

Research Article**Skills and Capabilities Needed for Agribusiness Graduates**Ifeloluwa R. Odiase^a, Aaron J Johnson^b, W. Scott Downey^a, and Rodney B. Holcomb^c^aPurdue University, ^bKansas State University, ^cOklahoma State University

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Abstract

Agribusiness significantly contributes to the US economy, employing about 22 million people. In 1987, the Agribusiness Management Aptitude and Skill Survey (AGRIMASS) assessed the skills desired by employers in undergraduate agribusiness majors. This study revisits the AGRIMASS survey, comparing its findings with the original 1987 results to identify shifts in employer preferences. A national survey of agribusiness professionals from over 14 sectors was conducted, and their perspectives were analyzed alongside the 1987 data. In addition, a factor analysis of AGRIMASS items identified 10 skill categories. The ranking of six skill categories remained unchanged from 1987 to 2023, with soft skills (Interpersonal and Communication Skills) consistently rated highest, followed distantly by Business and Economics Skills. The value of experiential learning, highlighted by Boland and Akridge (2004), has increased, emphasized by a higher score for work experience. While departments offering agribusiness programs have made strides in integrating business skills and experiential learning, progress in cultivating soft skills is less documented. To be positioned to build the future agribusiness workforce, it would be valuable for departments to consider conducting a curriculum mapping of their program relative to these industry-valued factors.

1 Introduction

Agriculture is critical for both the United States and global economies, and its significance extends beyond mere economic value, particularly considering ongoing discussions surrounding the pivotal role of agriculture in ensuring food security for the growing global population. According to the USDA-ERS (2023), the agribusiness industry employs around 22.1 million people nationally, and the US agribusiness industry will see further expansion in the foreseeable future. This claim is supported by a USDA report projecting the creation of 59,400 jobs annually by agricultural, food, and renewable natural resources firms in the United States between 2020 and 2025 that will require at least a bachelor's degree (Fernandez et al. 2020). AgCareers.com (2025) also reported more than 1.4 million website visits in 2024, with more than 14,000 new contacts subscribing monthly. Despite the massive number of projected jobs, only 36,100 students are estimated to graduate annually with agricultural or life-science related degrees (Fernandez et al. 2020).

Given the rising demand for skilled workers and the dynamic nature of the food and agribusiness sectors, it is crucial for institutions to evaluate the efficacy of the academic curriculum in equipping future agribusiness leaders with the requisite skills and competencies necessary for success. The current mindset of an ideal agribusiness curriculum has been informed by the seminal study of Litzenberg and Schneider (1987) and subsequent but not recent studies. Given the influence of these studies, it is helpful to determine whether today's agribusiness industry still values the same skills and competencies that were important years ago.

This paper examines Litzenberg and Schneider's (1987) seminal research, which investigated the significance of different skills and capabilities for agribusinesses and has influenced the adaptation of

agribusiness curriculum since, in light of the recruitment of new employees with a bachelor's degree. This paper then juxtaposes Litzenberg and Schneider (1987) findings with contemporary perspectives from the agribusiness industry regarding the essential skills for prospective hires, considering what is in demand today and how that has changed in the last 40 years. The result will provide agricultural educational programs with an updated reference point regarding the current skill set and capabilities required for success in the modern agribusiness industry.

2 Literature Review

Litzenberg and Schneider's (1987) original study details the Agribusiness Management Aptitude and Skill Survey (AGRIMASS), which surveyed 543 respondents representing 12 types of agribusinesses across 42 states. The survey consisted of 73 items of agribusiness skills and characteristics, divided into six categories (see Table 1): Business and Economic Skills; Computer, Quantitative, and Management Information Skills; Technical Skills (specifically in agricultural or food production); Communication Skills; Interpersonal Characteristics; and Previous Work Experience. Respondents were asked to rate each item on a 10-point scale, where a rating of 10 denoted high importance and 1 indicated low importance. No control questions were added to the survey; therefore, the responses represent rankings relative to the other items. Each characteristic was assigned an overall ranking and an in-category ranking based on individual Likert scale ratings.

Table 1. Litzenberg and Schneider (1987) and Urutyán and Litzenberg (2010) results

Category	Litzenberg and Schneider (1987)			Urutyán and Litzenberg (2010)		
	No. of Items	Average Score	Ranking	No. of Items	Average Score	Ranking
Interpersonal Characteristics	14	8.66	1	14	4.19	1
Communication Skills	9	8.14	2	10	4.12	2
Business and Economic Skills	20	6.47	3	21	3.31	4
Technical Skills	9	4.74	4	9	2.29	7
Computer, Quantitative, and Management Information Skills	10	4.67	5	11	2.54	6
Previous Work Experience	11	4.58	6	6	2.57	5
General Higher Education Experiences	N/A	N/A	N/A	7	3.38	3

Notes: "N/A" indicates "not applicable."

Litzenberg and Schneider (1987) reported that Interpersonal Characteristics were ranked the highest, with an average response of 8.66, followed closely by Communication Skills (8.14). Lagging the top two categories by over 1.6 points was Business and Economic Skills. The remaining three categories fell at least 1.73 points behind the average for Business and Economic Skills. Technical Skills; Computer, Quantitative, and Management Information Skills; and Previous Work Experience had average scores of 4.74, 4.67, and 4.58, respectively. The top three categories—Interpersonal Skills, Communication Skills, and Business and Economic Skills—were consistently ranked in the same order irrespective of company size, industry segment, or level of respondent, while the order of the remaining three categories varied.

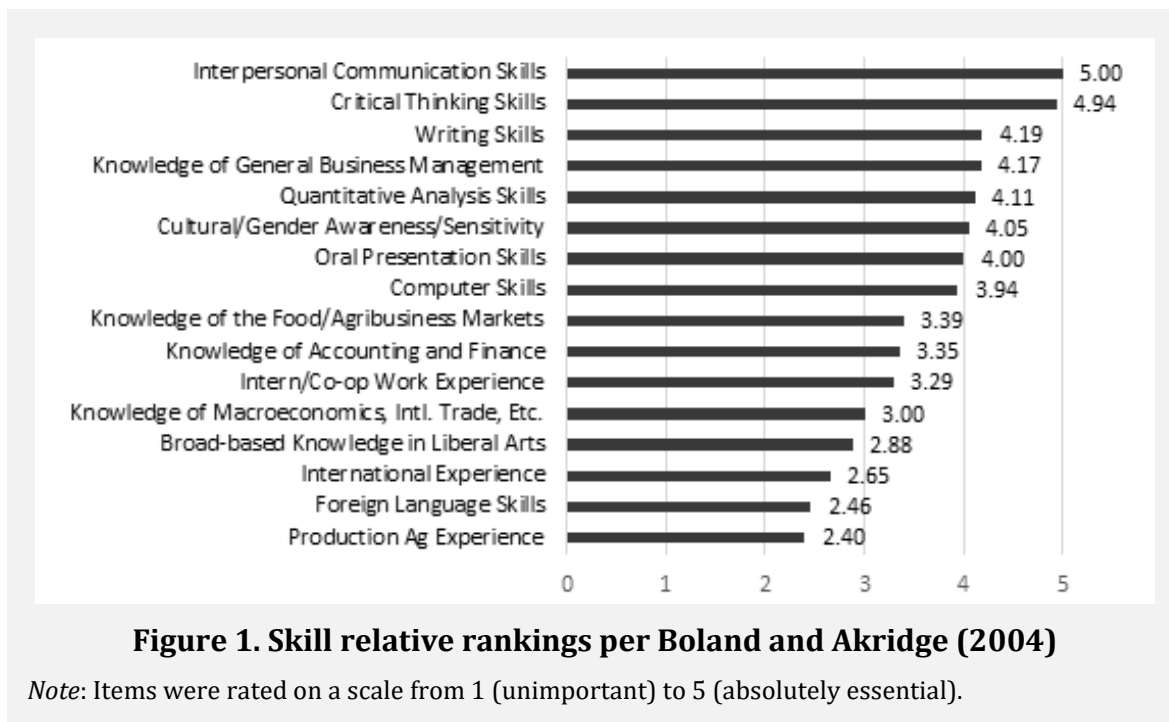
While the results in Litzenberg and Schneider (1987) represented relative rankings, the authors asserted that the results implied an adjustment to curriculum in agricultural higher education to include development of the skills desired by most agribusinesses. The authors proposed the following three suggestions for agricultural economics and agribusiness programs: industry-specific educational programs, internationalizing agribusiness education programs, and agribusiness executive development programs. For the industry-specific suggestion, the authors found that different agribusinesses had varying responses for items deemed most important. This variation in scores implied that it would be beneficial for graduates entering the industry to have specialization in a particular area depending on the type of firm they desired to work for in the future. Items dealing with internationalization were not consistently rated as of high importance; however, some firms did rank them as important, and the authors predicted an increase in international interactions over the coming decades. Finally, the proposal for the agribusiness executive development program was born from varying responses from respondents with increasing levels of responsibilities (higher positions on an organizational chart), noting that different levels of responsibilities require different skillsets.

Urutyan and Litzenberg (2010) developed a survey based on the Litzenberg and Schneider (1987) AGRIMASS survey (see Table 1) and conducted a similar study to analyze agribusiness programs in Armenia. The survey contained 78 items (five more than Litzenberg and Schneider's), divided into seven categories, adding General Higher Education Experience as a new category. Each item was evaluated on a 5-point Likert scale. The Technical Skills category contained specific skills for firms to identify important skills specific to their operations. A total of 100 executives from 80 diverse firms responded to the survey. As in Litzenberg and Schneider's survey, Interpersonal Characteristics and Communication Skills were valued as the most important of the seven categories, based on mean responses. Technical Skills was ranked as the least important. Among individual attributes, the top four highest ranked belonged to the Interpersonal Characteristics category. These attributes included loyalty to the organization, positive work attitude/personality/ability to work hard, the capacity to collaborate with others as a team player in problem-solving scenarios, and adherence to high moral/ethical standards. Urutyan and Litzenberg (2010) suggested a structural curriculum shift to focus more heavily on communication and personal skills and less on technical skills. The authors also noted that most personal and communication skills cannot necessarily be taught through classroom lecture but require complementary practical application.

Other studies have used different means than the AGRIMASS scale to determine what industry wanted in new hires. Boland and Akridge (2004) interviewed 26 senior executives (eight food executives, 12 agribusiness executives and six leaders from industry or government associations) to gain an industry perspective on components that comprise a successful agribusiness program. Most executives agreed that communication and interpersonal skills were most important for new graduates entering the industry (Figure 1). Responses varied considerably when participants were asked to identify characteristics that might distinguish agribusiness graduates. Some of the characteristics mentioned included knowledge and skills, strong work ethic, being a team player, and leadership skills. Similarly, when asked about weaknesses they see in current graduates, varied responses—like lack of communication skills, being less assertive and aggressive than graduates of other programs, and lack of familiarity with other cultures—were mentioned (Boland and Akridge 2004).

At the time of the interviews, the executives identified a broad set of issues and challenges that were faced by the agribusiness industry looking toward 2008 and beyond. The key themes mentioned were technology, the global business environment, and food safety and security issues. Due to the changes and predicted challenges for the industry, it was highlighted that agribusiness employees needed to be able to deal effectively with external issues surrounding the organization in addition to internal issues. Consolidation within the industry was also a trend. "Firm consolidation and the push for efficiency means expectations of new graduates will continue to escalate" (Boland and Akridge 2004, p. 568). Due to these views and challenges, the executives provided three main suggestions for agribusiness program

leaders: (1) incorporate more opportunities to experience diversity, (2) gear the curriculum more toward future agribusiness careers than past careers, and (3) encourage greater cooperation among universities in sharing resources including courses and faculty. Boland and Akridge (2004) proposed the use of curriculum mapping, which promotes understanding of the linkages and opportunities available to be exploited for integration and cooperation in the department, both internally and externally. The importance of industry engagement for the benefit of students and faculty, professional development for agribusiness faculty, and the ongoing need to differentiate from general business and management programs were among the final suggestions for agribusiness programs (Boland and Akridge 2004).



One possible idea to engage students with industry or current industry problems was suggested by Hall et. al (2003), who espoused the importance of capstone courses in preparing students to enter the agribusiness industry. Their study covered the structure and topics of capstone courses and challenges of developing the course and evaluating students' success throughout its duration. In general, three major components were identified as crucial for a capstone course: (1) experience in applied decision making, (2) utilization of economic theory to understand business decisions and behavior, as well as offer sound recommendations, and (3) incorporation of strategic management principles. Many teachers apply concepts from available textbooks to selected case studies for students to work through. The authors argue that case studies, service-learning projects, issue debates and discussions, and business strategy solutions are just some of the effective tools that can be used to challenge and prepare students for work after graduation. They note that this type of learning environment is quite different from the traditional classroom setting, and the transition can be difficult for both teachers and students. Hall et al. (2003) noted that clear communication of expectations and objectives is crucial for success and a positive experience.

Overall themes found in the literature indicate that in the past, agribusiness professionals have placed a high importance on interpersonal items and communication skills. While technical skills are important, they have placed less importance on this set of items relative to others. For effective curriculum to be developed, most suggestions center on the idea of cooperation between educational institutions and industry professionals.

These previous studies signal two facts. First, agribusiness graduates' abilities and the quality of their skills are important to the industry. Second, the points of emphasis ebb and flow but clearly put strong consideration to soft skills. Given the history of job providers' perspectives, attention is now turned to the current agribusiness industry professionals and how they value these various characteristics and skills.

3 Survey Design and Analytical Framework

The survey design used for this study was adopted from the 1987 AGRIMASS survey (Litzenberg and Schneider, 1987). It included relevant parameters needed to gather information on top desirable skills for students graduating with a bachelor's degree in agricultural business programs and empirically reevaluated their level of importance. Given the changes in the contemporary industry, the survey was modified to include key parameters such as consumer behavior analysis, the ability to raise capital for new and ongoing business ventures, proficiency in foreign language, professional emailing and texting etiquette, GPA, related summer employment experience, foreign study and internship experience, and experiential course work. The survey was disseminated to US agribusiness professionals through emails, with a request that recipients share the link with other agribusiness professional who might be interested in taking the survey. Subjects on the multiple email distribution lists came from alumni and industry partners from three land grant universities and subscribers of AgCareers.com. In addition, a Qualtrics panel of individuals fitting the targeted subject of professionals in the agricultural industry was employed. The Qualtrics respondents were paid for their responses. All responses were collected between May 2022 and January 2023.

The survey encompassed 82 items designed to assess the personal and professional characteristics essential for a successful agribusiness career. These questions were classified into seven categories: Interpersonal Characteristics; Communication Skills; General Higher Education Experience; Business and Economic Skills; Employment and Work Experiences; Computer, Quantitative, and Management Information Skills; and Technical Skills. It is relevant to note that the survey was administered prior to the widespread adoption of generative artificial intelligence.

For each item within the categories, respondents were asked to rate its level of importance (on a 1–10 scale) when hiring new employees into entry level positions, with 1 being “not at all important” and 10 being “extremely important.” An open question about additional skills was included in each category to gather relevant information not already listed.

The survey also included questions on the relationship between skills where the respondent was asked to classify each skill category as the “lowest requirement” for hiring (1) up to the “highest requirement” for hiring (5).

This study employed a three-part approach to analyze the updated AGRIMASS scale. First, average response scores, overall rankings, and in-group rankings were calculated for each characteristic. The approach entailed calculating the ranking of each of the six categories of skills and their components based on their in-group average response scores to evaluate the characteristics deemed most important. Furthermore, each category was ranked based on firm type, level of employee, and sales volume.

Second, these rankings were compared to those reported by Litzenberg and Schneider (1987) to assess potential shifts in perceived importance over time. The ranking results from the AGRIMASS survey were subtracted from the result of the 1987 scores to evaluate the changes that have occurred over the last four decades.

Finally, an exploratory factor analysis, following Hair et al. (2018), was utilized to identify underlying patterns among individual characteristics, independent of predefined group classifications. This effort was important to determine how the individual items align, providing a response-based set of factors/classifications. Maximum likelihood estimation with Varimax rotation was used in the estimation.

4 Results

A total of 1,370 responses were collected via the online survey, comprising 841 from the snowball sampling approach and 529 from the Qualtrics panel. To assess nonresponse bias, random subsamples from the initial and later waves of respondents were compared on key variables using mean difference tests. Additionally, the two data sources were evaluated for compatibility. No evidence of nonresponse bias was detected, and the datasets were found to be statistically comparable. It is impossible to calculate the response rate given that the collection method included a snowball approach.

The data were cleaned to omit respondents that provided demographic information only. A total of 955 agribusiness professionals across the United States provided usable responses. In addition, the two categories—Previous Work Experience and General Higher Education Experiences—were merged into one, reflecting the categories of Litzenberg and Schneider (1987). This combination of categories reduced the total number of categories to six.

The responses represented a variety of professionals across the food and agribusiness industry, with 200 firms noting that they engaged in multiple sectors of the industry (see Table 2).¹ In the sample surveyed, 39% of the respondents held positions in upper-level management, 38% occupied mid-level management roles, and 23% were at the entry level, representing 16 different types of agribusiness firms. A total of 544 respondents identified as male, constituting roughly 57% of the usable responses. Most respondents have a bachelor's degree (35%), followed by respondents who graduated from high school (18.1%), completed a master's degree (18%), attended but did not graduate from college (14.5%), completed an associate degree or trade school (9.8%), earned a PhD or professional degree (4.1%), and other (0.6%). Respondents in firms with more than 1,000 employees represented the largest portion of the sample (31.6%), and 194 respondents (20%) belonged to firms with annual sales greater than \$1 billion. Of all respondents, 69.2% noted they participate in the recruitment process of new college graduates into their organizations. Respondents working for local businesses represented the largest portion of sample (34.4%), followed by those working for regional (25%), national (18%), multinational (17%), and international (11%) businesses.

Table 2. Type of businesses represented

Primary Type of Business	No. of Participants	Percentage
Hotels and Others	246	26
Food Wholesale/Retail	143	15
Agricultural Production (Crops and Animals)	93	10
Agricultural Inputs Supplier	73	8
Agricultural Finance	62	6
Agricultural Machinery/Implements	54	6
Food Processing and Distribution	37	4
Produce marketing	16	2
Grain Processing	15	2
Aquaculture and Nursery	11	1
Dairy Processing	5	1
Multicategory	200	21

¹ Respondents were permitted to select all industry classifications that applied to their operations, and many selected multiple industry sectors. To prevent counting these responses multiple times when analyzing the data by industry sector, the variable was recoded to indicate either a single selected category or "Multicategory" for those who selected more than one.

A simple average of all item scores within a category was calculated for each of the six categories. Using those averages, Interpersonal Characteristics ranked highest, with an average response of 7.75. Communication Skills came in second (7.16), followed by Business and Economic Skills (5.99); Technical Skills (5.63); Computer, Quantitative, and Management Information Skills (5.54); and lastly Previous Work Experience (5.48). The largest gap between categories when ordered from highest average rating to lowest is 1.161, the distance between second place Communication Skills and third place Business and Economic Skills. That is more than double the spread between Business and Economic Skills and Previous Work Experience, the lowest ranked category. Professionals clearly value communication and interpersonal skills by a large margin.

Analyzing each of the items in detail provided additional insight (see Table 3). The highest rated item was Positive Work Attitude/Personality/Ability to Work Hard, followed by High Moral/Ethical Standards, and then by Self-Motivation. In fact, the top 10 items belonged to either Interpersonal Characteristics or Communication Skills categories. The five items that are least valued belonged to either the Previous Work Experience or Computer, Quantitative, and Management Information Skills categories. These individual rankings line up with the overall ranking of the categories. The two least-valued items of all were related to computer programming. Interestingly, as important as Communication ranked, foreign language skills was the sixth least-valued item of all.

Table 3. Ratings for all characteristics, average for all firms

Description of Characteristics	Average Response	Overall Rank	Intra-Group Rank
A. Business and Economic Skills	5.995	3	
Marketing administration	6.412	32	4
Historical agricultural policy	5.399	63	19
Professional selling techniques	6.882	25	3
Identify and manage risk and uncertainty	6.889	23	2
Current and historical intl. trade and export policies, procedures	5.159	67	20
Identify, monitor and evaluate key performance areas and progress toward the objective and goals of the firm	6.949	22	1
Firm/industry (micro) economics (supply, demand, and price determination)	6.119	44	11
Develop business policies and programs for the firm	5.680	54	15
Setting objectives and goals for the firm	6.320	35	5
Business organizational structure and the effect of this structure on business activity	6.153	43	10
Coordinate human and physical resources	6.231	38	7
Corporate finance	5.798	50	13
Human resources planning and control	5.459	61	18
International macroeconomics	4.854	73	21
Domestic macro economics	5.543	58	17
Process and product layout and design	5.714	52	14
Inventory management systems	6.157	42	9
National and political and economic forces on business operations	5.632	55	16
Accounting concepts and procedures	6.076	46	12
Financial statement analysis	6.194	39	8
Consumer behavior analysis	6.280	37	6

Table 3. Ratings for all characteristics, average for all firms

Description of Characteristics	Average Response	Overall Rank	Intra-Group Rank
<u>B. Computer, Quantitative, and Management Information Skills</u>	5.448	5	
General business computer software	7.662	13	1
Computerized accounting systems	5.707	53	4
Use computers in management decision-making	6.494	30	2
Interpret and use math and statistical methods	6.292	36	3
Write computer programs	4.026	81	9
Use quantitative techniques for managerial decision making	5.488	60	5
Purchase and implement business computer systems	4.652	76	8
Understand expert systems/AI technologies	4.983	70	7
Design computer programs	3.973	82	10
Communicate with computer programmers	5.202	66	6
<u>C. Technical Skills</u>	5.629	4	
Transportation and distribution	5.810	49	2
Science and processing technology	5.600	56	4
Engineering technology of production/processing machinery	5.246	65	9
Computer controlled mechanical processes	5.438	62	7
Specialized crop production systems	5.756	51	3
General crop production systems	6.424	31	1
General livestock/meat production systems	5.489	59	6
Bio-science, biotechnology and biochemistry	5.311	64	8
Soil chemistry and characteristics	5.588	57	5
<u>D. Communication Skills</u>	7.156	2	
Listen and carry out instructions	8.597	5	1
Express creative ideas verbally	7.531	16	6
Professional telephone skills and etiquette	7.787	10	3
Read and understand specific technical information	7.469	17	7
Write technical reports, memos, and letters	6.498	29	10
Give clear and concise instructions to others	7.896	9	2
Listen to and summarize lengthy oral presentations	6.619	28	9
Speak clearly and concisely on technical information	7.654	14	4
Express creative ideas in writing	6.350	34	11
Foreign language skills	4.537	77	12
Professional email etiquette	7.598	15	5
Professional text etiquette	7.338	20	8
<u>E. Interpersonal Characteristics</u>	7.752	1	
Loyalty to the organization	7.686	12	9
Positive work attitude/personality /ability to work hard	8.802	1	1
Work with others and be a team player in problem solving situations	8.628	4	4
High moral/ethical standards	8.755	2	2
Self-motivation	8.666	3	3
Work without supervision	8.255	6	5

Table 3. Ratings for all characteristics, average for all firms

Description of Characteristics	Average Response	Overall Rank	Intra-Group Rank
Self-confidence and ability to take a chance and handle stress/failure /rejection	8.029	7	6
Work under varied conditions	7.920	8	7
Recognize a business opportunity	7.392	19	11
Take a position and defend it, sell ideas	7.325	21	12
Provide leadership and make decisions	7.466	18	10
Manage people and delegate responsibility and authority	6.784	27	13
Apply technical skills and info. in problem solving situations	7.698	11	8
Raise capital for new and ongoing business ventures	5.119	68	14
F. Previous Work Experience	5.477	6	
Employment in international agribusiness firm	4.843	74	12
Employment in financial institution	4.876	72	11
Farm work	6.054	48	8
Employment in non-agricultural retail business	4.880	71	10
Employment in domestic agribusiness firm	6.163	41	5
Government/public affairs position	4.430	78	14
Work as student teaching assistant or part time in university	4.660	75	13
Extracurricular activities in university including leadership positions in student clubs and functions	6.061	47	7
General education in the classics/humanities /arts, etc.	5.003	69	9
Experience in developing business plan and organizing a business	6.176	40	4
Formal industry internship experiences	6.812	26	2
Related summer employment experience	6.887	24	1
Foreign internship experience	4.077	80	16
Foreign study experience	4.199	79	15
Experiential course work	6.397	33	3
High GPA	6.110	45	6

The average ratings in each category also provide some valuable information, especially considering the top and bottom ends of each category. For Interpersonal Skills, seven items had an average rating over 8.0. Taken together, they would indicate that people doing the hiring are looking for well-rounded, dependable, and proactive employees who can significantly contribute to the success and positive culture of any organization. The least-valued skill was raising capital and the second lowest dealt with managing people.

The top-rated skill by far for Communication Skills category was Listen and Carry Out Instruction, with more than a half a point between it and the second-ranked item, which dealt with being able to give clear instructions. The top eight rated skills in this category together, indicate that employers like candidates to be well-rounded communicators who can effectively share ideas, provide instructions, and interact professionally across various mediums. This combination of verbal and written communication skills is essential for maintaining clarity, efficiency, and professionalism in the workplace. As noted above, foreign language skills is a far distant last in this category.

In the third-ranked category of Business and Economic Skills, the highest valued skill was the ability to know what is important to the business being successful. The second was sales techniques and the third was being able to identify and manage risk and uncertainty. Collectively, these speak to one’s

ability to size up a situation and navigate to a success through challenges and difficulties. There were no items that averaged above 7.0, but 12 skills scored above 6.0. That result could indicate, in general, the value placed on a well-rounded business education. The two least-valued skills in this category dealt with international economy and trade.

While there was little to note from the Technical Skills category, it was clear from the Computer, Quantitative, and Management Information Skills category that job candidates needed to know their way around a computer. The total of responses does not speak to a specific level of expertise needed. In fact, the bottom two rated skills dealt with programming topics.

For the lowest-ranked category, Previous Work Experience, it is interesting to note that none of the skills had an average over 7.0. The two most valued items were related to summer jobs or internships. There was a sizable gap to the third category. Of the eight items that had an average above 6.0, four related to understanding or having experience with agricultural businesses. GPA was important, but it was not in the top five of this category. Similar to foreign language skills in the Communication Skills category, foreign experiences were least valued in this category.

Table 4. Skill relative rankings based on firm type, level of employee and sales volume

	Business and Economic Skills		Computer, Quantitative and MIS		Technical Information		Comm. Skills		Inter-personal Skills		Work Experience	
	Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank	Avg.	Rank
Industry												
Agricultural Finance	6.158	3	5.358	4	4.771	6	7.325	2	8.059	1	5.341	5
Dairy Processing	7.457	2	6.600	5	7.022	3	7.000	4	8.314	1	6.267	6
Food Processing and Distribution	6.507	3	5.638	6	6.123	4	7.207	2	7.674	1	5.865	5
Food Wholesale/ Retail	6.497	3	6.132	4	5.877	5	6.964	2	7.381	1	5.540	6
Grain Processing	5.511	3	5.060	4	5.037	5	6.078	2	7.500	1	4.589	6
Produce marketing	6.455	3	6.138	6	6.354	4	7.318	1	7.295	2	6.250	5
Agricultural Inputs Supplier	5.696	3	4.941	5	5.446	4	7.346	2	7.838	1	4.927	6
Agricultural Machinery/Implements	5.575	4	5.143	5	5.617	3	7.318	2	7.905	1	4.565	6
Agricultural Production (Crops and Animals)	5.515	4	4.876	6	5.688	3	7.012	2	7.909	1	5.143	5
Aquaculture and Nursery	5.433	5	5.164	6	5.505	4	6.606	2	7.760	1	5.773	3
Hotels and Others	5.792	3	5.296	4	5.171	5	7.255	2	7.808	1	4.858	6
Multicategory	6.182	4	5.632	5	6.191	3	7.168	2	7.762	1	5.450	6
Level of Employee												
Upper Management	5.726	3	5.229	5	5.517	4	7.180	2	7.922	1	4.995	6
Middle Management	6.155	3	5.552	5	5.810	4	7.305	2	7.826	1	5.412	6
Entry Level	6.189	3	5.648	4	5.521	5	6.870	2	7.339	1	5.232	6
Sales (\$)												
Under \$10 million	6.162	3	5.593	5	5.835	4	7.123	2	7.702	1	5.449	6
\$10-\$50 million	5.884	3	5.302	5	5.435	4	7.022	2	7.530	1	5.119	6
\$50-\$250 million	6.136	3	5.604	5	5.821	4	7.241	2	7.834	1	5.184	6
\$250-\$500 million	6.095	3	5.360	5	5.792	4	7.329	2	8.010	1	5.155	6
\$500-\$1,000 million	6.027	3	5.511	4	5.502	5	7.395	2	7.871	1	5.194	6
Over \$1,000 million	5.774	3	5.320	5	5.346	4	7.118	2	7.754	1	4.942	6

The rankings and emphasis placed on various skills can arguably vary from field to field. When the six categories were evaluated by sales volume and level of employee, each of their components agreed, with little variance, on the most important skill categories (see Table 4). Each of these components ranked Personal Characteristics first, Communication Skills second, Business and Economic Skills third, and Previous Work Experience sixth, which matches the overall average. Technical Information and Computer, Quantitative, and Management Information Skills categories were ranked fourth and fifth, respectively, except for Entry-Level Employees and companies with sales volumes of \$500–\$1,000 million. They ranked Computer, Quantitative, and Management Information Skills and Technical Information fourth and fifth, respectively. While the averages for these groups suggest a different rank, they are relatively close.

The order of the skill categories varied more when ranked based on industry. No category was given a consistent ranking across all industries; however, some themes are present. All firms ranked Interpersonal Skills first, except Produce Marketing, which may be because employees from this firm type are underrepresented in the sample (2% of sample data). Also, all firms ranked Communication Skills second, except Produce Marketing and Dairy Processing, which ranked Communication Skills first and fourth, respectively. These categories both had limited responses; thus, it is impossible to generalize these results. The results across the other industry categories suggest that the preference from employers across specific fields is robust for Interpersonal Skills and Communication Skills. From there, the numbers vary.

4.1 Comparison of Characteristics over Time

To evaluate how the importance of skills relevant to future agribusiness leaders has changed over the past 4 decades, this study compared its findings to those of Litzenberg and Schneider (1987) by subtracting their average response, overall rank, and in-group rank from the corresponding results reported here. The full table of differences are presented in Table A1.

For this study, we had 955 reportable participants compared to 543 participants in Litzenberg and Schneider (1987). The rank questions based on personal and professional characteristics of agribusiness managers had 82 items in contrast with the 1987 AGRIMASS survey, which had 73 items. We averaged the response of two items—“design computer programs” and “communicate with computer programmers”—to correspond to the 1987 AGRIMASS data. Ten items from the data used in this study and one item from the 1987 AGRIMASS data did not match. Overall, 71 items between both sets of data matched. Table A1 shows the difference between the ratings of all items of the 1987 AGRIMASS data and those of this study. Movements in rank based on average ratings were done relative to this subset of items (i.e., ranks for each of the surveys were recalculated based on the subset of skills used in Table A1). A positive value for average response signifies that a given skill is perceived to be more important today and a positive overall or in-group rank indicates that, relative to other items, a given item is valued more in 2023.

The ranking of all six categories by average responses on items remained constant; however, there were changes in the numerical averages. The average response of Technical Skills; Previous Work Experience; and Computer, Quantitative, and Management Information Skills increased by 0.865, 0.890, and 0.804, respectively, while those of Communication Skills, Interpersonal Skills, and Business and Economic Skills decreased by 0.757, 0.735, and 0.489, respectively. This result suggests a shift in the perceived importance of these skills.

The difference in average responses among all items in the Previous Work Experience; Technical Skills; and Computer, Quantitative, and Management Information Skills categories is also positive except for extracurricular activities (under Previous Work Experience). This positive number means these skills have increased in importance. To reinforce the increase in importance of skills in these categories, the results revealed that the five individual skills that saw the most increase in importance (based on overall

ranking) included general business and computer software, industry internships/cooperative work study, farm work, use computers in management decision-making, and employment in domestic agribusiness firms, which increased in ranking by 28, 27, 12, 11, and 11 positions, respectively. Consequently, the three items that decreased the most in importance were human resources planning and control, develop business policies and programs for the firm, and historical agricultural policy, all of which belong to the Business and Economic Skills category. They dropped in rank by 24, 22, and 18 positions, respectively.

The results also demonstrate changes in the ranking of items within each category. The top two items in both the Technical Skills and the Communication Skills categories remained unchanged. However, there are changes in the ranking of top items in other categories.

Table A2 shows that there was no variability in the order of Interpersonal Skills; Communication Skills; and Computer, Quantitative, and Management Information Skills when ranked based on level of employee and company sales volume. However, the order of the other categories varied minimally. It varied more based on firm type.

Before the firm type results could be compared, the results from three firm categories from Litzenberg and Schneider (1987) study—Fertilizer, Agri-Chemical, and Cooperatives—were averaged out and renamed Agricultural Input Suppliers, to match with the firm type used in this study. The comparison showed that there are minimal changes in the rankings by firm type and more variability between subsets today than 4 decades ago. This implies that it may provide benefit to offer industry-specific programs that prepare students for employment in the industry they would desire to enter, which corresponds to the conclusion made by Litzenberg and Schneider (1987).

4.2 Factor Analysis

The comparison of the items from nearly 40 years ago provides some insight about the skills sought by professionals when hiring new agribusiness graduates. For additional insights, we ran exploratory factor analysis on the 82 skills items to determine how they loaded together independent of group classification imposed by the AGRIMASS model. This work revealed three factors. A percentage or portion for each factor was calculated for all items by taking the absolute value of the factor over the sum of the absolute value of all factors. We considered items with the largest proportion of total loading on Factor 1 to be oriented toward “Scientific Knowledge,”. Those with the highest proportion of total loading on Factor 2 were considered to be focused on “Business Knowledge.” Those with the highest proportion of loading on Factor 3 were considered to be oriented toward “Work With Others.” After the highest proportions were allocated, the second-highest proportions were allocated, and all items were sorted accordingly (see Table A3). Items with similar themes were placed adjacent to one another. The items were examined according to these factors and then generalized to subcategories of “Specialized Business Knowledge,” “Business Judgment,” “Work Judgment,” “Work Experience,” “Agricultural Experience,” and “Other Specialized Knowledge,” for a total of nine categories. A tenth category was “Overall Decision Application,” which consisted of items whose proportion of total loading did not appear to be particularly aligned with any one of the three factors.

The average value of each item was calculated across all 10 groups for both this study and the 1987 AGRIMASS study (See Table A4). The results reveal a heightened emphasis on knowledge and experience compared to 4 decades ago. Specifically, the importance of Scientific Knowledge and Other Specialized Knowledge increased by nearly 20%. Agricultural Experience and Work Experience saw increases of 10% and 13%, respectively. Specialized Business Knowledge increased in importance, but only minimally. This result is in contrast to the idea that the category Work Experience was ranked as the lowest among all categories. The relative importance of Business Knowledge, Business Judgment, and Work Judgment decreased in importance by 12.1%, 9.1%, and 11.6%, respectively, while Work with Others and Overall Decision Applications each diminished by nearly 6%. From these numbers, it appears

that employers are putting more emphasis on technical, agricultural, and work perspectives over business-related topics.

5 Conclusion and Discussion

Comparing the seminal AGRIMASS work by Litzenberg and Schneider (1987) and this updated 2023 study reveals how industry preferences have changed and sets directives for how and where the academy's emphases should shift. It is apparent that Interpersonal Skills and Communication Skills have been and remain a steady focus for agribusinesses when they evaluate new college graduates for employment. This relationship held true when the responses were considered by industry and position held by the respondent. However, the absolute numbers on soft skills did decrease and the emphasis on Technical Skills, Previous Work Experience, and Computer, Quantitative, and Management Information Skills increased. This movement is reflected in the factor analysis results. Employers are looking for people who can work and communicate with others while understanding agriculture and technical skills. Whether it was from the AGRIMASS items and categories or the factor analysis results, it is clear that specific business-related skills are not as emphasized as one would expect for a degree focused on business.

Boland and Akridge (2004) found that one thing that set the agribusiness graduate apart from their peers majoring in other fields (e.g., business) was their technical knowledge. These same results seem to be reflected in the current study as well, especially when considering the factor analysis results. In short, employers want graduates who understand agriculture. This conclusion is in line with Urutyan and Litzenberg (2010), who found that experiential knowledge is highly sought and sets agribusiness graduates apart from their peers.

Work experience and experience in agriculture can bring some of that experiential knowledge. A capstone course that strongly emphasizes application and activities that promote critical thinking skills can provide a type of experiential knowledge that is valued as well. Boland and Akridge (2004) recognized this when they pushed for a strategy-focused capstone for agribusiness majors. Agricultural programs with agribusiness majors have largely added this comprehensive strategy-focused capstone experience to their curriculum.

While the adoption of capstone courses has become more widespread across agribusiness programs, there is less evidence that the softer skills have gained comparable emphasis within the agribusiness curriculum. The authors note—based on observation rather than empirical evidence—that these skills have received some attention, though typically in informal contexts and rarely through structured, program-wide initiatives.

As Boland and Akridge (2004) suggest, curriculum mapping would help departments understand where they connect the dots of practice to desired outcome. This would require an in-depth discussion by departmental faculty to determine program learning outcomes. Even if a department never undertakes an actual curriculum mapping effort, discussion about desired outputs would yield some insights into the collective emphasis of a department. Perhaps doing this type of work may allow us to find the relevance that industry desires and that sets our graduates apart.

Since the start of this study, generative artificial intelligence has taken the world by storm. It has permeated nearly all facets of life, including how businesses do their work. These technological and societal shifts will no doubt be disruptive to education as well. This potential disruption adds to the arguments for agribusiness and agricultural economics programs to continually work with employers to identify needed skills and knowledge as well as intentionally review and revise their curricula to be as effective as possible at producing well-prepared professionals.

Appendix

Table A1. AGRIMASS changes in ratings for all items, 1987 vs. 2023

Description of Characteristics	Average Response	Overall Rank	Rank in Group
A. Business and Economic Skills			
Marketing administration	-0.648	-1	<u>2</u>
Historical agricultural policy	-0.511	-18	-5
Professional selling techniques	0.000	<u>8</u>	<u>5</u>
Identify and manage risk and uncertainty	-0.137	<u>8</u>	<u>5</u>
Current and historical international trade and export policies and procedures	0.122	-9	0
Identify, monitor and evaluate key performance areas and progress toward the objective and goals of the firm	-0.872	<u>1</u>	<u>1</u>
Firm/industry (micro) economics (supply, demand, and price determination)	-0.666	-7	0
Develop business policies and programs for the firm	-1.646	-22	-10
Setting objectives and goals for the firm	-1.520	-11	-4
Business organizational structure and the effect of this structure on business activity	0.420	<u>5</u>	<u>6</u>
Coordinate human and physical resources	-1.467	-10	-3
Corporate Finance	-0.563	-10	0
Human resources planning and control	-1.351	-24	-8
International macroeconomics	0.220	-9	0
Domestic macro economics	-0.068	-7	<u>1</u>
Process and product layout and design	0.080	-2	<u>3</u>
Inventory management systems	0.374	<u>5</u>	<u>6</u>
National and political and economic forces on business operations	0.094	-3	<u>3</u>
Accounting concepts and procedures	-0.581	-7	0
Financial statement analysis	-1.060	-7	-2
B. Computer, Quantitative, and Management Information Skills			
General business computer software	1.855	<u>28</u>	<u>2</u>
Computerized accounting systems	0.256	<u>1</u>	0
Use computers in management decision-making	0.558	<u>11</u>	-1
Interpret and use math and statistical methods	0.414	<u>8</u>	-1

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Table A1. AGRIMASS changes in ratings for all items, 1987 vs. 2023

Description of Characteristics	Average Response	Overall Rank	Rank in Group
Write computer programs	1.372	<u>1</u>	<u>2</u>
Use quantitative techniques for managerial decision making	0.470	-2	0
Purchase and implement business computer systems	0.037	-10	-1
Understand expert systems/AI technologies	1.587	<u>6</u>	<u>3</u>
C. Technical Skills			
Transportation and distribution	0.600	<u>6</u>	0
Science and processing technology	1.005	<u>9</u>	<u>1</u>
Engineering technology of production/processing machinery	0.727	<u>1</u>	-3
Computer controlled mechanical processes	1.386	<u>7</u>	<u>2</u>
Specialized crop production systems	1.067	<u>10</u>	0
General crop production systems	0.302	<u>8</u>	0
General livestock/meat production systems	0.868	<u>4</u>	-2
Bio-science, biotechnology and biochemistry	0.898	<u>4</u>	0
Soil chemistry and characteristics	1.152	<u>10</u>	<u>2</u>
D. Communication Skills			
Listen and carry out instructions	-0.248	0	0
Express creative ideas verbally	-0.926	-2	-2
Professional telephone skills and etiquette	-0.476	<u>5</u>	<u>1</u>
Read and understand specific technical information	-0.107	<u>9</u>	<u>3</u>
Write technical reports, memos, and letters	-1.235	-4	-1
Give clear and concise instructions to others	-0.820	-1	0
Listen to and summarize lengthy oral presentations	-1.050	-1	<u>1</u>
Speak clearly and concisely on technical information	-0.228	<u>5</u>	<u>2</u>
Express creative ideas in writing	-1.720	-13	-4
E. Interpersonal Characteristics			
Loyalty to the organization	-0.942	-3	-2
Positive work attitude/personality /ability to work hard	-0.369	<u>1</u>	<u>1</u>
Work with others and be a team player in problem solving situations	-0.400	0	0
High moral/ethical standards	-0.389	<u>1</u>	<u>1</u>
Self-motivation	-0.559	-2	-2
Work without supervision	-0.568	0	0
Self-confidence and ability to take a chance and handle stress/failure /rejection	-0.715	0	0
Work under varied conditions	-0.691	<u>3</u>	<u>2</u>
Recognize a business opportunity	-0.790	-2	<u>2</u>
Take a position and defend it, sell ideas	-1.029	-5	-1
Provide leadership and make decisions	-1.155	-7	-2
Manage people and delegate responsibility and authority	-1.733	-12	-3
Apply technical skills and information in problems solving situations	-0.217	<u>7</u>	<u>6</u>

Table A1. AGRIMASS changes in ratings for all items, 1987 vs. 2023

Description of Characteristics	Average Response	Overall Rank	Rank in Group
F. Previous Work Experience			
Employment in international agribusiness firm	1.070	0	-1
Employment in financial institution	0.905	0	-1
Farm work	1.358	<u>12</u>	<u>1</u>
Employment in non-agricultural retail business	1.541	<u>6</u>	<u>3</u>
Employment in domestic agribusiness firm	0.644	<u>11</u>	0
Government/public affairs position	1.115	<u>1</u>	0
Student teaching assistant/part time work	0.920	0	-1
Extracurricular activities	-0.068	-6	-3
General education—humanities	0.196	-8	-1
Developing business plan	0.224	<u>2</u>	0

Note: Average Change = 2023 Average - 1987 Average; Rank Change = 1987 Rank - 2023 Rank.
 Boldface font indicates a drop in ranking in 2023; underlining indicates a gain in ranking in 2023.

Table A2. Changes in AGRIMASS category scores between 1987 and 2023 by industry, level of employee, and sales

Industry	Business & Economics		Computer & MIS		Technical Information		Communication		Interpersonal		Work Experience	
	Avg. Change	Rank Change	Avg. Change	Rank Change	Avg. Change	Rank Change	Avg. Change	Rank Change	Avg. Change	Rank Change	Avg. Change	Rank Change
Agricultural Finance	-0.827	0	-0.110	0	-0.182	-1	-0.978	0	-0.866	0	0.559	<u>1</u>
Dairy	1.129	<u>1</u>	1.857	<u>1</u>	2.262	<u>2</u>	-0.991	-2	-0.195	0	1.260	-2
Food Proc. & Distr.	-0.105	0	0.447	-2	0.982	<u>1</u>	-1.204	0	-1.204	0	1.105	<u>1</u>
Food Wholesale/Retail	-0.024	0	1.003	0	1.889	<u>1</u>	-1.131	0	-1.131	0	1.482	-1
Grain Processing	-1.090	0	0.259	<u>2</u>	-0.058	-1	-2.122	0	-2.122	0	-0.334	-1
Produce Marketing	0.157	0	1.726	-1	1.857	0	-1.058	<u>1</u>	-1.058	-1	1.982	<u>1</u>
Ag. Inputs Supplier	-0.482	0	0.391	0	0.990	<u>2</u>	-0.776	0	-0.776	0	0.395	-1
Level of Employee												
Upper Management	-1.351	0	0.235	-1	0.606	<u>1</u>	-1.167	0	-1.167	0	0.135	0
Middle Management	-0.372	0	0.863	0	1.055	0	-0.952	0	-0.952	0	0.938	0
Entry Level	1.274	0	1.794	-2	1.220	-1	-0.741	0	-0.741	0	1.073	-1
Sales (\$M)												
Under 10	-0.065	0	1.219	<u>1</u>	1.075	0	-0.967	0	-0.895	0	1.058	-1
10-50	-0.642	0	0.409	-1	0.649	<u>1</u>	-1.324	0	-1.069	0	1.048	0
50-250	-0.389	0	0.849	0	0.970	0	-0.821	0	-0.863	0	0.461	0
250-500	-0.115	0	0.907	0	1.926	<u>2</u>	-1.909	0	-0.686	0	0.379	-2
500-1,000	-0.554	0	0.979	<u>2</u>	0.910	0	-0.297	0	-0.892	0	0.292	-2
Over 1,000	-1.087	0	0.546	0	0.312	0	-1.334	0	-1.139	0	0.210	0

Notes: Average Change = 2023 Average - 1987 Average; Rank Change = 1987 Rank - 2023 Rank.
 Boldface font indicates a drop in ranking in 2023; underlining indicates a gain in ranking in 2023.

Table A3. Factor analysis grouping of AGRIMASS items

Original Item	Factor Grouping
Experience in developing business plan and organizing a business Use computers in management decision-making Interpret and use math and statistical methods Express creative ideas in writing Listen to and summarize lengthy oral presentations Write technical reports, memos, and letters	Overall Decision Application
Human resources planning and control Domestic macro economics International macroeconomics Inventory management systems Raise capital for new and ongoing business ventures Current and historical international trade and export policies and procedures National and political and economic forces on business operations Process and product layout and design Employment in financial institution Computerized accounting systems Historical agricultural policy Transportation and distribution	Specialized Business Knowledge
Develop business policies and programs for the firm Financial statement analysis Corporate Finance Business organizational structure and the effect of this structure on business activity Setting objectives and goals for the firm Firm/industry (micro) economics (supply, demand, and price determination) Accounting concepts and procedures Coordinate human and physical resources Marketing administration Consumer behavior analysis	Business Knowledge
Identify and manage risk and uncertainty Professional selling techniques Identify, monitor and evaluate key performance areas and progress toward the objective and goals of the firm Manage people and delegate responsibility and authority	Business Judgment
Recognize a business opportunity Provide leadership and make decisions	Work Judgment
Listen and carry out instructions Self-motivation Work with others and be a team player in problem solving situations Work without supervision High moral/ethical standards Positive work attitude/personality /ability to work hard Self-confidence and ability to take a chance and handle stress/failure /rejection Work under varied conditions General business computer software	Work With Others

Table A3. Factor analysis grouping of AGRIMASS items

Original Item	Factor Grouping
Professional email etiquette Apply technical skills and information in problems solving situations Loyalty to the organization Professional telephone skills and etiquette Give clear and concise instructions to others Professional text etiquette Express creative ideas verbally Take a position and defend it, sell ideas Speak clearly and concisely on technical information	
Related summer employment experience Read and understand specific technical information Formal industry internship experiences	Work Experience
Experiential course work Extra-curricular activities in university including leadership positions in student clubs and functions Farm work Employment in domestic agribusiness firm General crop production systems Specialized crop production systems	Ag. Experience
Soil chemistry and characteristics Bio-science, biotechnology and biochemistry Science and processing technology High GPA	Scientific Knowledge
Employment in an international agribusiness firm Work as student teaching assistant or part time in university Foreign study experience Foreign internship experience Foreign language skills Understand expert systems/AI technologies Government/public affairs position General education in the classics/humanities /arts, etc. Engineering technology of production/processing machinery Write computer programs Design computer programs Computer controlled mechanical processes Employment in non-agricultural retail business Communicate with computer programmers Purchase and implement business computer systems General livestock/meat production systems Use quantitative techniques for managerial decision making	Specialized Knowledge

Table A4. Factor composite scores for AGRIMASS items

	1987	2023	Change (%)
Overall Decision Application	6.87	6.40	-6.8
Specialized Business Knowledge	5.42	5.45	0.7
Business Knowledge	6.97	6.13	-12.1
Business Judgment	7.56	6.88	-9.1
Work Judgment	8.40	7.43	-11.6
Work with Others	8.48	7.99	-5.7
Work Experience	6.39	7.06	10.4
Ag Experience	5.43	6.14	13.1
Scientific Knowledge	4.48	5.65	26.1
Specialized Knowledge	3.98	4.77	19.9

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