ELEVATING DAIRY RESEARCH AND EXTENSION THROUGH PARTNERSHIP:

A Framework for Strategic Collaboration

USDA United States Department of Agriculture

National Institute of Food and Agriculture

USDA Agricultural Research Service

NDC NATIONAL DAIRY COUNCIL™

CONTRIBUTORS

The Elevating Dairy Research and Extension Through Partnership Meeting held at the National Agricultural Library in Beltsville, Maryland in 2018 was organized by Marlen Eve, USDA – ARS, Jeanette Thurston, USDA – NIFA, Juan Tricarico, NDC, and Nancy Sandbach, NDC.

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PURPOSE

The United States Department of Agriculture (USDA) and National Dairy Council (NDC) recognize that collaboration and coordination among government, industry, and academic scientists are critical to improving the availability of safe and nutritious dairy foods that promote health and are sustainably produced. The Framework for Strategic Collaboration is meant to establish and articulate a clear path forward for coordinated collaboration among dairy community stakeholders in the public and private sectors. Its purpose is to catalyze further progress in planning, executing and utilizing research that will elevate dairy in the marketplace.

The United States Department of Agriculture (USDA) and National Dairy Council (NDC) recognize that collaboration and coordination among government, industry, and academic scientists are critical to improving the availability of safe and nutritious dairy foods that promote health and are sustainably produced.

EXECUTIVE SUMMARY

The world population is expected to reach nearly 10 billion by 2050. Increasing agricultural output and environmental stewardship to ensure a healthy and safe food supply without depleting finite resources will be necessary to meet global demand. In response to this, a concerted effort has been made by USDA – Agricultural Research Service (ARS), USDA – National Institute of Food and Agriculture (NIFA), and NDC to think more broadly about the direction, translation and dissemination of dairy-related research. The Framework for Strategic Collaboration serves as the agenda for coordinated collaboration among the private and public sectors. Key topics of mutual interest identified at the "Elevating Dairy Research and Extension through Partnership Meeting" held in 2018 and vetted by experts in industry, academia and government that were in attendance were categorized under the following research areas: human nutrition; environmental sustainability; food safety and product innovation. Gaps in knowledge identified by members of the dairy community within each of these key topics of mutual interest included:

HUMAN NUTRITION

- Dairy food composition
- Dairy in sustainable, nutritious diets
- Whole-milk dairy foods

ENVIRONMENTAL SUSTAINABILITY

- Dairy cow care and nutrition
- New tools and technologies
- Integrated systems approach to measure and evaluate system-wide impacts and contributions
- Consumer trust

FOOD SAFETY

- Consumer trust
- New approaches to sanitation with emphasis on both traditional and dry-powder environments
- Artisan cheese food safety education and training
- Quantitative Microbial Risk Assessment

PRODUCT INNOVATION

- New uses for dairy products and co-products
- Technology enhancement

The Framework for Strategic Collaboration addresses these gaps in knowledge by describing successes to date and the necessary actions in research and extension that will help fill these knowledge gaps. The Framework for Strategic Collaboration serves as the agenda for coordinated collaboration among USDA – ARS, USDA – NIFA and NDC that demonstrates a strategic approach to advancing dairy's position in a nutritious, safe and sustainable food supply.

Increasing agricultural output and environmental stewardship to ensure a healthy and safe food supply without depleting finite resources will be necessary to meet global demand.

PUBLIC – PRIVATE PARTNERSHIP IS CRITICAL TO MEETING GLOBAL FOOD DEMAND

The world population is expected to reach nearly 10 billion by 2050. Increasing agricultural output and environmental stewardship to ensure a healthy and safe food supply without depleting finite resources will be necessary to meet global food demand. Public U. S. spending on agricultural research and development that can address feeding a global population, however, is in decline. In fact, the share of U.S. public investment in agricultural research and development is currently below private sector investment.[1] It is time to leverage public-private partnerships to address challenges the dairy sector faces with the limited monetary resources that are currently available.

RECENT HISTORY OF PUBLIC-PRIVATE PARTNERSHIP BETWEEN THE UNITED STATES DEPARTMENT OF AGRICULTURE AND NATIONAL DAIRY COUNCIL

Research collaboration between the USDA – ARS, USDA - NIFA and NDC was formally established in 2007 when the National Dairy Research Program (NDRP) was launched. The NDRP was a collaborative research effort to develop the scientific knowledge that would help enhance the domestic and global markets for US dairy producers and manufacturers; remove barriers to dairy consumption and new product development; improve the nation's nutrition and health; and assist in providing for a strong national defense. Initial participants included Dairy Management, Inc. / Dairy Research Institute*; Department of Defense; Natick Soldier Research, Development and Engineering Center; National Aeronautics and Space Administration; USDA – Agricultural Marketing Service; USDA – ARS; and the US Army Research Institute for Environmental Medicine.

In 2014, USDA – ARS, USDA – NIFA and Dairy Management, Inc. signed a Memorandum of Understanding (MOU), the purpose of which was to strengthen the collaboration between NDC and USDA in areas of mutual interest through cooperative research programs and information exchanges. In response to the 2014 MOU, representatives from USDA – ARS, USDA - NIFA, USDA - Economic Research Service and NDC convened in 2016 for the "USDA and NDC Collaborative Research Planning Meeting" to identify joint research priorities in the areas of nutrition, food safety, product research and environmental sustainability.[2] The meeting resulted in research collaborations that helped foster co-funding of research grants, joint programming of outreach activities, stakeholder input, co-authorship on peer-reviewed publications, and shared subject matter expertise on reviewer panels. These research collaborations continue to benefit NDC, USDA and the dairy research community overall by allowing more research planning, execution and communication on a larger scale and in a more efficient manner. Ultimately, these collaborations positively impact consumers in addition to the agricultural sector that USDA and NDC serve.

In 2018 there was a concerted effort by USDA – ARS, USDA – NIFA and NDC to think more broadly about the translation and dissemination of dairy related research by actively engaging researchers that work in extension to help plan, execute and communicate research. The "Elevating Dairy Research and Extension through Partnership Meeting"[3] was held with the following specific objectives:

- Provide a forum that built upon existing collaborations and expanded involvement to represent extension and broader research interests, such as from Land Grant Universities, to address and align specific objectives, activities, timelines and resources required for the development of a research and extension roadmap;
- Align on the iterative strategic planning required to develop and articulate a vision for dairy research and extension shared by all dairy community participants;
- Provide strategic and implementation guidance for stakeholders and partners to meet their own organizational goals on dairy research and extension through collaborative efforts;
- Realign and confirm priorities for human nutrition, environmental sustainability, food safety and product development that empower activation toward the vision and strategic priorities articulated in the roadmap; and
- Align on research roadmap components and develop an agreed upon research and extension agenda

The development of the Framework for Collaboration was a direct output from the meeting and serves as the agenda for coordinated collaboration among USDA – ARS, USDA – NIFA and NDC.

** Dairy Research Institute has since dissolved. Research activities of Dairy Management Inc. are conducted by NDC.*

A FRAMEWORK FOR STRATEGIC COLLABORATION

Key topics of mutual interest between USDA – ARS, USDA – NIFA and NDC that were identified at the "Elevating Dairy Research and Extension through Partnership Meeting" held in 2018 and vetted by experts in industry, academia and government that were in attendance were categorized under the following research areas: human nutrition; environmental sustainability; food safety; and product innovation.[3] By developing a comprehensive framework, however, research can become more integrated across these topic areas. Ultimately, by coordinating research across disciplines, larger, more integrated projects that address the dairy value chain from farm to fork can be developed.

The key topics of mutual interest within each research area of the Framework for Strategic Collaboration were broken down into three categories: gaps in knowledge that need to be addressed; successes to date; and necessary actions that will close current knowledge gaps.

Ultimately, by coordinating research across disciplines, larger, more integrated projects that address the dairy value chain from farm to fork can be developed.

A FRAMEWORK FOR STRATEGIC COLLABORATION

HUMAN NUTRITION

Within the human nutrition research area, key topics of mutual interest included dairy food composition, dairy in sustainable nutritious diets and whole-milk dairy foods.

DAIRY FOOD COMPOSITION
GAPS IN KNOWLEDGE

What is the composition of dairy products beyond basic nutrients?

DAIRY FOOD COMPOSITION
SUCCESSES TO DATE

Currently, the USDA – ARS Food Data System contains nutrient information on the foods and beverages typically consumed by Americans. It also includes ingredient and label information on branded foods that is provided by the food industry. One such database, the USDA – ARS Food Composition Database, is of particular importance because it is used by government scientists, consumers, researchers, farmers and food producers. This transdisciplinary approach to data collection, storage and management allows for bigger data sets that can drive analyses and can help close gaps in knowledge and ultimately benefit consumers.

Research on dairy food composition can lead to better understanding of the unique bioactives present in dairy foods that could impact health beyond nutrition. For example, bringing together the public and private sectors to work together toward understanding bioactive nutrients found in milk and other dairy foods that can ultimately be isolated or enriched to improve human health.

DAIRY FOOD COMPOSITION
NECESSARY ACTIONS

With shared data available and the momentum of transdisciplinary research meetings fueling the key topic area of food composition, the necessary action identified by the attendees is an integrated transdisciplinary research program dedicated to identifying bioactive components in dairy foods and their effects on human health and disease. Whereas this key topic of dairy food composition resides in the human nutrition research area of the Framework for Strategic Collaboration, the integration of product innovations that would safely isolate and deliver these components to consumers and research on their direct health effects highlight transdisciplinary research opportunities that can be explored.

DAIRY IN SUSTAINABLE NUTRITIOUS DIETS
GAPS IN KNOWLEDGE

How do USDA-recommended dietary patterns align with sustainable diets?

DAIRY IN SUSTAINABLE NUTRITIOUS DIETS
SUCCESSES TO DATE

The 2015 Dietary Guidelines Advisory Committee (DGAC) reviewed literature on the environmental impact of dietary patterns and concluded "Consistent evidence indicates that, in general, a dietary pattern that is higher in plant-based foods, such as vegetables, fruits, whole grains, legumes, nuts, and seeds, and lower in animal based foods is more health promoting and is associated with lesser environmental impact (greenhouse gas emissions and energy, land, and water use) than is the current average U.S. diet."[4] A recent modeling analysis of nutritional and greenhouse gas impacts of removing animals from U.S. agriculture, however, indicated that removing animals from U.S. agriculture would create a food supply incapable of supporting the U.S. population's nutritional requirements.[5] Whereas a diet devoid of animal protein would reduce total U.S. greenhouse gas emissions by 2.6 percentage points, it would result in excess dietary energy and essential nutrient deficiencies.[5] Sustainable diets encompass more than a low carbon footprint. Sustainable diets lower environmental impacts; contribute to food and nutrition security and health; protect biodiversity and ecosystems; are culturally acceptable and accessible; are economically fair and affordable; are nutritionally adequate, safe and healthy; and optimize natural and human resources.[6] Whereas dairy production, processing and consumption contributes approximately two percent of total U. S. greenhouse gas emissions and utilizes about 5.1% of U. S. water withdrawal,[5] dairy foods contribute the majority of calcium, vitamin D, potassium and other essential nutrients to the American diet and fit into healthy dietary eating patterns that consider nutrient needs and calorie recommendations.[4]

DAIRY IN SUSTAINABLE NUTRITIOUS DIETS
NECESSARY ACTIONS

Sustainable nutritious diets will be necessary to feed the growing population, which is estimated to reach almost 10 billion people by 2050. Transdisciplinary research that assesses not only environmental impacts, but also health, economic, and cultural aspects to optimize natural and human resources related to diet is warranted.

WHOLE-MILK DAIRY
GAPS IN KNOWLEDGE

How do whole-milk dairy foods fit into healthy dietary patterns associated with reduced risk for chronic diseases, particularly in children and elderly populations?

Are there novel components in milk-fat that provide a human health benefit? Can they be enhanced?

WHOLE-MILK DAIRY
SUCCESSES TO DATE

Emerging evidence published over the past 10 years examining saturated fat consumption and cardiovascuar disease (CVD) endpoints indicates that saturated fat per se may not be directly associated with CVD risk. Thus, saturated fat on its own may be a poor metric for identifying healthy foods or diets. Additionally, although more evidence from randomized feeding-controlled trials is needed comparing the effects of whole-fat versus low-fat or fat-free dairy foods, few available studies in this regard have shown that full-fat dairy foods provide similar benefits as their low-fat counterparts. For instance, in a study in which a modified Dietary Approaches to Stop Hypertension (DASH) diet containing whole milk dairy foods was compared to the standard DASH diet it was found that the modified DASH diet lowered blood pressure to the same degree as the standard DASH diet, reduced blood levels of triglycerides, did not increase total cholesterol and low-density lipoprotein cholesterol (LDL-C) despite of higher SFA intake during the modified DASH diet, and did not decrease high-density lipoprotein cholesterol (HDL-C).[7] This study demonstrated that whole milk and dairy foods can be incorporated into a healthy eating pattern that is calorie-balanced and improves standard biomarkers related to heart disease risk.

In another study full-fat cheese versus low-fat cheese versus a control diet were compared in subjects with metabolic syndrome (MetS). The intervention lasted 12 weeks. It was found there was not any statistical difference between high daily intake of full-fat cheese and the other two treatments on LDL-C and other MetS risk factors.[8]

Further, a study comparing whole-milk versus skimmed milk consumption for three weeks in healthy adults found no significant differences on total and LDL-C, triglycerides, insulin and glucose between whole milk and skimmed milk consumption. In contrast, whole milk intake increased HDL-C. Based on these results it was concluded that whole milk can be part of a healthy diet among healthy individuals.[9]

WHOLE MILK DAIRY
NECESSARY ACTIONS

Whereas whole-milk dairy foods contribute calories and saturated fat to the diet, their role in weight and risk for chronic disease has not been fully elucidated. Emerging research indicates the consumption of whole milk dairy foods may actually contribute to weight maintenance and be neutral in regards to chronic disease risk.[10] Further, dairy-derived fatty acids have been implicated in reduced risk of type-2 diabetes.[10] Whether these fatty acids exert any biological activity related with the prevention of type 2 diabetes needs to be elucidated. Most of this evidence, however, is coming from observational studies, therefore, dietary intervention trials assessing the effects from whole-milk dairy foods, including milk, cheese and yogurt, in the context of healthy eating patterns in diets across the lifespan are necessary to better understand the role of whole milk dairy foods in healthy dietary patterns.

An intriguing lipid fraction of milkfat is phospholipids, compounds that are found primarily as part of the milkfat globule membrane (MFGM) (the membrane that surrounds the lipid globules in milk). Phospholipids constitute approximately 40% of the total lipids in the MFGM. Studies evaluating the uniqueness of fatty acids, elucidating their potential benefits and the mechanisms of action responsible are warranted.

A FRAMEWORK FOR STRATEGIC COLLABORATION

ENVIRONMENTAL SUSTAINABILITY

Within the environmental sustainability research area, key topics of mutual interest included consumer trust, dairy cow care and nutrition, new tools and technology and an integrated systems approach to measuring and evaluating system-wide impacts and contributions. Collaboration on dairy net-zero greenhouse gas (GHG) emissions targets as well as research and adoption of economically viable technologies and practices that achieve improvements in water quality are of importance.

DAIRY COW CARE AND NUTRITION
GAPS IN KNOWLEDGE

How can dairy research and extension lead to optimized dairy cow nutrition and environmental outputs (ecosystem services)?

DAIRY COW CARE AND NUTRITION
SUCCESSES TO DATE

Dairy cow care and nutrition have helped improve dairy sustainability over time. The US dairy industry produces fifty-nine per cent more milk with sixty-four percent fewer cows that consume seventy-seven per cent less feed per unit of milk produced than it did thirty to forty years ago.[11] A recent analysis indicated that US dairy production systems use approximately seventy-five percent of the cattle, eighty-three per cent of the feedstuffs, eighty per cent of the land and seventy percent of the water as it did a little over a decade ago.[12] Further improvements in milk production per cow will reduce the number of cows needed to produce the same amount of milk, leading to a reduced environmental impact of dairy production.

DAIRY COW CARE AND NUTRITION
NECESSARY ACTIONS

Dairy cows digest high-fiber feeds and food industry by-products and convert them into nutritious milk. Enteric methane gas is a byproduct of ruminant digestion. The U. S. dairy industry contributes approximately two percent of total anthropogenic GHG emissions with enteric methane being the largest source of emissions associated with milk production. To optimize dairy cow nutrition and environmental outputs, research is necessary on dairy cow biologic limitations and capacity for feed efficiency, enteric methane emissions, influence of the microbiome, nitrogen utilization, and reproductive efficiency.

Increasing feed efficiency by dairy cows provides opportunities to improve nutrient use (e.g. nitrogen) and milk production while reducing greenhouse gas emissions and nutrient losses to the environment. Developing genomic markers for feed efficiency and incorporating this complex selection trait into genetic selection indexes used extensively by farmers such as the net merit index is desirable. Greater feed efficiency can also be achieved by improving feed quality and digestibility, especially for forages. Research on plant breeding and improved harvesting and storage conditions can drive dairy feed nutrient quality and digestibility and ultimately feed efficiency.

Understanding how the ruminal microbiome affects cow (host) health status, productivity and efficiencies of nutrient (e.g. energy, nitrogen, phosphorous) use is a primary research objective. Some of the specific knowledge that is needed includes improved understanding of the relationships between protozoa, methanogens, and bacteria, cow (host)-microbe interactions, quantitative knowledge of ruminal biochemical transactions including their thermodynamic regulation, and improved understanding of how the microbial population is determined by the host and reacts to dietary manipulation and feeding practices. Information on volatile fatty acid and branched-chain fatty acid production rates resulting from ruminal fermentation is a knowledge gap. Future research must focus on characterizing the relationships between ruminal microbiome structure and function and its impact on cow health, nutritional efficiency and milk production.

Reproductive efficiency also influences the use of biophysical and financial resources on dairy farms and the production and sale of milk and animals (live and for beef). The use of automated measures for estrus detections of cows is particularly promising. Research objectives include improved estrus detection, estrus synchronization, and prevention of early embryonic death.

NEW TOOLS AND TECHNOLOGY
GAPS IN KNOWLEDGE

How can dairy research and extension accelerate the use of new technology to improve dairy farm labor, animal well-being and milk quality?

NEW TOOLS AND TECHNOLOGY
SUCCESSES TO DATE

Investment in dairy genetics research during the mid twentieth century positioned the U.S. as a global leader in dairy cow breeding and milk production. Growth in milk production per cow since 1950 demonstrates the success of U.S. investment in dairy genetics research over that time period. In addition, the development and adoption of genomic tools during the last decade increased the rate of genetic merit gain and allows for the development of complex genetic traits.

NEW TOOLS AND TECHNOLOGY
NECESSARY ACTIONS

As technological advances allow for increased efficiency of on-farm labor, animal welfare and milk quality have the opportunity to be improved upon and optimized. New tools and approaches are required to align productivity gains with sustainable milk production and dairy supply chain social responsibility requirements. Necessary actions to ensure acceleration of the use of new technologies on-farm include coordination of dairy genetics research in the U.S. and multi-year, transdisciplinary projects with well defined goals that research genetics to improve milk characteristics, management technology integration, new sensor data on milk quality and composition, and the use of robotics and technology to increase efficiency and improve animal comfort and well-being.

INTEGRATED SYSTEMS
GAPS IN KNOWLEDGE

How can dairy research and extension help optimize dairy systems on a landscape scale within the context of global food systems?

INTEGRATED SYSTEMS
SUCCESSES TO DATE

NDC scientists were able to provide stakeholder input to the USDA – ARS Dairy Agroecosystems Working Group within the Dairy Agriculture for People and the Planet Grand Challenge. Collaboration resulted in a publication that highlighted the need for coordinated solutions to ensuring environmentally and economically sustainable dairy.[13] NDC and USDA scientists have also worked together to provide subject matter expertise on grant review panels that resulted in funded research.

Currently, scientists from USDA-ARS, NDC and land-grant universities are developing a new modeling environment known as the, "Ruminant Farm Systems" model (RuFaS) to stimulate flows of carbon, nitrogen, and phosphorus through the dairy farm system. The model represents the diversity of dairy farm practices in the U. S. and connections between animals, manure, soil and crop components. It will evaluate the effects of farming practices and technologies and provide insights for sustainable production and environmental goals at an integrated whole-farm level.

Management practices determine environmental and economic performance of dairy farms, but quantifying the impacts of adding, removing, or changing individual practices is impossible without the ability to model whole dairy farm systems. Whole-farm models are also required to evaluate connections between system components that field research cannot practically investigate and, in many instances, they can provide information cheaper and faster than physical experimentation. Research is needed that supports the development of a model system that simulates flows of carbon, nitrogen, phosphorus, and water through various dairy farm types under different management and environmental conditions and takes advantage of the vast amounts of data currently collected on commercial farms to identify ways to improve whole-farm production efficiency and minimize environmental impacts. Research and adoptions of economically viable technologies and practices is warranted.

INTEGRATED SYSTEMS
NECESSARY ACTIONS

Integration of pre- and post harvest dairy production using transdisciplinary research teams to better understand production, processing, and sales from farm to table with consumers included in the process will be necessary to fully optimize dairy production systems.

CONSUMER TRUST
GAPS IN KNOWLEDGE

How can dairy research and extension contribute to building consumer trust?

CONSUMER TRUST
SUCCESSES TO DATE

The US Dairy Stewardship Commitment aims to provide transparency in respect to production practices and improvement efforts across the value chain. It was developed to support dairy companies and suppliers to work together toward supplying responsibly produced dairy foods that are nutrient-rich, affordable and preserve natural resources.

CONSUMER TRUST
NECESSARY ACTIONS

In an effort to ensure that consumers trust the agricultural system that nourishes them, researchers must be able to relate with consumers and effectively contextualize the scientific findings that ultimately impact them.

A FRAMEWORK FOR STRATEGIC COLLABORATION

FOOD SAFETY

Within the food safety research area, key topics of mutual interest included new approaches to sanitation, the use of quantitative microbial risk assessment for dairy, and education and training on artisan cheese food safety.

NEW APPROACHES TO SANITATION
GAPS IN KNOWLEDGE

How can sanitation methods be further improved to ensure consistency in production plants?

NEW APPROACHES TO SANITATION
SUCCESSES TO DATE

Food plant sanitation has become more effective in recent years due to improvements in sanitary equipment design, new cleaning chemicals and improved practices, which have been widely shared through trade organizations, such as the International Association for Food Protection. Despite these advances, there are opportunities to improve consistency and new technologies.

NEW APPROACHES TO SANITATION
NECESSARY ACTIONS

Sanitation best practices for pathogen control across the dairy industry is a key priority for both USDA and NDC. Both traditional and dry-powder environments should be the focus for effective sanitation procedures improvement. Necessary actions include utilizing extension to improve outreach and education efforts to share sanitation best practices. Further research on best practice guidance for membrane and ion exchange processes, genome sequencing, improved cleaning, improved dry environment cleaning and sanitation, sanitation automation, novel food contact surfaces and robotics to improve sanitation is warranted.

QUANTITATIVE MICROBIAL RISK ASSESSMENT FOR DAIRY
GAPS IN KNOWLEDGE

Where should efforts be focused and how can food-born illness from dairy foods be prevented?

QUANTITATIVE MICROBIAL RISK ASSESSMENT FOR DAIRY
SUCCESSES TO DATE

Whereas QMRAs were conducted with the emergence of listeria monocytogenese in the meat industry, no recent comprehensive assessments have been conducted in dairy.

QUANTITATIVE MICROBIAL RISK ASSESSMENT FOR DAIRY
NECESSARY ACTIONS

Listeria and salmonella were identified as key pathogens of interest for preventing food born illness from dairy. To conduct a QMRA it will be necessary to gain broad alignment on study details, methodology, and companies willing to share sensitive data with appropriate safeguards for study blinding. Conducting a QMRA could ensure improvements efforts are focused on the most important issues.

ARTISAN CHEESE AND DAIRY
GAPS IN KNOWLEDGE

How can dissemination and adoption of current knowledge and best practices be improved?

ARTISAN CHEESE AND DAIRY
SUCCESSES TO DATE

NDC organized and was a co-Principle Investigator on a USDA – NIFA grant intended to support nationwide coaching and training sessions for artisan and small dairy manufacturers to write their own food safety plans and to help create a network of local support and extension representatives in currently underserved areas. NDC added funding to expand the part-time support role at Cornell University included in the grant to a full-time expert support role in Artisan dairy.

The educational program funded by the grant extensively leverages previously developed tools including an online food safety workshop and it uses dairy-specific templates developed at NDC-funded national dairy foods research centers to support artisan and small dairy manufacturers nationwide.

NDC, through the Innovation Center for U.S. Dairy, has offered artisan food safety education since 2012, including classes, resource websites, online training, and support through the dairy research centers.

ARTISAN CHEESE AND DAIRY
NECESSARY ACTIONS

Education through joint NDC and USDA education and outreach initiatives can improve dissemination of current knowledge and practices to a broad dairy community that includes small / artisan producers. Research to develop new tools and interventions to address risks associated with traditionally “artisan” products, especially Hispanic style cheeses with high moisture and neutral pH and surface ripened cheeses, which may have high exterior pH and are subject to extended post-pasteurization exposure.

A FRAMEWORK FOR STRATEGIC COLLABORATION

PRODUCT INNOVATION

Within the product innovation research area, key topics of mutual interest included new uses for dairy products and co-products and technology enhancement.

NEW USES FOR DAIRY PRODUCTS AND CO-PRODUCTS
GAPS IN KNOWLEDGE

What are the most promising new uses for dairy products and their co-products?

NEW USES FOR DAIRY PRODUCTS AND CO-PRODUCTS
SUCCESSES TO DATE

In the US and globally, the production and sale of artisan cheese continues to grow rapidly. Shelf life extension using novel technologies such as super-chilling and high pressure processing has helped expand the global reach of U.S. dairy products such as cheese. Investment in technologies to upcycle co-products such as permeates and acid whey has fueled the creation of ingredients that offer health and wellness benefits to todays' consumer (e.g. bioactives, galacto-oligosaccharides, sodium and sugar reduction tools).

NEW USES FOR DAIRY PRODUCTS AND CO-PRODUCTS
NECESSARY ACTIONS

Growing the artisan cheese market in a safe, nutritious and sustainable way continues to be of importance. Other agreed upon research areas to address new uses for dairy products and co-products include fiber enhancement, sugar-reduction, non-food uses, such as bioplastics, investigation into their role in human health across the lifespan, as well as their role in pet foods and other animal food uses.

TECHNOLOGY ENHANCEMENT
GAPS IN KNOWLEDGE

What technologies will best enhance efficiency, sustainability and innovation?

TECHNOLOGY ENHANCEMENT
SUCCESSES TO DATE

The use of microfiltration for more sustainable cheesemaking as well as sustainable technologies for making milk powders and milk and whey proteins such as high solids drying, forward osmosis, and charged membranes are noted as technological successes to date for new uses of dairy products and co-products.

Also, one of the more recent successes was that the Northeast Dairy Center/Cornell University received a federal grant towards minimizing food waste by more accurately predicting milk shelf life.

TECHNOLOGY ENHANCEMENT
NECESSARY ACTIONS

Agreed upon research areas to advance technology enhancement include analytical method standardization and improvement, biofilms for packaging, filtration technology and genomics.

THE DAIRY GRAND CHALLENGE: A TRANSDISCIPLINARY APPROACH TO RESEARCH AND EXTENSION

The Framework for Strategic Collaboration outlines a path forward for coordinated dairy research in areas of mutual interest to the public and private sectors. Whereas coordination within the areas of nutrition research, environmental sustainability, food safety and product innovation are of the utmost importance, the integration across disciplines is what will ultimately drive innovation in addressing the challenges facing agriculture.

The Dairy Grand Challenge Project: Dairy Agriculture for People and the Planet is one example of a successful transdisciplinary approach to addressing sustainable dairy food production systems that improve human health and well-being. Dairy Agriculture for People and the Planet, funded by USDA – ARS and USDA – NIFA, utilized the Innovation Center for U. S. Dairy as an industry partner, helping to coordinate dairy industry and stakeholder input. This large-scale public-private partnership aimed to address nutrition and sustainability by breaking down the wall between pre- and post harvest of dairy by using systems biology to better understand how to optimize production systems and improve soils, forages, and cows on-farm to improve milk quality, processing and ultimately human health.

Dairy Agriculture for People and the Planet offered key learnings related to the promises and pitfalls of large-scale transdisciplinary research projects. As the results of Dairy Agriculture for People and the Planet are communicated and activated over the next several years, new grand challenges for dairy can be created and utilized to address the areas of mutual interest agreed upon by USDA and NDC.

The Framework for Strategic Collaboration outlines a path forward for coordinated dairy research in areas of mutual interest to the public and private sectors.

CONCLUSION

Public-private partnership between USDA and NDC has facilitated advancements in dairy research and extension that has helped elevate dairy in the market place and benefited consumers. Working together with the broader research community to focus on gaps in knowledge and common goals and objectives will help ensure reduced redundancy and faster solutions to challenges facing the current agricultural landscape. The Framework for Strategic Collaboration addresses needs facing today's agricultural landscape and ensures a strategic approach to securing dairy's position in a nutritious, safe and sustainable food supply.

Working together with the broader research community to focus on gaps in knowledge and common goals and objectives will help ensure reduced redundancy and faster solutions to challenges facing the current agricultural landscape.

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