acceptance using consumer panels.	Funding stability: Establishing a consistent financial base for your program. ($n = 5$ of 9; 55.6%)
Objective 4: Develop a diverse and innovative suite of flavorful, affordable, and nutritious food products that will be accessible to consumers from all income levels.	Partnerships: Cultivating connections between your program and its stakeholders/invested parties. ($n = 5$ of 9; 55.6%)
Objective 5: Conduct population studies to explore impacts on dietary quality by increasing target crops in US diets and assessing consumer acceptance and valuation of whole grain and legume-based foods.	Communications: Strategic communication with stakeholders/invested parties and the public about your program. ($n = 5$ of 10; 50.0%).
Objective 6: Focus our educational capacity on secondary student instruction and teacher professional development, and farmer training.	Organizational capacity: Having the internal support and resources needed to effectively manage your program and its activities. ($n = 5$ of 9; 55.6%).
Objective 7: Disseminate knowledge gained and products developed to stakeholders/invested parties across agriculture, food, and health sciences, and communities, schools, and underserved populations through a wide-reaching extension effort.	Communications: Strategic communication with stakeholders/invested parties and the public about your program. ($n = 5$ of 9; 55.6%)

Among the top choices for each component, the organizational capacity sustainability domain was the most popular whereas the program evaluation sustainability domain never breached the top three choices for any component. When asked for suggestions or additional thoughts for leadership as they begin the initial planning efforts related to project sustainability, one person suggested, “focus on additional funding opportunities and collaborations that expand the team.”

Final Thoughts

Following the sustainability section, all team members were invited back to provide final thoughts and reflections. Team members reflected on the **most significant benefits or impacts** of being part of the AFRI SAS Soil to Society project. The most frequently reported benefits or impacts were **teamwork experience** (e.g., internal and external collaboration, networking, exchanging skills/knowledge; $n = 15$), **research opportunities, experience, and advancement** (e.g., deploying national surveys, engaging with experiments, improving awareness, better understanding of field/research; $n = 14$), and **benefits from the interdisciplinary nature of the project** (e.g., deeper understanding of research/topic and different disciplines, stronger interdisciplinary connections; $n = 9$). Though not requested, two individuals left suggestions for leadership, including the need to improve collaboration with others on methods and analysis techniques and to provide professional development opportunities for students.

When asked to identify **which aspects of the program have been most successful when considering both progress and collaboration, respondents identified several aspects, the most frequent of which was collaborations** (internally, externally, and cross-institutionally; $n = 11$) **and the multi/transdisciplinary teams** ($n = 7$). To advance the project’s efforts toward progress and collaboration, respondents most frequently suggested improving/continuing to support collaborations ($n = 4$) and to create/consult for connection to the food industry for marketing final products ($n = 3$).

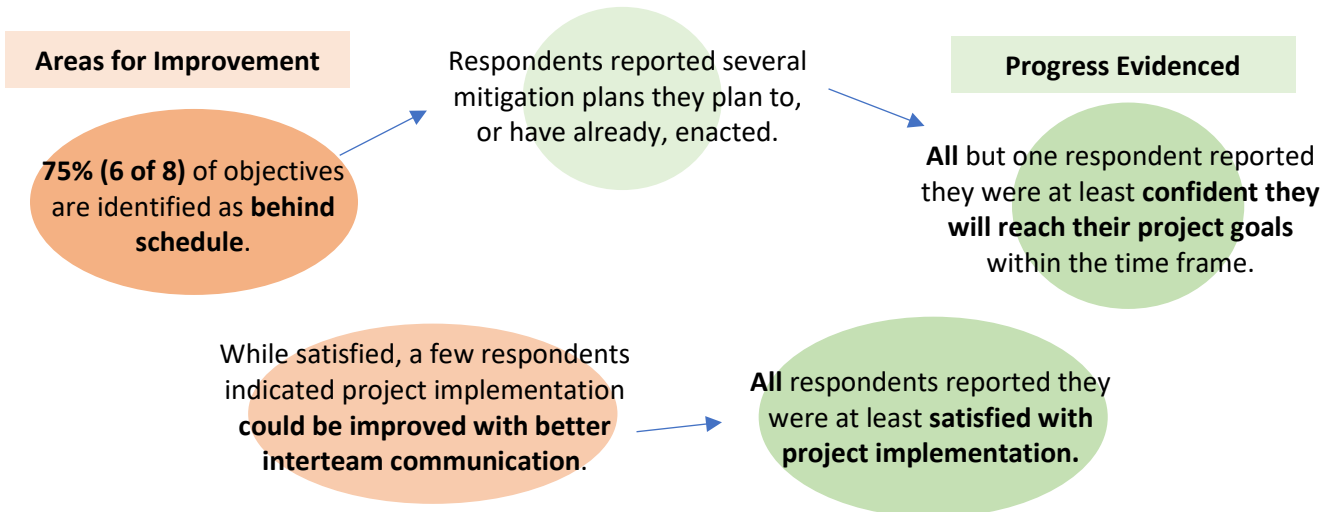
Finally, when **asked for any last comments or feedback** related to the project’s progress or collaboration efforts, respondents **most frequently commented that they had a positive experience** participating in the project ($n = 2$) and that **they believe leadership is doing a great job** (e.g., organizing the annual meetings; $n = 2$).

Observations and Recommendations

OEIE offers the following observations and recommendations to assist AFRI SAS Soil to Society project leadership in moving forward with evaluation results. These recommendations are organized by evaluation question as outlined in the evaluation plan. Please see Appendix C for additional details, including specific ideas provided by team members. OEIE recommends project leadership look for opportunities to use information gained from this evaluation activity to enhance project planning and implementation.

To what extent are project objectives being completed as proposed?

Much of the survey results demonstrate progress toward accomplishing project objectives as proposed. While there have been a few areas identified that may need improvement, respondents reflected confidence in mitigating issues and achieving goals on time. Specifically, the evaluation team has observed the following:



Recommendations: Considering the data above, OEIE suggests that in order to progress in the areas identified for improvement, leadership should consider the aspects respondents reported they were behind on and the mitigation plans they identified (see Figure 2) when considering how to better support their team. Also, while all respondents were satisfied with project implementation, team members did suggest that interteam communication and knowing the ongoing progress toward goals would improve their satisfaction. Such suggestions are in line with the aspect of project implementation that received the lowest satisfaction score, which was related to team integration. Furthermore, the majority (60%) of team members reported they collaborate with others for the project monthly or even less often and largely through remote means (emails and videoconferencing), indicating room for improvement.

Leadership should consider improving team integration by the following so that they can, in turn, improve upon communication and awareness: increasing group activities; including group progress presentations; meetings; trans-objective student internships; creating a centralized collaborative platform/research network; or other feasible activities that may encourage interteam collaboration. Additional suggestions to help project integration and meet project goals include hiring or allocating more staff, team members, and interns.

How has transdisciplinary research collaboration enhanced the work of the project?

The survey has evidenced the transdisciplinary character of the project as a valuable aspect of project research. Graduate and postdoctoral researchers identified interdisciplinary benefits as one of the top benefits toward their careers as products of their involvement with the project. Similarly, team member respondents identified transdisciplinary aspects of the project as one of the most significant benefits or impacts they experienced as being a part of the project — enabling a deeper understanding of the research/topic and different disciplines and creating stronger interdisciplinary connections. Also, team member respondents reported, on average, that they agree that their experiences with the project have increased their interest in transdisciplinary collaboration on future projects.

Progress Evidenced

Team members recognize the transdisciplinary character of the project as **important** and **impactful**.

62.9% of the social network collaborations are **transdisciplinary**.

A greater percentage of new collaborations are transdisciplinary than prior collaborations.

Team members recognize that the transdisciplinary character of the project **creates a deeper understanding** of the material.

Overall, **the SNA is well-integrated** among team members, disciplines, institutions, and external individuals.

The SNA collected additional evidence on transdisciplinary collaboration progress. The greater percent of transdisciplinary collaborations among new collaborations as opposed to prior indicates movement among team members to engage in more transdisciplinary collaborations (provided that respondent data is extendable to the whole network).

Broadening out to increased collaborations in general, the SNA indicates that the project team is well-integrated, with many links (collaborations) among and between project team members, disciplines, project institutions, and external individuals and institutions. Over a quarter of collaborations were interinstitutional (28.4%) and just under half of the collaborations were new (44.9%). There were many new external partnerships as well, with almost 40% of collaborators in the network identified as external. However, WSU disproportionately dominates the network to a higher degree than can be explained solely by the number of team members affiliated with WSU: 41 (68.3%) of the network team members are associated with WSU, while 23 of 28 (82.1% of the network) of team members who completed the collaboration section of the survey are associated with WSU. Yet WSU participates in 92.2% of all collaborations present in the network. It is also worth noting that all collaborations involving Viva Farms stem from that organization (i.e., no individual from any other project institution cited individuals from Viva Farms as collaborators), suggesting that Viva Farms and other project institutions should emphasize collaboration between team members. This suggests that there is scope to expand the role of JHU and Viva Farms in the Soil to Society project network.

Additionally, the sociograms demonstrate the existence of small clusters of researchers — of the 24 total external collaborations, 7 (29.2%) are established through isolated collaboration groups that are not attached to the main network (see Figures 2–3 in Appendix D). These relationships are among WSU collaborators. While it is possible that these researchers are better integrated in the team than the survey results indicate, the existence of two groups of this type suggests that some subteams may benefit from greater integration with the overall project network.

Areas for Improvement

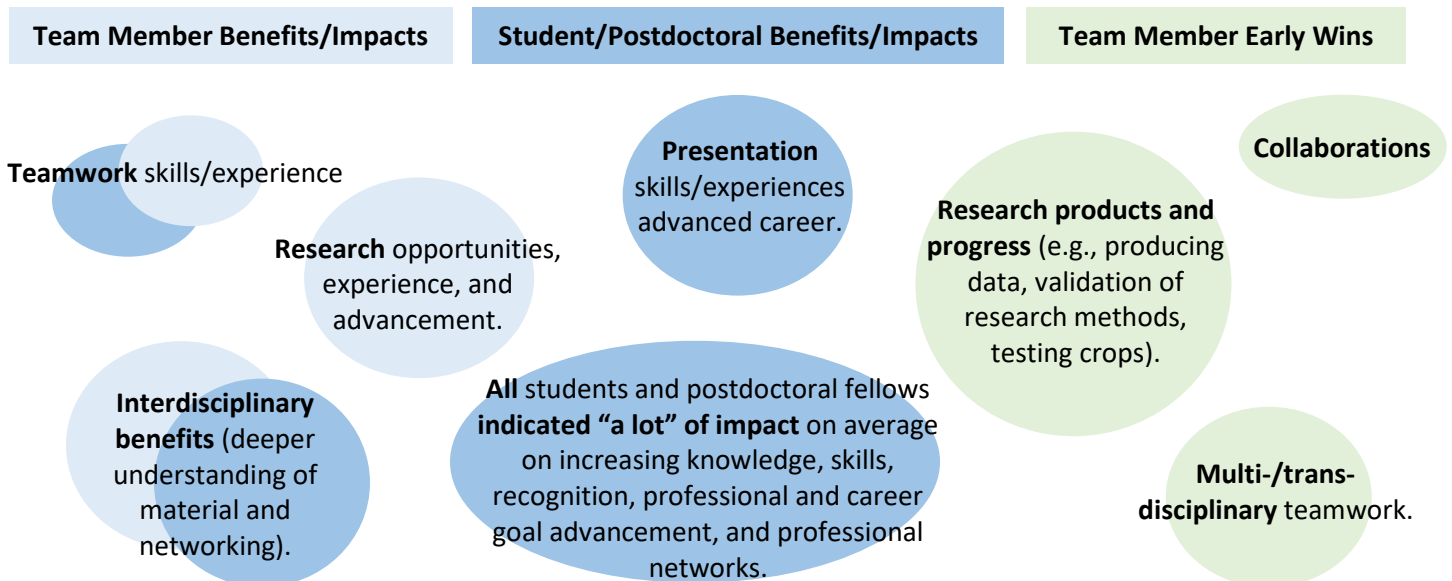
A disproportionate number of collaborations stemmed from WSU (App. D, Fig. 3).

There are some isolated groups of WSU collaborators and external partners in the SNA (App. D., Fig. 2-3).

Recommendations: There is a high degree of transdisciplinary collaboration within the project that team members appear to celebrate. As such, OEIE recommends that leadership continue to support and facilitate transdisciplinary and interinstitutional collaboration via hosting meetings, conferences, seminars, and the like. To better integrate external collaborations, some of which were observed to be rather isolated with WSU collaborators, OEIE recommends leadership encourage team members to facilitate their external connections with other team members. If leadership implements the recommendations related to collaboration from the previous section, they could incorporate transdisciplinary collaboration encouragement in the same action.

To what extent is the project meeting its overarching aim to develop and deploy nutritious food products made from improved crop varieties grown within sustainable cropping systems?

Part of meeting this overarching aim is not just research advancement, but also developing a workforce pipeline that has the knowledge, skills, and awareness of research goals and strategies. Overall, team members reported numerous benefits, impacts, and early wins they have acquired through participating in the project:



These impacts, benefits, and developments highlighted and reported by team members provide evidence toward the project reaching its overarching aim.

Recommendations: OEIE suggests that project leadership continue its efforts in supporting the team members’ research and providing opportunities for experience for students, postdoctoral fellows, internships, and outreach/education to the public and youth. Throughout the survey, there were several comments related to education and outreach initiatives, indicating that the project should allocate more time and energy toward their efforts. Also, a consistent suggestion from team members to support their progress was to hire or allocate more team members. OEIE suggests that leadership consider these suggestions as well and consider acquiring more funding (if necessary) to hire more team members and allocate more resources accordingly. These efforts would help expand the current progress in research development and create a greater knowledgeable and skilled workforce.

What mechanisms have been put in place to sustain project initiatives?

To address this evaluation question, this year's Progress and Collaboration survey included a section of questions related to sustainability of the project's initiatives available only to project leadership. Respondents indicated that among the eight sustainability domains listed, the project has only achieved four of them, including environmental support, organizational capacity, (cultivating) partnerships, and strategic planning. The remaining domains were program adaptation, communications, program evaluation, and funding stability. Overall, the mean scores of these last four domains neared "Agree," indicating that many team members did feel like the project was getting close to having these domains in place. As such, this may indicate that the project is not lacking these features entirely but may need more emphasis.

Furthermore, to help leadership narrow down and pinpoint the exact needs of their varied initiatives, the survey asked team members to select the top three most important sustainability domains for each objective. OEIE summarized these results in Table 1 (page 8). For each objective, team members appeared to have come largely to agreement on at least the first most important sustainability domain, the most frequent of which is "organizational capacity," which is defined as having the internal support and resources needed to effectively manage your program and its activities.

Recommendations: Based on the observations above, OEIE recommends that leadership consider reviewing and tailoring sustainability efforts according to the importance of each domain type respondents identified as most important for each objective (see Table 1 in the Highlights section). While the four domains that were indicated as not achieved by the project require some attention to increase their effectiveness, it is important to do so according to the need required of each project objective. Hence, while the communications domain was not identified as an acquired domain, the leadership effort to increase communications should perhaps be disproportionately emphasized in objective initiatives 5 and 7 since team members identified that communication was the most important to those objectives. Likewise, while respondents indicated that the project *does* have the organizational capacity domain, it perhaps needs to be further emphasized in objectives 1, 2, and 6.

**Optimizing Human Health and Nutrition: From Soil to Society
Year 3 Progress and Collaboration Survey Report
Appendix A – Copy of Survey**

AFRI SAS Soil to Society Year 3 Progress & Collaboration Survey (2023)

AFRI SAS Soil to Society Project Progress & Collaboration Survey (Year 3)

The purpose of this survey is to gain your experiences with and feedback on progress made by and collaboration within the AFRI SAS Optimizing Human Health and Nutrition: From Soil to Society (AFRI SAS Soil to Society) project. For those of you who identify as being part of leadership (including objective leads), this survey includes a short additional survey segment to gather your perspectives and feedback on project sustainability.

Your participation is voluntary, and your responses to survey questions will be kept confidential to the extent that your responses will not be tied to your name in the reporting of results. Responses from all participants, including text comments, will be combined with those of other survey respondents and reported to the AFRI SAS Soil to Society team for their use with project planning and reporting. Information shared will not be used or distributed for any other purpose.

We ask that you please complete this survey by October 20, 2023. The survey should take approximately 15-20 minutes to complete. Your feedback is important, as your responses will contribute to successful project implementation and reporting to the AFRI SAS Soil to Society team.

For technical assistance related to the survey or questions about the evaluation, please contact the evaluation team members Adrienne L. McCarthy (mccarthy@ksu.edu) or Laurel Schmidt (lrschmidt@ksu.edu).

Questions about the project and the evaluation can also be directed to [Kevin Murphy](#), AFRI SAS Soil to Society Project Director. You may also contact the [Research Compliance Office](#) at Kansas State University with questions about the evaluation.

Thank you,

Adrienne L. McCarthy, Laurel Schmidt, Mukesh Bhattarai, and Kristin Wright
AFRI SAS Soil to Society External Evaluation Team
Office of Educational Innovation and Evaluation (OEIE)
Kansas State University

CONSENT

Q1 Please indicate your consent to participate in this survey. By selecting "I agree to participate," you are providing your consent to participate in this survey. If you would like a copy of the consent form, please print this page for your own records.

- I agree to participate.
- I prefer to not participate.

Q2 Please indicate your role in the AFRI SAS Soil to Society project:

- Project Leadership (including team leads)
- Faculty (non-leadership)
- Post-Doc
- Student
- Outreach/education
- Other (Please specify) _____

Q3 Please indicate which AFRI SAS Soil to Society objective(s) you are a part of (select all that apply).

- Objective 1: Soil Management & Cropping Systems
- Objective 2: Plant Breeding & Genetics
- Objective 3: Human Health & Nutrition
- Objective 4: Food Science & Product Development
- Objective 5: Community-based Health & Nutrition
- Objective 6: Education
- Objective 7: Extension
- Other (Please specify) _____

Q4 For each objective you are a part of, please rate the current status of progress made toward the goal of this objective this year.

	Not applicable (Work is scheduled to start at a later time)	Significantly behind schedule	Somewhat behind schedule	On schedule	Somewhat ahead of schedule	Significantly ahead of schedule
Objective 1: Soil Management & Cropping Systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Objective 2: Plant Breeding & Genetics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Objective 3: Human Health & Nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Objective 4: Food Science & Product Development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Objective 5: Community-based Health & Nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Objective 6: Education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Objective 7: Extension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (Please specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5 For each objective that you indicated is behind or somewhat behind schedule, please briefly describe which parts of the objective(s) are behind and any mitigation plans that have been developed to address reaching the project goals.

Q6 How confident are you that the project can achieve its goals?

- Not at all confident
- Less than confident
- Confident
- More than confident
- Completely confident

Q7 Briefly describe why you are less than or not at all confident that the project can achieve its goals and any additional supports you feel are needed for the project to achieve its goals.

Q8 Overall, how satisfied are you with the implementation of the AFRI SAS Soil to Society project?

- Not at all satisfied
- Less than satisfied
- Satisfied
- More than satisfied
- Completely satisfied

Q9 Please briefly explain why you are "[previous choice]" with the implementation of this project.

Q10 Think about your experiences with the AFRI SAS Soil to Society project. Rate your level of agreement with each statement below.

I am satisfied with the amount of...

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Communication/information I receive about the project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resources I have to support my work on the project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time/energy I am contributing to the project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time/energy others are contributing to the project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Integration between objectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Progress being made toward the overall goals of the project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11 Please describe any initial work being done to integrate work from your objective(s) with other objectives' work this year.

Q12 What support or resources would help facilitate the integration of work from your objective(s) with other objectives' work?

Q13 How much do you think your participation in AFRI SAS Soil to Society has had an impact on...

	None at all	A little	A moderate amount	A lot	A great deal
Advancing your professional/career goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building your professional network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing your knowledge of project-related research topics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing your skills for working as an integrated member of a research team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bringing recognition to the work you are doing on the project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14 Please describe the ways that you believe your involvement in the AFRI SAS Soil to Society project has helped advance your career.

Collaboration

We want to understand the collaboration that is occurring on the AFRI SAS Soil to Society project (e.g., collaborations on research, manuscripts, presentations, proposals, workshops or specialized training, curriculum development, invited speaking engagements, product development, etc.). Your responses to these questions will help us understand existing patterns of collaboration and ways to enhance collaboration during future years of the project.

Q15 Who are your primary collaborators on the AFRI SAS Soil to Society project?

Please list up to 5 people with whom you collaborate most frequently on this project. These collaborators may be internal team members or external partners. For each of these primary collaborators, please list their name and institution/organization, and indicate whether this collaboration was established due to AFRI SAS Soil to Society or if it existed prior the project.

	Name of Collaborator		Institution or Organization	Is this a <u>new</u> collaboration due to working on this project or did this collaboration <u>exist prior to</u> this project.		Is the collaboration with this person <u>interdisciplinary</u> ?	
	First Name	Last Name		New	Existed prior	Yes	No
#1			Please list the collaborator's institution or organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
#2				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
#3				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
#4				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
#5				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q20 For this next set of questions, consider all collaborations with which you are involved for the AFRI SAS Soil to Society project.

Q16 On average, how frequently do you collaborate with others for this project?

- Daily
- Weekly
- Monthly
- Quarterly
- Annually

Q17 What methods do you typically use to collaborate with others for this project? (Select all that apply)

- Emails
- In-person meetings
- Instant messaging (e.g., Teams, Slack)
- Microsoft Teams
- Personal communications (e.g., direct phone calls/text messages)
- Telephone calls/teleconference
- Videoconferences (e.g., Zoom, WebEx)
- Other (please specify) _____

Q18 Please rate your level of agreement with these statements about your collaboration experiences on the AFRI SAS Soil to Society project.

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
I appreciate the contributions of others working on the project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Others working on the project appreciate my contributions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am included in brainstorming/planning with others working on the project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The benefits outweigh the challenges associated with collaboration on this project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Collaborating with others on this project is producing a higher quality product than working individually.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My experiences on this project have increased my interest in interdisciplinary collaboration on future projects.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sustainability Domains [made available to leadership only]

For the following items, please rate the Soil to Society project across a range of specific factors that affect sustainability. Please respond to as many items as possible. If you truly feel you are not able to answer an item, you may select "Not Applicable."

Definitions of terms frequently used throughout the survey include:

Organization encompasses all the parent organizations or agencies in which the project is housed.

Depending on your project the organization may refer to a national, state, or local department, a nonprofit organization, a hospital, etc.

Community refers to the stakeholders who may benefit from or who may guide the project. This could include local residents, organizational leaders, decision-makers, etc. Community does not refer to a specific town or neighborhood.

Q19 Please indicate the degree to which Soil to Society has or does the following things:

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree	N/A
Environmental Support: Having a supportive internal and external climate for the Soil to Society project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Funding Stability: Establishing a consistent financial base for the Soil to Society project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Partnerships: Cultivating connections between the Soil to Society project and its stakeholders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Organizational Capacity: Having the internal support and resources needed to effectively manage the Soil to Society project and its activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Program Evaluation: Assessing the Soil to Society project to inform planning and document results	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Program Adaptation: Taking actions that adapt the Soil to Society project to ensure its ongoing effectiveness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communications: Strategic communication with stakeholders and the public about the Soil to Society project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strategic Planning: Using processes that guide the Soil to Society project's direction, goals, and strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q48 For each of the project components, select the **top three** sustainability domains that will be most important for sustaining each component:

Q49 Objective 1 – Understand and apply the roles of environment, soil, and cropping system management on soil health, farm economics, and the nutritional content of the grain for each target crop.

- Environmental Support: Having a supportive internal and external climate for your program
- Funding Stability: Establishing a consistent financial base for your program
- Partnerships: Cultivating connections between your program and its stakeholders
- Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities
- Program Evaluation: Assessing your program to inform planning and document results
- Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness
- Communications: Strategic communication with stakeholders and the public about your program
- Strategic Planning: Using processes that guide your program’s direction, goals, and strategies
- N/A

Q50 Objective 2 – Develop new varieties of barley, wheat, peas, lentils, quinoa, and buckwheat with enhanced health and nutritive value

- Environmental Support: Having a supportive internal and external climate for your program
- Funding Stability: Establishing a consistent financial base for your program
- Partnerships: Cultivating connections between your program and its stakeholders
- Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities
- Program Evaluation: Assessing your program to inform planning and document results
- Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness
- Communications: Strategic communication with stakeholders and the public about your program
- Strategic Planning: Using processes that guide your program’s direction, goals, and strategies
- N/A

Q52 Objective 3 – Confirm the impact of nutritionally enhanced varieties on key indicators of human health and assess acceptance using consumer panels.

- Environmental Support: Having a supportive internal and external climate for your program
- Funding Stability: Establishing a consistent financial base for your program
- Partnerships: Cultivating connections between your program and its stakeholders
- Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities
- Program Evaluation: Assessing your program to inform planning and document results
- Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness
- Communications: Strategic communication with stakeholders and the public about your program
- Strategic Planning: Using processes that guide your program’s direction, goals, and strategies
- N/A

Q53 Objective 4 – Develop a diverse and innovative suite of flavorful, affordable, and nutritious food products that will be accessible to consumers from all income levels.

- Environmental Support: Having a supportive internal and external climate for your program
- Funding Stability: Establishing a consistent financial base for your program
- Partnerships: Cultivating connections between your program and its stakeholders
- Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities
- Program Evaluation: Assessing your program to inform planning and document results
- Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness
- Communications: Strategic communication with stakeholders and the public about your program
- Strategic Planning: Using processes that guide your program’s direction, goals, and strategies
- N/A

Q54 Objective 5 – Conduct population studies to explore impacts on dietary quality by increasing target crops in US diets and assessing consumer acceptance and valuation of whole grain and legume-based foods.

- Environmental Support: Having a supportive internal and external climate for your program
- Funding Stability: Establishing a consistent financial base for your program
- Partnerships: Cultivating connections between your program and its stakeholders
- Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities
- Program Evaluation: Assessing your program to inform planning and document results
- Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness
- Communications: Strategic communication with stakeholders and the public about your program
- Strategic Planning: Using processes that guide your program’s direction, goals, and strategies
- N/A

Q55 Objective 6 – Focus our educational capacity on secondary student instruction and teacher professional development, and farmer training

- Environmental Support: Having a supportive internal and external climate for your program
- Funding Stability: Establishing a consistent financial base for your program
- Partnerships: Cultivating connections between your program and its stakeholders
- Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities
- Program Evaluation: Assessing your program to inform planning and document results
- Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness
- Communications: Strategic communication with stakeholders and the public about your program
- Strategic Planning: Using processes that guide your program’s direction, goals, and strategies
- N/A

Q56 Objective 7 – Disseminate knowledge gained and products developed to stakeholders across agriculture, food, and health sciences, and communities, schools, and underserved populations through a wide-reaching extension effort.

- Environmental Support: Having a supportive internal and external climate for your program
- Funding Stability: Establishing a consistent financial base for your program
- Partnerships: Cultivating connections between your program and its stakeholders
- Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities
- Program Evaluation: Assessing your program to inform planning and document results
- Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness
- Communications: Strategic communication with stakeholders and the public about your program
- Strategic Planning: Using processes that guide your program’s direction, goals, and strategies
- N/A

Q20 Please provide any additional thoughts or suggestions that may be helpful to project leadership as they begin initial planning efforts related to sustainability of the Soil to Society project.

Final Thoughts

Q21 What have been the most significant benefits or impacts for you in being a part of the AFRI SAS Soil to Society project? (What have you gained so far?)

Consider: Possible improvements to your awareness, knowledge/understanding, skills/abilities, attitudes/mindset, behaviors/practices, and/or connections/networks.

Q22 Considering progress and collaboration, what aspects of this project are most successful? (What are the project's strengths? What have been some early "wins"?)

Q23 Please share any suggestions you may have to improve the project's efforts toward progress and collaboration.

Consider: How should the project focus its efforts to maximize impact? What aspects of the project are most in need of improvement? What are the project's greatest challenges at this point?

Q24 Please share any additional comments or feedback you may have related to the AFRI SAS Soil to Society project's progress or collaboration efforts.

Optimizing Human Health and Nutrition: From Soil to Society Year 3 Progress and Collaboration Survey Report Appendix B - Compiled Results

Table 1: Please indicate your consent to participate in this survey. By selecting "I agree to participate," you are providing your consent to participate in this survey. If you would like a copy of the consent form, please print this page for your own records. (n = 31)

Response Option	Frequency	Percent
I agree to participate	31	100.0%
I prefer not to participate	-	-
Total	31	100.0%

Note. The original number of respondents was 36, however, five respondents were dropped from analysis due to incomplete responses (<40% completed).

Progress and Satisfaction:

Table 2: Please indicate your role in the AFRI SAS Soil to Society project. (n = 31)

Response Option	Frequency	Percent
Project Leadership (including team leads)	10	32.3%
Faculty (non-leadership)	8	25.8%
Student	6	19.4%
Post-Doc	3	9.7%
Outreach/education	3	9.7%
Other (please specify)	1	3.2%
Total	31	100.0%

Note. "Other" response was "Tech."

Table 3: Please indicate which AFRI SAS Soil to Society objective(s) you are a part of (select all that apply). (n = 31)

Response Option	Frequency	Percent
Objective 1: Soil Management and Cropping Systems	9	29.0%
Objective 2: Plant Breeding and Genetics	9	29.0%
Objective 3: Human Health and Nutrition	5	16.1%
Objective 4: Food Science and Product Development	5	16.1%
Objective 5: Community-based Health and Nutrition	5	16.1%
Objective 6: Education	6	19.4%
Objective 7: Extension	4	12.9%
Other (please specify)	1	3.2%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%. "Other" response was "Population & Social Science."

Table 4: For each objective you are a part of, please rate the current status of progress made toward the goal of this objective this year.

Statement	Not applicable (Work is scheduled to start at a later time)	Significantly behind schedule	Somewhat behind schedule	On schedule	Somewhat ahead of schedule	Significantly ahead of schedule	Total (n)	Mean (SD)
Objective 1: Soil Management and Cropping Systems	-	-	3 (33.3%)	6 (66.7%)	-	-	9	2.7 (0.5)
Objective 2: Plant Breeding and Genetics	1 (11.1%)	-	-	8 (88.9%)	-	-	9	3.0 (0.0)
Objective 3: Human Health and Nutrition	-	-	4 (80.0%)	1 (20.0%)	-	-	5	2.2 (0.4)
Objective 4: Food Science and Product Development	-	-	1 (20.0%)	4 (80.0%)	-	-	5	2.8 (0.4)
Objective 5: Community-based Health and Nutrition	-	-	1 (20.0%)	4 (80.0%)	-	-	5	2.8 (0.4)
Objective 6: Education	-	-	2 (33.3%)	4 (66.7%)	-	-	6	2.7 (0.5)
Objective 7: Extension	-	-	3 (75.0%)	1 (25.0%)	-	-	4	2.3 (0.5)
Other (please specify)	-	-	-	1 (100.0%)	-	-	1	3.0 (0.0)

Note. Individuals were only asked to rate those objectives in which they had previously indicated they are a part of. Means are on a scale from 1 = Significantly behind schedule to 5 = Significantly ahead of schedule. Means do not incorporate non-applicable answers. "Other" response was "Population & Social Science."

Table 5: For each objective that you indicated is significantly behind schedule or somewhat behind schedule, please briefly describe which parts of the objective(s) are behind and any mitigation plans that have been developed to address reaching the project goals. (n = 11)

Theme	Frequency
<i>Aspects/Reasons Behind</i>	
Waiting on materials/processing (i.e., waiting for harvest, lengthy processing time, lack of infrastructure, maintenance delays).	9
Lack of staff/staff availability	4
Preliminary work slow (i.e., method development, method validation, preliminary testing) and needs to be finished to begin research.	2
Behind on developing methods.	1
Budget limitations.	1
Goals impossible in time frame and the nature of the study.	1
Little to no extension/outreach work.	1
<i>Mitigation Plan(s)</i>	
Hiring more team members/staff and/or establishing new partnerships.	3
Reorganizing/coordinating schedules to prioritize/facilitate research.	2
Working on alternative/intervention plans.	2
Acquired more funding.	1
Coordinating with contractors to fix equipment.	1
Developed new tool/instrument to facilitate production.	1
Need to engage/involve invested parties more.	1
Will do check-ins on partners/teams.	1
Would like procedure created for extension factsheets/materials.	1

Note. Individuals were only asked about objectives in which they indicated they participate. Survey participant responses have been coded to multiple themes as applicable. Therefore, the sum of the frequencies may be greater than *n*.

Table 6: How confident are you that the project can achieve its goals? (n = 31)

Response Option	Frequency	Percent
Not at all confident	-	-
Less than confident	1	3.2%
Confident	15	48.4%
More than confident	7	22.6%
Completely confident	8	25.8%
Total	31	100.0%

Note. Means are on a 5-point scale (1 =Not at all confident to 5 = Completely confident). *M* = 3.7, *SD* = 0.9

Table 7: Briefly describe why you are less than or not at all confident that the project can achieve its goals and any additional supports you feel are needed for the project to achieve its goals. (n = 1)

Response	Frequency
<i>I think that the proposed work can be accomplished, but in terms of the ultimate impact, the project had very lofty goals that were always going to be difficult to fully achieve.</i>	1

Note. Only participants who selected “Not at all confident” or “Less than confident” in Table 5 received this item. No themes were observed for this question.

Table 8: Overall, how satisfied are you with the implementation of the AFRI SAS Soil to Society project? (n = 31)

Response Option	Frequency	Percent
Not at all satisfied	-	-
Less than satisfied	-	-
Satisfied	16	51.6%
More than satisfied	12	38.7%
Completely satisfied	3	9.7%
Total	31	100.0%

Note. Means are on a 5-point scale (1 =Not at all satisfied to 5 = Completely satisfied). $M = 3.6$, $SD = 0.7$

Table 9: Please briefly explain why you are satisfied or not satisfied with the implementation of this project. (n = 28)

Theme	Frequency
<i>Completely satisfied</i>	
Ongoing progress towards goals	2
Good collaboration (including, monthly leadership, summer meeting)	1
Project is original and feasible	1
Team is professional	1
<i>Satisfied/More than satisfied</i>	
Good collaboration (incl. monthly leadership and summer meetings).	10
Ongoing progress toward goals.	10
Leadership is good (i.e., good facilitators, good communication, hard workers, good support).	7
The multi/transdisciplinary nature of the project.	7
Breadth of project is impressive and impactful.	3
Hard to connect meaningfully or see progress across outcomes.	2
Academic and professional development through mentoring.	1
Need more inter-team synergy (i.e., centralized data/resource lists).	1
Project is original and feasible.	1
Team is professional.	1
Too much management.	1
<i>Less than satisfied/Not at all satisfied</i>	
[no respondents selected less than or not at all satisfied]	

Table 10: Think about your experiences with the AFRI SAS Soil to Society project. Rate your level of agreement with each statement below. I am satisfied with...

Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Total (n)	Mean (SD)
Resources I have to support my work on the project.	-	1 (3.3%)	2 (6.7%)	15 (50.0%)	12 (40.0%)	30	4.3 (0.7)
Communication/information I receive about the project.	-	-	2 (6.7%)	20 (66.7%)	8 (26.7%)	30	4.2 (0.6)
Progress being made toward the overall goals of the project.	-	-	-	27 (87.1%)	4 (12.9%)	31	4.1 (0.3)
Time/energy I am contributing to the project.	-	1 (3.2%)	3 (9.7%)	20 (64.5%)	7 (22.6%)	31	4.1 (0.7)
Time/energy others are contributing to the project.	-	-	5 (16.1%)	21 (67.7%)	5 (16.1%)	31	4.0 (0.6)
Integration between objectives.	-	3 (9.7%)	5 (16.1%)	19 (61.3%)	4 (12.9%)	31	3.8 (0.8)

Note. Means are on a scale from 1 = Strongly disagree to 5 = Strongly agree.

Table 11: Please describe any initial work being done to integrate work from your objective(s) with other objectives' work this year. (n = 25)

Theme	Frequency
Research results/materials have been or will be integrated with other objectives (i.e., processed treatment results, analyzed quinoa products, developed curricula that influenced others, developed foods for clinical trials, produced phenotypic and nutritional data for new crops).	12
Collaborated/met with other leads, team members, partners.	9
Organized and/or facilitated inter-team meetings, annual meetings.	2
Participated in and/or facilitated internship program(s).	2
Need to coordinate with others more frequently.	1
Publicizing progress/research.	1
Unsure (new to project); N/A.	3

Note. Survey participant responses have been coded to multiple themes as applicable. Therefore, the sum of the frequencies is greater than *n*.

Table 12: What support or resources would help facilitate the integration of work from your objective(s) with other objectives' work? (*n* = 20)

Theme	Frequency
Increase collaborations between groups (share progress through presentations, additional meetings, social/collaborative activities, and create centralized collaborative platforms/research networks between team members and institutions to share data, findings, and best practices).	6
Hire/allocate more staff, team members, and interns.	3
Increase funding (to support collaboration, research teams, etc.).	2
Create more education/outreach materials (i.e., initial findings/ progress updates, interview videos with team members, clean data sets for curriculum).	1
Document or list available/projected plant materials and those that may be available, but not directly grown for the project.	1
Recruit trainees who can work a minimum of 6 months.	1
Resources put into teams from the summer meeting.	1
Synchronize/schedule sampling periods, lab times, etc.	1
N/A or nothing else needed.	6

Note. Survey participant responses have been coded to multiple themes as applicable. Therefore, the sum of the frequencies is greater than *n*. Additionally, one response was not coded as it did not fit the prompt: "Just if the weather cooperates consistently over the next two years and we get good yields for the food product development work would be great."

Graduate Students/Postdoctoral Researchers:

Table 13: How much do you think your participation in AFRI SAS Soil to Society has had an impact on...

Statement	None at all	A little	A moderate amount	A lot	A great deal	Total (n)	Mean (SD)
Increasing your knowledge of project-related research topics.	-	-	1 (11.1%)	4 (44.4%)	4 (44.4%)	9	4.3 (0.7)
Increasing your skills for working as an integrated member of a research team.	-	1 (11.1%)	1 (11.1%)	4 (44.4%)	3 (33.3%)	9	4.0 (1.0)
Bringing recognition to the work you are doing on the project.	-	1 (11.1%)	2 (22.2%)	3 (33.3%)	3 (33.3%)	9	3.9 (1.1)
Advancing your professional/career goals.	-	-	5 (55.6%)	1 (11.1%)	3 (33.3%)	9	3.8 (1.0)
Building your professional network.	-	-	5 (55.6%)	1 (11.1%)	3 (9.7%)	9	3.8 (1.0)

Note. Means are on a scale from 1 = None at all to 5 = A great deal.

Table 14: Please describe the ways that you believe your involvement in the AFRI SAS Soil to Society project has helped advance your career. (n = 8)

Theme	Frequency
Developed teamwork skills (collaboration, communication, networking, experience with large projects).	6
Interdisciplinary benefits (collaboration and communication with experts from other fields, knowledge, research, networking, problem-solving).	4
Presentation skills/experience.	3
Developed grant writing skills.	1
Fulfilling academic goals.	1
Increase credibility and visibility.	1
Personal development (sense of purpose and commitment).	1
Presentation skills/experience.	1
Professional outputs (paper outputs).	1

Collaboration:

Table 15: Who are your primary collaborators on the AFRI SAS Soil to Society project? Please list up to 5 people with whom you collaborate most frequently on this project. These collaborators may be internal team members of external partners. For each of these primary collaborators, please list their name and institution/organization, and indicate whether this collaboration was established due to the AFRI SAS Soil to Society or if it existed prior to the project.

[Refer to Appendix D: Social Network Analysis for further information on this question.]

Table 16: On average, how frequently do you collaborate with others for this project? (*n* = 30)

Response Option	Frequency	Percent
Daily	4	13.3%
Weekly	8	26.7%
Monthly	12	40.0%
Quarterly	6	20.0%
Annually	-	-
Total	30	100.0%

Table 17: What methods do you typically use to collaborate with others for this project? (Select all that apply). (*n* = 31)

Response Option	Frequency	Percent
Emails	31	100.0%
Videoconferences (e.g., Zoom, WebEx)	20	64.5%
In-person meetings	14	45.2%
Microsoft Teams	14	45.2%
Personal communications (e.g., direct phone calls/text messages)	10	32.2%
Instant messaging (e.g., Teams, Slack)	8	25.8%
Telephone calls/teleconference	3	9.7%
Other (please specify)	1	3.2%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100% and the frequency summation will be greater than *n*. The "Other" response was "Field work"

Table 19: Please rate your level of agreement with these statements about your collaboration experiences on the AFRI SAS Soil to Society project.

Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Total (n)	Mean (SD)
Collaborating with others on this project is producing a higher quality product than working individually.	-	-	3 (10.3%)	13 (44.8%)	13 (44.8%)	29	4.3 (0.7)
I appreciate the contributions of others working on the project.	-	-	-	20 (66.7%)	10 (33.3%)	30	4.3 (0.5)
My experiences on this project have increased my interest in interdisciplinary collaboration on future projects.	-	-	4 (13.8%)	16 (55.2%)	9 (31.0%)	29	4.2 (0.7)
Others working on the project appreciate my contributions.	-	-	5 (17.2%)	16 (55.2%)	8 (27.6%)	29	4.1 (0.7)
The benefits outweigh the challenges associated with collaboration on this project.	-	-	4 (13.3%)	19 (63.3%)	7 (23.3%)	30	4.1 (0.6)
I am included in brainstorming/planning with others working on the project.	1 (3.4%)	1 (3.4%)	5 (17.2%)	13 (44.8%)	9 (31.0%)	29	4.0 (1.0)

Note. Means are on a scale from 1 = Strongly disagree to 5 = Strongly agree.

Sustainability Domains:

NOTE. The sustainability section (tables 21-29) were only available to team members who identified as project leadership (n = 10).

Table 21: For the following items, please rate the Soil to Society project across a range of specific factors that affect sustainability. Please respond to as many items as possible. If you truly feel you are not able to answer an item, you may select "Not Applicable." Please indicate the degree to which Soil to Society has or does the following things:

Statement	Not applicable	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Total (n)	Mean (SD)
Environmental Support: Having a supportive internal and external climate for the Soil to Society project.	-	-	-	1 (10.0%)	4 (40.0%)	5 (50.0%)	10	4.4 (0.7)
Organizational Capacity: Having the internal support and resources needed to effectively manage the Soil to Society project and its activities.	-	-	-	1 (10.0%)	5 (50.0%)	4 (40.0%)	10	4.3 (0.7)
Partnerships: Cultivating connections between the Soil to Society project and its stakeholders.	-	-	-	2 (20.0%)	3 (30.0%)	5 (50.0%)	10	4.3 (0.8)
Strategic Planning: Using processes that guide the Soil to Society project's direction, goals, and strategies.	2 (20.0%)	-	-	-	7 (70.0%)	1 (10.0%)	10	4.1 (0.4)
Communications: Strategic communication with stakeholders and the public about the Soil to Society project.	1 (10.0%)	-	-	2 (20.0%)	7 (70.0%)	-	10	3.8 (0.4)
Program Evaluation: Assessing the Soil to Society project to inform planning and document results.	1 (10.0%)	-	-	3 (30.0%)	5 (50.0%)	1 (10.0%)	10	3.8 (0.7)
Funding Stability: Establishing a consistent financial base for the Soil to Society project.	-	-	1 (10.0%)	2 (20.0%)	6 (60.0%)	1 (10.0%)	10	3.7 (0.8)
Program Adaptation: Taking actions that adapt the Soil to Society project to ensure its ongoing effectiveness.	2 (20.0%)	-	-	3 (30.0%)	5 (50.0%)	-	10	3.6 (0.5)

Note. Means are on a scale from 1 = Strongly disagree to 5 = Strongly agree. "Not applicable" answers were not figured into the means.

For each of the project components, select the top three sustainability domains that will be most important for sustaining each component:

Table 22: Objective 1 – Understand and apply the roles of environment, soil, and cropping system management on soil health, farm economics, and the nutritional content of the grain for each target crop. (n = 9)

Response Option	Frequency	Percent
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities.	7	77.8%
Environmental Support: Having a supportive internal and external climate for your program.	3	33.3%
Funding Stability: Establishing a consistent financial base for your program.	3	33.3%
Partnerships: Cultivating connections between your program and its stakeholders.	3	33.3%
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness.	3	33.3%
Communications: Strategic communication with stakeholders and the public about your program.	2	22.2%
Program Evaluation: Assessing your program to inform planning and document results.	2	22.2%
Strategic Planning: Using processes that guide your program’s direction, goals, and strategies.	1	11.1%
N/A	1	11.1%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%.

Table 23: Objective 2 – Develop new varieties of barley, wheat, peas, lentils, quinoa, and buckwheat with enhanced health and nutritive value. (n = 9)

Response Option	Frequency	Percent
Funding Stability: Establishing a consistent financial base for your program.	5	55.6%
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities.	5	55.6%
Environmental Support: Having a supportive internal and external climate for your program.	4	44.4%
Partnerships: Cultivating connections between your program and its stakeholders.	3	33.3%
Communications: Strategic communication with stakeholders and the public about your program.	2	22.2%
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness.	2	22.2%
Program Evaluation: Assessing your program to inform planning and document results.	1	11.1%
Strategic Planning: Using processes that guide your program’s direction, goals, and strategies.	1	11.1%
N/A	2	22.2%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%.

Table 24: Objective 3 – Confirm the impact of nutritionally enhanced varieties on key indicators of human health and assess acceptance using consumer panels. (n = 9)

Response Option	Frequency	Percent
Funding Stability: Establishing a consistent financial base for your program.	5	55.6%
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities.	3	33.3%
Communications: Strategic communication with stakeholders and the public about your program.	2	22.2%
Environmental Support: Having a supportive internal and external climate for your program.	2	22.2%
Partnerships: Cultivating connections between your program and its stakeholders.	2	22.2%
Strategic Planning: Using processes that guide your program’s direction, goals, and strategies.	2	22.2%
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness.	1	11.1%
Program Evaluation: Assessing your program to inform planning and document results.	1	11.1%
N/A	3	33.3%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%.

Table 25: Objective 4 – Develop a diverse and innovative suite of flavorful, affordable, and nutritious food products that will be accessible to consumers from all income levels. (n = 9)

Response Option	Frequency	Percent
Partnerships: Cultivating connections between your program and its stakeholders.	5	55.6%
Communications: Strategic communication with stakeholders and the public about your program.	4	44.4%
Environmental Support: Having a supportive internal and external climate for your program.	3	33.3%
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities.	3	33.3%
Funding Stability: Establishing a consistent financial base for your program.	2	22.2%
Strategic Planning: Using processes that guide your program’s direction, goals, and strategies.	2	22.2%
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness.	1	11.1%
Program Evaluation: Assessing your program to inform planning and document results.	-	-
N/A	2	22.2%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%.

Table 26: Objective 5 – Conduct population studies to explore impacts on dietary quality by increasing target crops in US diets and assessing consumer acceptance and valuation of whole grain and legume-based foods. (n = 10)

Response Option	Frequency	Percent
Communications: Strategic communication with stakeholders and the public about your program.	5	50.0%
Strategic Planning: Using processes that guide your program’s direction, goals, and strategies.	4	40.0%
Funding Stability: Establishing a consistent financial base for your program.	2	20.0%
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities.	2	20.0%
Partnerships: Cultivating connections between your program and its stakeholders.	2	20.0%
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness.	2	20.0%
Environmental Support: Having a supportive internal and external climate for your program.	1	10.0%
Program Evaluation: Assessing your program to inform planning and document results.	-	-
N/A	4	40.0%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%.

Table 27: Objective 6 – Focus our educational capacity on secondary student instruction and teacher professional development, and farmer training. (n = 9)

Response Option	Frequency	Percent
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities.	5	55.6%
Environmental Support: Having a supportive internal and external climate for your program.	4	44.4%
Communications: Strategic communication with stakeholders and the public about your program.	3	33.3%
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness.	3	33.3%
Strategic Planning: Using processes that guide your program’s direction, goals, and strategies.	3	33.3%
Funding Stability: Establishing a consistent financial base for your program.	1	11.1%
Partnerships: Cultivating connections between your program and its stakeholders.	1	11.1%
Program Evaluation: Assessing your program to inform planning and document results.	1	11.1%
N/A	2	22.2%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%.

Table 28: Objective 7 – Disseminate knowledge gained and products developed to stakeholders across agriculture, food, and health sciences, and communities, schools, and underserved populations through a wide-reaching extension effort. (n = 9)

Response Option	Frequency	Percent
Communications: Strategic communication with stakeholders and the public about your program.	5	55.6%
Strategic Planning: Using processes that guide your program’s direction, goals, and strategies.	4	44.4%
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities.	3	33.3%
Partnerships: Cultivating connections between your program and its stakeholders.	3	33.3%
Environmental Support: Having a supportive internal and external climate for your program.	2	22.2%
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness.	2	22.2%
Funding Stability: Establishing a consistent financial base for your program.	1	11.1%
Program Evaluation: Assessing your program to inform planning and document results.	1	11.1%
N/A	2	22.2%

Note. Respondents could select multiple responses; thus, the sum of the frequency percentages will be greater than 100%.

Table 29: Please provide any additional thoughts or suggestions that may be helpful to project leadership as they begin initial planning efforts related to sustainability of the Soil to Society project. (n = 2)

Responses
<i>Focus on additional funding opportunities and collaborations that expand the team.</i>
N/A.

Note. No themes were found for this question.

Final Thoughts:

Table 30: What have been the most significant benefits or impacts for you in being a part of the AFRI SAS Soil to Society project? (What have you gained so far?) Consider: Possible improvements to your awareness, knowledge/understanding, skills/abilities, attitudes/mindset, behaviors/practices, and/or communications/networks. (n = 27)

Theme	Frequency
Teamwork experience (i.e., internal and external collaboration, networking, exchanging skills/knowledge).	15
Research opportunities, experience, and advancement (i.e., deploying national surveys, engaging with experiments, improving awareness, better understanding of field/research).	14
Benefit from the interdisciplinary nature of the project (i.e., deeper understanding of research/topic and different disciplines, stronger interdisciplinary connections).	9
Strategic communication, marketing, and project logistic skills.	3
Academic development.	2
Professional/career development.	2
Appropriately funded.	1
Developing education models.	1
Grant writing.	1
Greater appreciation of work.	1
Personal improvements.	1
N/A.	2
<i>Suggestions</i>	
Need to improve collaboration with others on methods and analysis techniques.	1
Provide professional development opportunities for students.	1

Note. Survey participant responses have been coded to multiple themes as applicable. Therefore, the sum of the frequencies is greater than *n*. Additionally, two respondents left suggestions rather than or in addition to listing benefits, the themes of such are listed at the bottom of the table.

Table 31: Considering progress and collaboration, what aspects of this project are most successful? (What are the project's strengths? What have been some early "wins"?) (n = 23)

Theme	Frequency
Collaborations (internally, externally, and cross-institutionally).	11
Multi-/trans- disciplinary teams.	7
Research products and progress (producing data, validation of research methods, testing crops).	4
Capable, impressive, and passionate team/leadership.	3
Focusing on consumer health as the end target.	2
Good communication (including summer meeting).	2
Establishing summer high school research opportunities.	1
Goal flexibility.	1
New products, research, and research materials.	1
Too early to tell/not sure yet.	2

Note. Survey participant responses have been coded to multiple themes as applicable. Therefore, the sum of the frequencies is greater than *n*.

Table 32: Please share any suggestions you may have to improve the project’s efforts toward progress and collaboration. Consider: How should the project focus its efforts to maximize impact? What aspects of the project are most in need of improvement? What are the project’s greatest challenges at this point? (n = 18)

Theme	Frequency
Improve/continue to support collaborations.	4
Create/consult for connection to food industry for marketing final products.	3
Improve research/project dissemination (via social media, emails on listservs, and expand scope of information disseminated and the targeted audience).	2
Conduct shorter surveys.	1
Extension needs more focus across all other objectives.	1
Help with logistics of planning.	1
Improve summer high school internship programs.	1
Increase co-PI meetings or weekly/biweekly communications.	1
Need more equipment/instruments.	1
Need more staff/team members to do research.	1
Provide a S2S gathering for public attendance.	1
Shift focus to transfer findings to application for impact.	1
Other.	2
N/A.	4

Note. Survey participant responses have been coded to multiple themes as applicable. Therefore, the sum of the frequencies is greater than *n*. “Other” responses included: “I am happy to be a part of this project” and “I think we are doing great with such a big team. The annual meeting, quarterly grad student meetings, and team bi-monthly meetings are working well in my opinion.”

Table 33: Please share any additional comments or feedback you may have related to the AFRI SAS Soil to Society project’s progress or collaboration efforts. (n = 9)

Theme	Frequency
Enjoyed/positive experience participating in the project.	2
Leadership is doing great (i.e., organizing the annual meetings).	2
All team members have been pleasant to work with.	1
Looking forward to getting to know everyone and their work.	1
Need more equipment/instruments.	1
Need more staff/team members to do lab work.	1
N/A.	4

Note. Survey participant responses have been coded to multiple themes as applicable. Therefore, the sum of the frequencies is greater than *n*.

Optimizing Human Health and Nutrition: From Soil to Society

Year 3 Progress and Collaboration Survey Report

Appendix C - Responses to Qualitative Items

Please note that comments have been edited to protect confidentiality and enhance readability. The numbering corresponds to the table number in Appendix B.

Progress and Satisfaction:

5. For each objective that you indicated is behind or somewhat behind schedule, please briefly describe which parts of the objective(s) are behind and any mitigation plans that have been developed to address reaching the project goals. (n = 11)

- Completing the full dietary fiber analysis due to schedules, equipment maintenance delays, and inventory. Equipment has been fixed/addressed/replaced many times (as necessary), establishing connections with contractors for expedited assistance, and trying to coordinate schedules with other users of the same equipment to utilize it.
- For the Food Science team, we need to be doing a better job of engaging with our invested parties and getting them involved in product development. We've done a lot of preliminary work, and the methods are ready, we just need to start doing the work with our project materials and should really have invested parties' priorities represented before then. The Human Health and Nutrition team is ahead of schedule in methods but is waiting on material which will come this year. I have gotten the impression that [redacted] is behind on developing their methods. No tests were required this past year, so next year will be more telling. The Education team is on schedule. I think [the project] hasn't progressed much this last year on farm to school and farmer education workshops. I don't believe anything has specifically been done for outreach and extension. We have our marketing accomplishments. I don't think we are scheduled to have any formal products out yet, but it would be nice to have some sort of procedure for future extension fact sheets and materials.
- I need to wait for others to collect their data before I start to analyze. There was a delay in a student starting. We are working on an alternative.
- In vitro fermentation and microbiome analyses work has taken longer than anticipated due to general research infrastructure limitations that needed to be addressed.
- We have hired a staff member and have developed an intervention plan and specific objectives. The new project is back on schedule to be completed on time.
- Mainly we are waiting for the harvest to be completed so we can get the seeds for processing and product development.
- Method validation for 9 elements done on a single element basis, was a very long process. However, with the collective experience through this process, we will be able to develop a multi-element calibration, which will dramatically increase the throughput. Preliminary testing has shown good results and further validation of this method will continue soon.
- Processing samples takes a long time to complete. This results in some delay to our schedule. As a result, I am organizing my schedule to allow me to better use time and facilities during the week.
- The farm-to-school engagement piece has lagged a little due to staff transitions and capacity internally and externally at partner schools. We are actively working to build capacity with internal hiring and establishing partnerships with new staff at partner organizations.
- We have had a gap in staffing around farm-to-school related activities and are currently hiring to get these activities back on track. Confident that we can recover and get back on track?

- We'd hoped to have fielded the survey and a choice-experiment of American perceptions of whole grains and pulses by now, but when we received the quote for how much it would cost, it exceeded our planned budget (costs went up due to inflation). It took time but we were able to find complementary funding to be able to carry out the survey, by building on a collaboration with the Center for a Livable Future at Johns Hopkins. At the end of the day this partnership also allowed us to incorporate more questions and to gain the insights of a broader group of experts as they had carried out similar national surveys in the past related to meat consumption.

7. Briefly describe why you are less than or not at all confident that the project can achieve its goals and any additional supports you feel are needed for the project to achieve its goals. (n = 1)

- I think that the proposed work can be accomplished, but in terms of the ultimate impact, the project had very lofty goals that were always going to be difficult to fully achieve.

9. Please briefly explain your satisfaction level with the implementation of this project. (n = 28)

Completely satisfied

- I believe in the originality and feasibility of the project. According to the reports of the process so far, the results are successful. Additionally, the professionalism of the project team makes me feel completely satisfied.
- We are on track to meeting the proposed objectives of the project.
- We have a great team and the vision we have for what we will get out of this project has become much clearer over the past year as a result of many discussions. Rather than duplicating findings of previous studies, we took the time to review the literature, reflect on what is known and what isn't, and what information might be needed to help Americans eat more whole grains and to test out and get feedback on the questions we want to ask. I'm very excited to see what the findings show.

More than satisfied

- All the teams work well together. People are willing to share information and help where needed.
- At this time last year, I would have said "Satisfied", but our collaborative research projects are really starting to ramp up nicely. Our individual (within objective) research is going well; however, it is transdisciplinary research that is beginning to make real progress. I've seen/heard/participated in more communication across objectives the last few months than the previous almost two years and I find this very encouraging.
- Great group of collaborative individuals and good project support.
- I feel that the leadership team and each of the researchers are working hard to address the objectives and to coordinate among the teams to enhance cross-disciplinary understanding and work.
- I think the team is really becoming more integrated across disciplines.
- It's hard to see all the progress occurring by our individual teams, but I am always excited when I hear all the projects/findings that folks are working on when I speak one-on-one with our co-PIs or at the all-group meetings.
- Seems to be a great group with lots of activity. We have been somewhat on the fringes of much of the project and were not able to attend the most recent annual meeting and so are admittedly a little bit out of the loop; But we've been impressed with communications from project management and seems to be on track.

- The communication and integration of the ideas from various collaborators has been great. Our monthly leadership meetings have been wonderful.
- The project is able to achieve its goals and is aptly working towards future goals.
- The team works well together. Good idea generating and interactions at grant meetings. Decent support of cross-collaborating projects.
- We set very specific goals in the proposal regarding our sampling and sample processing schedule. We have already collected a lot of samples, which are currently being processed. The setback we have is due to the unusually dry conditions this spring which prevented us from completing this sampling cycle. We will attempt again next spring.

Satisfied

- Although it is a large project, there is progress being made by every single team. I know for the Soil and Crop group there have been challenges that keep us from being where we would like to be, but there is progress every quarter.
- [redacted] are good facilitators. The project meeting this summer was informative and stimulating. It is nice in the second year to see the real outcomes that are being generated.
- Beginning this project with instruments that required method validation before sending results off has been a challenge. With everyone's patience, we have been given the opportunity to produce reliable data with versatile methods of analysis to accommodate such a wide range of crop species.
- Effective teams have been formed and the work is being done from my perspective. Communications in different formats have been great to assist in keeping abreast of the project as a whole.
- Good collaboration among project partners, solid leadership, and connections are being made between research groups.
- Have gained a better understanding about others' work through the in-person meetings and have started meaningful collaboration that would be impossible otherwise.
- I believe everyone is working together toward the end goal.
- Implementation of the AFRI SAS Soil to Society project is providing more opportunities to work with many food grains, which will help to understand the physiological health benefits of each grain.
- It is evident that the different teams are making good progress. On the other hand, and maybe not surprisingly, synergism between work packages is still somewhat limited. Some sort of running document summarizing plant material available AND of interest for nutritional analyses would be very helpful.
- It's a large project with perhaps a few more layers of management than necessary, hard to connect meaningfully across components; but the breadth of work under the overall project is certainly impressive and will be impactful.
- The AFRI Soil to Society initiative encompasses more than just agricultural activities taking place on farmers' fields. Instead, it establishes a multidisciplinary network involving experts at every stage, from production to consumption. Beginning with soil health and progressing through the cultivation of healthy plants and the quality of nutritious food, it ultimately extends to the well-being of consumers. This project effectively bridges the gap from soil to society.
- The project helped me as a student to push my academic and professional boundaries with the opportunity of mentoring a high school student during the summer.
- The project successfully leverages the value of its transdisciplinary members and approaches, fostering the development of more relevant research goals.

- This is a large project with several different people involved and several different goals. The teams seem to be working well together to complete a cohesive project.

Less than satisfied

[No answers were received for this item]

Not at all satisfied

[No answers were received for this item]

11. Please describe any initial work being done to integrate work from your objective(s) with other objectives' work this year. (n = 26)

- Communication between breeders and cropping systems researchers about variety selection and potential end use.
- Communication with other objectives, particularly Objective 3.
- Facilitating inter-team meetings. Integration of platforms allowing for consistent full group communication. Organizing annual meeting and bi-annual winter update.
- Germplasms are being evaluated for their nutrient content and assessed using genetic analysis techniques to accurately select those that will ensure gain with specific traits in the future.
- From year 1, we had some small seeds from the agronomy team that we used to get the baseline data for the quality of the seeds as well as some model food products.
- I am happy with the way we integrate our efforts within the Soils and Crop group. I do not know much about how the other groups are integrating, other than what I heard at the annual meeting. My specific research [redacted] only integrates with members of the Soil group.
- For the project, we have got all the plants harvested from the field. I am working on looking for the protocols necessary for the analysis of micronutrients in my project.
- I am working with [redacted] to develop food products for my human clinical trial.
- I learn so much from hearing what the other groups within the project are working on and the in-person visits at the annual meeting were very inspiring. We've had a number of meetings within our objectives to look for synergies- for example, I'm doing a separate analysis of [redacted] and came across some analytical tools that I thought would be helpful for the analysis that [redacted] is leading. We also got some early findings from their work that informed some of the food choices we included in our survey. In terms of work across objectives, we have had a couple of discussions with [redacted] about linking their work to our qualitative work which we think will lead to richer findings as we could potentially capture participant experiences with the products they are testing using qualitative methods. It was also great to get feedback from researchers from the other working groups when we presented our plan for the study at the annual meeting; they came up with ideas that I hadn't thought of.
- In objective 4, in-vitro fermentation of different processing treatments (raw, boiling, extrusion, quinoa cookies) on quinoa has been conducted and it was found that different processing treatments significantly change the gut microbiota profiles. This preliminary work was integrated with the objective 1 (Plant Breeding & Genetics), where they have grown and supplied the quinoa grains, and objective 3 (Food Science & Product Development), where extruded quinoa and quinoa cookies developed and sent to objective 4 to perform gut health using in-vitro fermentation techniques.
- I will be working with graduate students and staff to test the bread quality coming from wheat from the SAS project.
- N/A.

- None yet because of a delay with a student.
- Our quinoa and buckwheat breeding lines and varieties are being tested by the Food Science team for functionality, flavor, and seed composition. Recipes are being developed and evaluated critically for functionality and flavor. These seeds have been and continue to be tested by Franck Carbonero's team for their potential impact on the human gut microbiome. The Population Health team is also now collecting 100 pounds of buckwheat, quinoa, and barley, for their research. It is looking like at least 2 of these three crops will be using WSU lines/varieties, and hopefully all 3 crops.
- Participated in the high school internship program for the Education objective component.
- Plant breeders need to be able to coordinate with others more frequently than the semiannual meetings. I think maybe some of that coordination can be in the spring prior to the field season. It is hard to maintain communication in the summer because we are all so busy and I don't see that changing.
- Producing phenotypic and nutritional data to produce new crop varieties, which can then be passed on to all other objectives.
- There has been communication between objective teams about integration, many of these potentials are pending based on the timing of the work.
- This year we placed 5 high school interns with different mentors from different research teams. The mentor participation we had was great! We are currently in the process of developing curriculum that pulls from the content area and research from across all objectives.
- To carry out our nutritional quality studies on lentils, especially resistant starch and folates, the population was selected, and reproduction was started. Breeding and genetic studies will continue for more nutritious lentils after reproduction.
- We are actively publicizing our work on whole grain baking.
- We have performed analyses with quinoa products from the Food Science team and the bread lab. We have also planned for the upcoming buckwheat harvest.
- We met with the other leads on our work package, and they provided input that helped to craft our nationally representative survey.
- We worked with scientists in Spokane on the health aspects of whole grain meals.
- Working on developing curriculum that simulates the objectives and research projects.

12. What support or resources would help facilitate the integration of work from your objective(s) with other objectives' work? (n = 21)

- Additional activities like those conducted on the second day at the annual meeting, additional opportunities to meet in-person, short presentations on people's areas of study (these are great so far).
- Just within the Soil team: help with field work (which we had), synchronize sampling period (which we did), and use the lab facilities (which we do).
- Working in the Breeding group, we have a substantial amount of work to be done in collaboration with the Food Quality group for the micronutrient analysis and other breeding teams. Therefore, helping any programs to get to know each other and identify how and what they are working on can help a lot. Sharing the work progress through presentations and making connections with all the group can help.
- Continuing the ongoing collaborative meetings.
- Document(s) with a list of available/projected plant materials that people are interested in testing for nutritional properties. As a supplement, lists of crops/products that may be available but not

directly grown for the project (for example barley varieties are almost entirely malting ones, so food barley varieties would be needed...).

- Finding an appropriate student.
- Forming interdisciplinary research teams that include experts from diverse fields such as agronomy, nutrition science, genetics, and food technology can foster the integration of work. Creating collaborative platforms or research networks where researchers and institutions can easily share data, findings, and best practices is crucial. Funding can support joint research initiatives, workshops, and conferences to promote knowledge sharing. Developing a centralized data-sharing infrastructure can help researchers across objectives access and analyze relevant data efficiently. This infrastructure should prioritize data security, quality, and accessibility.
- I hate to say additional meetings, but I think we may need some of that.
- I think we are doing fine on this aspect; the quarterly graduate student meetings help.
- I would like to suggest recruiting some trainees who can work with us for a minimum of 6 months, and they can interact and teach their knowledge to the local society, which will further integrate objective 6 (Education) and objective 7 (Extension).
- Just if the weather cooperates consistently over the next two years and we get good yields for the food product development work, that would be great.
- N/A. (5)
- Nothing outside of what I already have access to.
- Resources put onto teams from the summer meeting.
- The concept of Soil to Society is a brilliant one. I would love to see an effort to pull together a paper spanning all working groups, describing the gaps in knowledge that we are filling. I know it's not in our work plans, but I think could be quite impactful.
- Well, quite frankly, we could use more funds. I think applying for additional funding these last three years of this project will be critical. Other important support includes setting up small transdisciplinary group meetings that are dedicated to examining each crop and how it is flowing through the pipeline. This will help us make sure no crop is being left behind.
- Willingness to host interns in all objective areas, initial findings (regular updates on findings and progress), and clean, sample data sets that can be used in curriculum design. Video interviews with researchers and grad students across the research areas.

Graduate Students/Postdoctoral Researchers:

14. Please describe the ways that you believe your involvement in the AFRI SAS Soil to Society project has helped advance your career. (n = 8)

- Being a part of the AFRI SAS Soil to Society project will help me collaborate and communicate with the multi-disciplinary experts working in different fields who are responsible for connecting the farms to the consumer's plate. Working with such a dynamic group will increase my knowledge and my networks with diverse aspects of agriculture and beyond, which will be helpful for my career.
- Being part of this project will provide me with invaluable research experience. The project will encourage collaboration with researchers from diverse backgrounds and expertise. Working in interdisciplinary teams will hone my ability to communicate effectively, solve problems collaboratively, and appreciate different perspectives. These skills will make me a more effective team player in my career. The project will result in numerous research findings and outcomes. I will have the privilege to co-author publications and present research at conferences. These experiences will help establish my credibility in my field and increase my visibility among peers

and professionals. Through the project, I will have the chance to connect with fellow researchers, mentors, and industry experts. These networking opportunities will open doors to new collaborations, potential job opportunities, and access to valuable resources within the field. Beyond the professional benefits, this project will contribute to my personal growth. It will instill a strong sense of purpose and commitment to making a positive impact through my work, which will be a driving force in my career trajectory.

- Building connections.
- Experiencing the value brought by an interdisciplinary approach in scientific research.
- I am able to learn different skills including teamwork, better communication, and presentation skills in addition to fulfilling my academic goals.
- It has allowed me to work in an interdisciplinary team and experience how large teams like these are managed/organized. I hope to carry out a similar type of work after my studies.
- Participation in the project has improved my ability to explain my research project to a broad audience that doesn't necessarily have a scientific background.
- This project helped me to learn more about teamwork, writing grants together, and doing research work, which is connected with each other's research. I believe this will help me do better in my future career too.

Sustainability Domains:

29. Please provide any additional thoughts or suggestions that may be helpful to project leadership as they begin initial planning efforts related to sustainability of the Soil to Society project. (n = 2)

- Focus on additional funding opportunities and collaborations that expand the team.
- N/A.

Final Thoughts:

30. What have been the most significant benefits or impacts for you in being a part of the AFRI SAS Soil to Society project? (What have you gained so far?) Consider: Possible improvements to your awareness, knowledge/understanding, skills/abilities, attitudes/mindset, behaviors/practices, and/or communications/networks. (n = 27)

- A better awareness and understanding of the work of colleagues in other disciplines that link to human health and nutrition of the food we eat. Stronger connections with colleagues in other disciplines.
- An awesome opportunity to carry out a nationally representative survey and a choice experiment that will yield important insights for consumer behavior and change communication and product packaging/labeling/marketing to reach consumers with healthier and more sustainable options.
- Appropriate level of funding for a project, connections with researchers outside of WSU, and connections to plant breeders and food scientists at WSU.
- A website that lists links all PIs home website.
- Building collaborations for future projects, growing knowledge of other research areas within the grant, and developing educational models that can be expanded upon.
- Collaborations. A better understanding of the broad issues with a wholistic lens.
- Connections and skills/abilities.
- Could be better about reaching out to others within the SAS program to gain more insight on method development and analysis techniques.

- For me it has been learning about cropping systems that I have not worked with before joining the SAS Soils and Crop teams. Previously, I have worked with tree crops and now working with row crops and learning more about their management is very valuable for me as I hope to proceed with a career as an extension agent.
- I got to know about lots of people working in different disciplines in this project and identified my potential collaborators for the future.
- I cannot answer because I have not started working full time yet.
- I have learned about teamwork and collaborations, networking, exchanging skills and knowledge, grant writing, and self-improvement.
- My knowledge of the science and literature related to whole grains, lentils, etc., has grown exponentially, particularly related to sub-aims outside my main focus of training. Having the space to develop our research questions in a way that is informed by this growing knowledge has been very helpful. It's been wonderful getting to know researchers from each of the different disciplines covered in the project, so my network has grown a lot.
- I have gained more awareness in terms of what research entails. I am gaining more knowledge on the grant topic. I am learning more about creating timelines and being more independent in my grant work.
- I have learned more about many aspects of the food system and what happens to crops after they come out of the ground.
- Improvements to awareness of nutrition and food product research.
- Knowledge.
- Knowledge/understanding, practices of others, and connections/networks.
- Learning about and an improved understanding of the other disciplines involved in this project. Developing and expanding professional network for collaboration.
- N/A.
- Strategic communication, marketing, knowledge of project logistics, lots of connections within WSU and partner organizations.
- Strengthening connections and opening possibilities for new research questions.
- The project is a great place to exchange knowledge. Perhaps the project could offer professional development training to students in the future.
- This project has been instrumental in my academic and professional progress. I am making new connections, learning new skills, and gaining in-depth knowledge about my discipline.
- Understanding the difficulties of planning in agricultural systems and thus appreciation for this type of work.
- Understanding the value of inter-disciplinary collaborations.
- We benefit from the interdisciplinary aspect of this grant.

31. Considering progress and collaboration, what aspects of this project are most successful? (What are the project's strengths? What have been some early "wins"?) (n = 23)

- Clearly the collaborations across the WSU campus have been very fruitful and we've been integrated into some of that as an external partner. We have also found the cross-institution collaborations within our objective to be really beneficial.
- Collaborating with others who study other different aspects of soil health. This is the strength of the project. There are a lot of unknowns when it comes to soil biota, especially in the Pacific Northwest. Every piece of data we collect will be new.
- Connections being built and synergies with ongoing projects.

- Development of new cultivars and development of new food products.
- Each individual team is incredibly smart and capable of meeting their research goals. I am consistently impressed by our co-PI's knowledge of their research and passion for the project.
- Good communication so far. Helps to help things in check.
- I cannot answer because I have not started working full time yet.
- I appreciated the flexibility in changing objectives. With the objective [redacted] team, collaboration is more helpful.
- I think the project strength is the collaborations within teams. It is more difficult to work with people outside your own team, but within teams, collaboration and support is very present.
- I think we have a solid team and will soon have a lot of exciting data to work with- we have asked important questions that I hope will also be impactful.
- I would say teamwork and collaboration. Because of teamwork and collaboration, we have successfully completed our preliminary work.
- Multidisciplinary teams are on the same platform. The targeted end is the consumer's health, which is the ultimate end-product for all research.
- Not sure yet.
- Partnerships across disciplines with the common goal of health.
- Producing valid data; having the ability to produce accurate data.
- The comprehensive nature of the project calls for collaboration, which the project team has successfully achieved. This is a major strength of the project.
- Strengths: Strong collaborative working relationships. Early Win: Establishment of summer research opportunity for high school students and the level of work they completed, generating excitement in possible career fields moving forward.
- The interdisciplinarity is the best aspect/strength for me and an early win would be the validation of methods needed in biofortification research.
- The network.
- The Plant Breeding and Soils/Cropping System groups are moving forward on all fronts. The breeders have mostly integrated well with the Food Science team, though it would be good to do some internal checking on this to make sure all crops are making their way through the pipeline. Early wins include the testing of most, if not all, of these crops by both the Food Science and the Human Health teams. This is just beginning, but it is exciting.
- The project's strength is the interaction among colleagues. The summer meeting was successful in terms of learning more about what others are doing.
- Thinking and working across disciplines.
- We have a project team that is very invested in and passionate about this topic and this work. We have leaders in the field as part of our project, truly wanting to work together to make positive change.

32. Please share any suggestions you may have to improve the project's efforts toward progress and collaboration. Consider: How should the project focus its efforts to maximize impact? What aspects of the project are most in need of improvement? What are the project's greatest challenges at this point? (n = 18)

- All the components are in different stages so it is hard (too early) to tell a coherent story about outcomes, but we will get there!
- Do shorter surveys.

- For the Soil team, and especially for us, the greatest challenge is the logistics of planning. We live on the East Coast and our sampling requires a specific set of weather and soil conditions. These things are unpredictable, and we have only a narrow window in spring and fall.
- I am happy to be part of this project.
- I am most interested in learning what the Human Health researchers have found with our varieties and if we could begin the process of initiating feedback loops. I feel like this is a mystery at this point, perhaps because it is still early in the project. I am encouraged by Franck Carbonero's collaborative work and look forward to seeing and discussing results. I am excited that recruiting and human feeding trials will begin this winter. I would like to see and learn more about [redacted]'s involvement; I'm not quite clear yet what their work entails and what it means for the rest of the team.
- I cannot answer because I have not started working full time yet.
- I don't know the early wins of other areas. Better stakeholder engagement. Focus on transferring findings to application to make an impact.
- In the Nutrition and Gut Health team, we need more manpower, some specific equipment, mainly gas chromatography-mass spectrometer (GCMS), real-time PCR, conventional PCR, nano drop for DNA/RNA quantification, and a bead-beater for DNA extraction.
- I think the extension aspects of the project need more focus across all the other objectives. The greatest challenges will be moving the needle significantly in a short time frame and figuring out pathways to keep the collaborations that are being built ongoing.
- There can be some more collaborations, including industry partners. In addition to this, the summer internship program with high school students can be improved to make it a success.
- I think we are doing great with such a big team. The annual meeting, quarterly grad student meetings, and team bi-monthly meetings, are working well in my opinion.
- I think we need to think a lot about dissemination of findings beyond just peer reviewed papers... planning events in different parts of the country/online to disseminate findings to different groups, for example.
- Maximize outreach and interdisciplinary collaboration.
- More social media action. Emails on listservs. The project's greatest challenges so far are implementing research and getting the word out there about the research.
- N/A. (2)
- Soil to Society gathering for the public.
- Stronger stakeholder/advisory board voice. Connection to the food industry for marketing our final products. More all co-PI meetings or weekly/biweekly communications.

33. Please share any additional comments or feedback you may have related to the AFRI SAS Soil to Society project's progress or collaboration efforts. (n = 9)

- Great work by the leadership team! The biggest obstacle is going to be everyone's bandwidth to fully take advantage of all that this project has to offer.
- I am honored to collaborate with members of the Soil and Crop team and getting to know Kevin as a leader. All members, researchers, students, and staff have been extremely helpful and pleasant to interact with. I was involved in other big projects in the past; so far this is my most positive experience.
- I cannot answer because I have not started working full time yet.
- Looking forward to getting to know everyone in this project and their work.
- N/A. (3)
- This has been a wonderful project to be part of and the leadership has done a great job getting everyone together for the annual meetings!
- We need more manpower to do the lab work and some specific equipment mainly gas chromatography-mass spectrometer (GCMS), real-time PCR, conventional PCR, nano drop for DNA/RNA quantification, and a bead beater for DNA extraction.

Optimizing Human Health and Nutrition: From Soil to Society

Year 3 Progress and Collaboration Survey Report

Appendix D – Social Network Analysis

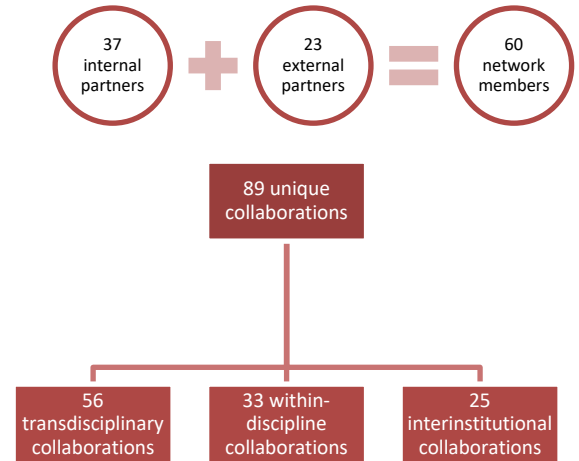
To further understand the Year 3 network among Soil to Society project team members, the evaluation team used key data to complete a social network analysis (SNA) and created three network plots (i.e., sociograms) that represent ways in which project collaborators are connected (see Figures 2–4 on pages 5–7). The SNA used data collected through the Year 3 annual Progress and Collaboration survey. Survey respondents shared the name and institution or organization of up to five people with whom they collaborate most frequently on the project (either internal team members or external partners) and the history of the collaboration (i.e., new collaboration established due to the project or existed prior).

The evaluation team used Cytoscape, a software tool for the analysis and visualization of social networks, to create the sociograms. The following information will assist in interpreting the sociograms:

- A sociogram is a graphical representation of the structure of a social network using shapes (“nodes”) and lines (“edges”) between the nodes. The network includes all nodes and all edges.
- Nodes in a sociogram represent participants of the network. In this analysis, a node can represent individuals (a survey respondent or a primary collaborator listed by a survey respondent) or institutions. Individuals and institutions may be either internal or external to the project.
- Node size, shape, and color represent attributes of network members (e.g., group affiliation). In this analysis, the size of a node represents the frequency with which that network member is a part of reported project collaborations (“degree”), with larger nodes representing respondents with more reported collaborations. In sociograms of individuals, the color of the node represents the network member’s group affiliation: institution (Figures 2 and 4) and discipline (Figure 3). The shape of the node indicates whether an individual or institution is internal (circle) or external (square) to the project.
- Edges between nodes in a sociogram represent relationships between network members. Physical characteristics of edges (e.g., color, pattern) represent attributes of relationships. In this analysis, the color of an edge represents when the collaborative relationship was established (i.e., whether it is a new collaboration established due to the Soil to Society project or existed prior to the project), while the pattern indicates whether a collaboration is transdisciplinary.
- The specific position of the nodes is not necessarily representative of any factor related to the social network. However, nodes with more connections tend to be more centrally located. In this analysis, the evaluation team adjusted the placement of the nodes to ensure that the characteristics of all nodes and edges could be seen clearly.
- It is important to note a few limitations of this SNA. Not all Soil to Society project team members participated in this survey nor did those who did respond answer all the questions. In addition, those who did respond were asked to identify up to five people they collaborate with most frequently on this project and were not able to list any connections exceeding this number. Furthermore, network members external to the project did not receive the survey, so they were not able to select other network members as collaboration partners. Therefore, this SNA presents a snapshot of the connections among the surveyed individuals involved in Soil to Society rather than a comprehensive depiction of all connections occurring in the project.

Social Network Analysis Highlights

The Soil to Society social network is based on the responses of 28 survey participants, 23 from Washington State University (WSU) (82.1%), four from Johns Hopkins University (JHU) (14.3%), and one from Viva Farms (3.6%). These respondents shared a total of 102 total collaborative relationships, 89 of which are unique (counting reciprocal relationships only once). Collaborations occur between 60 individuals across 14 institutions (with the exception of one individual whose institution was not identified). Overall, out of the 60 network members, 68.3% hailed from WSU ($n = 41$), 11.7% from JHU ($n = 7$), and 1.7% ($n = 1$) from each of the following: Agilent, ANKOM Technology, Ardent Mills, Hungarian Institute for Soil Sciences – Centre for Agricultural Research (ATK TAKI), King Arthur Baking, Kansas State University (KSU), Malvern Panalytical, University of Alabama (UA), USDA Agricultural Research Service, Pullman (USDA ARS, Pullman), USDA Beltsville Agricultural Research Center (USDA BARC, Beltsville), Viva Farms, and one individual did not have an institution listed.



The institutions in the project’s social network included those internal to the project (i.e., are part of the Soil to Society grant) and external partner organizations. Internal institutions included WSU, JHU, and Viva Farms.

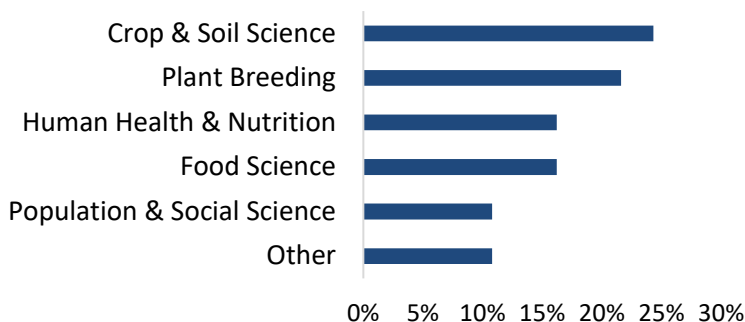
- WSU dominates the project’s social network, participating in 82 of the 89 collaborations (92.1%).*
- JHU is involved in 17 of the 89 collaborative relationships (19.1%).*
- Viva Farms participates in four of the 89 collaborations (4.5%).*

*Note that cumulative percentages will exceed 100% because more than one institution is involved in each collaboration.

Primary Collaborators

A total of **28 survey participants submitted a total of 89 unique collaborative relationships**. The 89 collaborative relationships correspond to **60 unique project collaborators**, which was composed of 23 external partners (38.3%) and 37 internal team members (61.7%). **The network of collaborators represents 14 unique known institutions and organizations associated with the project.**

Figure 1. Team members in network by discipline.



External institutions with which team members are collaborating include:

- Academic institutions: ATK TAKI, KSU, and UA.
- Government organizations: USDA BARC and USDA ARS, Pullman.

The team members present in the social network represent **five main disciplines and an “Other” discipline** that is composed of less populated disciplines (e.g., economics) (see Figure 1).

Social Network Analysis

From the respondent data, the evaluation team created and analyzed three different social networks — one demonstrating collaborative relationships by discipline and relationship type (new or prior) (Figure 2), another by individual institution and the transdisciplinary nature of collaboration (Figure 3), and a third displaying institutional-level collaborations (Figure 4). Overall, the sociograms demonstrate a well-integrated network, with many links between project team members and institutions as well as the 23 external partners. Among all sociograms, however, there are several aspects that warrant consideration. Notably, among the individual-based sociograms, there are two clusters of nodes that are isolated from the main body of the network. Looking at the individual-level sociograms, the evaluation team observed the following trends:

Overall Collaborations:

- **Interinstitutional:** Over a quarter, or 25 of the 88 (28.4%) collaborations with known institutions, were interinstitutional (one individual did not have an institution listed).
 - Of these 25 interinstitutional collaborations:
 - WSU collaborated with:
 - JHU (10 of 25; 40.0%).
 - External institutions in industry and research, e.g., Agilent and ANKOM Technology (5 of 25; 20.0%).
 - Viva Farms (4 of 25; 16.0%). These account for all of Viva Farm’s collaborations.
 - USDA ARS, Pullman (2 of 25; 8.0%).
 - JHU collaborated with:
 - UA, USDA BARC, and ATK TAKI (1 of 25; 4.0% for each).
 - Of the remaining 63 collaborations that occurred *within* their own institutions, WSU collaborated within itself the most (59 of 63; 93.7%), followed by JHU-JHU collaborations (4 of 63; 6.3%).
- **New and Prior:** Just over half of the collaborations existed prior to the start of the project (49 of 89; 55.1%) and thus **just under half of collaborations were newly established** as a result of participating in the project (40 of 89; 44.9%). As such collaborations grow collectively, new and prior, the sustainability of the project grows. Additionally, all relationships have the potential to form new relationships, as collaborating with prior partners enables access to their networks, thereby expanding the whole network.
- **Transdisciplinary:** Almost two-thirds of collaborations were transdisciplinary (56 of 89; 62.9%). Of these transdisciplinary collaborations, about half are new (27 of 56; 48.2%).
 - The proportion of transdisciplinary collaborations among new collaborations of the network is 67.5% (27 of 40), whereas the proportion of transdisciplinary collaborations among prior collaboration is 59.2% (29 of 49); an approximate 8% difference, indicating a greater proportion of new collaborations are transdisciplinary.

Internal Collaborations:

- Since **37 internal collaborators account for 65 of the 89 network collaborations** (73.0%; external partners accounted for the remaining 24 collaborations), **each internal collaborator has made 1.8 collaborations on average**, with a minimum of one to a maximum of 12. Overall, the evaluation team identified **61.5% (40 of 65) of internal collaborations as transdisciplinary**, and **21.5% (14 of 65) as interinstitutional**.

- **Interinstitutional:** Of the 65 internal collaborations, 14 (21.5%) were interinstitutional. The interinstitutional relationships that accounted for the most of these 14 interinstitutional collaborations were as follows in ascending order: WSU-JHU ($n = 10$; 71.4%) and WSU-Viva Farms ($n = 4$; 28.6%). The remaining 51 internal collaborations (78.5%) occurred within their own institutions, the majority of which were between WSU internal collaborators ($n = 50$; 98.0%). Only 2.0% of within-institution collaborations occurred between JHU internal collaborators ($n = 1$).
- **New collaborations:** The three internal collaborators — WSU, JHU, and Viva Farms — created 29 new collaborations among themselves as a result of working on the project, which accounts for 44.6% of the internal collaborations. Additionally, more than two-thirds of new internal collaborations were transdisciplinary ($n = 20$ of 29; 69.0%).
- **Prior collaborations:** The remaining 36 internal collaborations (55.4%) existed prior to working on the project. Three prior collaborations existed between team members at WSU and Viva Farms (8.3%) and two between team members at WSU and JHU (5.6%). The remaining 31 collaborations occurred between team members at WSU (86.1%). Of the prior collaborations, 20 (55.6%) collaborations were transdisciplinary.

External Collaborations:

- The network contained **23 external collaborators who accounted for 24 of the 89 network connections (27.0%)**. All external collaborators **only collaborated with one other** collaborator in the network except for one external partner who collaborated with two collaborators, indicating one average collaboration per external collaborator. **Interinstitutional collaborations accounted for 11 of the 23 (47.8%) collaborations** with known institutions (one individual did not have an institution listed) and **transdisciplinary collaborations accounted for two-thirds (16 of 24; 66.7%)** of the external collaborations.
- **Interinstitutional:** 11 of the 23 (47.8%) external collaborations with known institutions were interinstitutional collaborations. The interinstitutional relationships that accounted for the most of these 11 interinstitutional collaborations were as follows in ascending order: WSU-external industrial or research organization (e.g., Agilent, ANKOM Technology) (5 of 11; 45.5%), WSU-USDA ARS (2 of 11; 18.2%), and the following had one (9.1%) collaboration each: WSU-KSU, JHU-UA, JHU-USDA BARC, and JHU-ATK TAKI. The remaining 12 external collaborations (52.2%) occurred within their own institutions, the majority of which were between WSU collaborators (9 of 12; 75.0%) followed by JHU collaborators (3 of 12; 25.0%).
- **New collaborations:** 11 of the 23 (47.8%) external collaborations were new. Among these new collaborations, eight (72.7%) were transdisciplinary.
- **Prior collaborations:** Of the 12 external collaborations that existed prior to the project, eight (66.7%) were transdisciplinary.
- **Additional features:** Of the 24 total external collaborations, 7 (29.2%) were established through isolated collaboration groups that are not attached to the main network. These relationships were among WSU collaborators.

Figure 2. Soil to Society social network by individual discipline and relationship type.

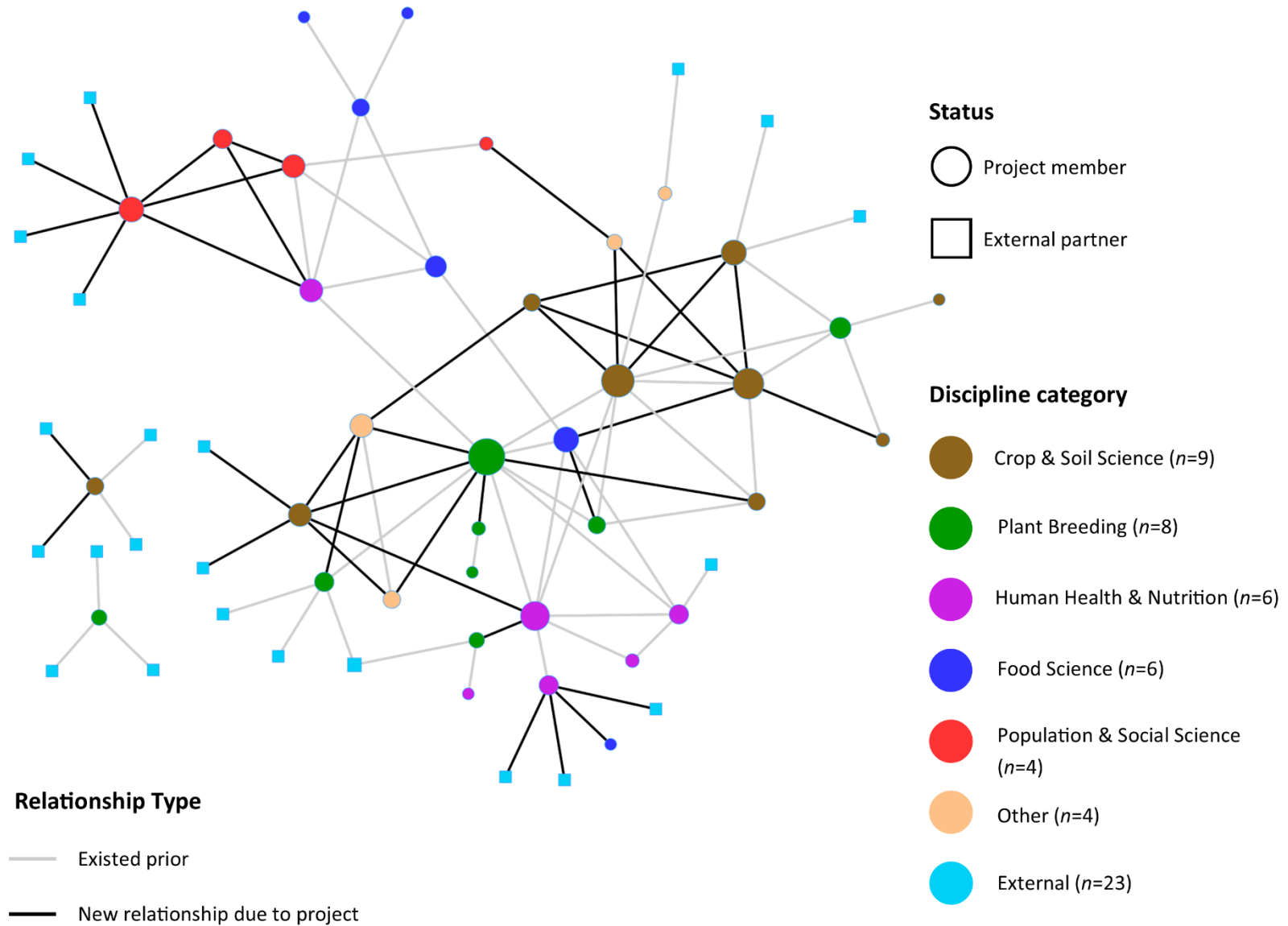
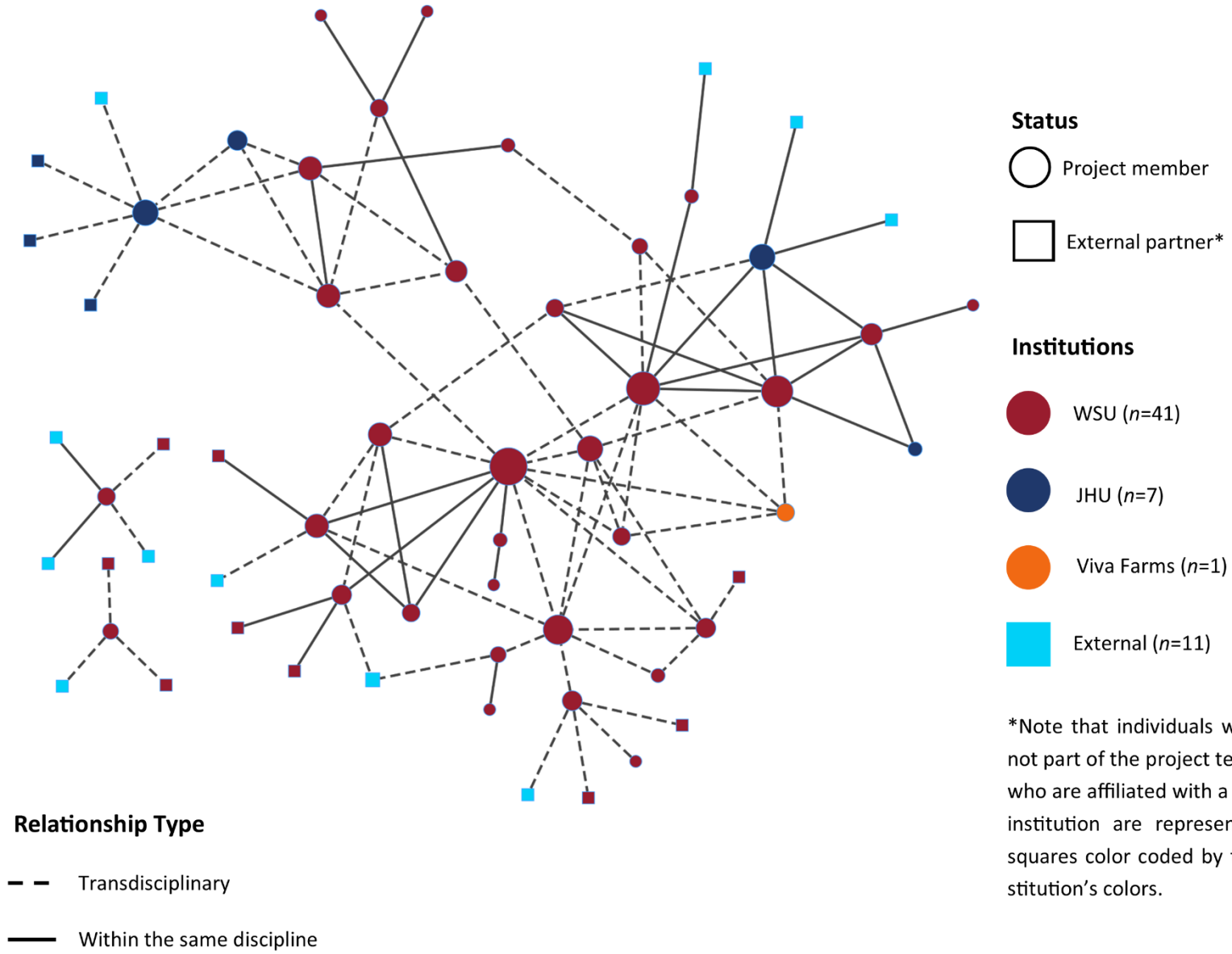


Figure 3. Soil to Society social network by institution and transdisciplinary nature.



*Note that individuals who are not part of the project team but who are affiliated with a project institution are represented as squares color coded by that institution's colors.

Figure 4. Soil to Society institutional sociogram.

