doi: 10.5191/jiaee.2020.274128

Employability of Egyptian Agriculture University Graduates: Skills Gaps

Paul Ebner
Leah Thompson
Purdue University

Ramjee Ghimire
D. Hashini Galhena Dissanayake
Nanda Joshi
Michigan State University

Waleed D. Saleh
Cairo University

Abstract

Egypt's Strategic Development plan calls for higher-education curricula that produce workforce-ready graduates. Creating such curricula requires strong understanding of the skills and attributes most valued in the economy. Toward this end, this study focused on Egyptian agriculture sectors and measured perspectives of Egyptian agriculture university professors, students and private-sector employers on areas for potential job opportunities for agriculture university graduates and the skills graduates need to obtain and excel in those jobs. Using a survey-based approach, the study included responses from 417, 974, and 92 professors, students, and employers, respectively. Employers and professors identified poultry production, food/beverage processing, and protected horticulture as sectors (among 24 choices) with the most employment opportunities for agriculture university graduates. The most valued skills in new employees from employers' perspectives (among 35 choices) were identified by principle component analysis and included familiarity with technologies, ability to apply academic knowledge to real scenarios, ethical decision-making, teamwork and problem-solving skills, ability to work with others from diverse backgrounds, and motivation and ability to learn new things. The largest students' skills gaps (difference between value of the skill in new employees and students' competency level in the same skill as assessed by employers) included time management, ability to plan/organize, conflict management, knowledge of industry, and ability to manage tasks/projects. Taken together, these results can inform development of market-driven curricula in Egyptian agriculture universities by highlighting areas/attributes where students should focus to increase their employability and pedagogies that allow students to gain these skills during their university careers.

Keywords: Egypt, higher education, agriculture, skills gaps

Acknowledgements: This study was made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the cooperative agreement #72026319CA00002. The contents are the responsibility of authors and do not necessarily reflect the views of USAID or the United States Government.

Introduction

Egypt's higher education system has a long and rich history. Al Azhar University in Cairo, founded in 970, is considered the second oldest university in the world and Egyptian universities contribute significantly to life sciences and humanities. Today, education is a right for Egyptians enshrined in the country's constitution and Egyptians passing secondary education exams are provided tuition-free enrollment at public universities through the undergraduate level.

Enrollment in Egyptian universities has increased significantly over the past two decades, coinciding with massive population growth in Egypt, which has almost doubled since 1990 (World Bank, 2019). Currently, there are 26 public universities and 31 private universities in Egypt (Mohamed et al., 2019). In 2018, just under 650,000 students completed the secondary education final exam and estimated 2.2 million students were enrolled in public universities in Egypt in 2017/2018, including Al Azhar University (Central Agency for Public Mobility and Statistics, 2019b). Although, there has been growth in both university seats and the general population, Egyptian higher education is not thought to be saturated at the university level and supply (university seats) still outpaces demand (Buckner, 2013). The employment market for university graduates, however, is not nearly as solvent as discussed in in subsequent sections.

In 2017, over 125,000 Egyptians earned diplomas from Egyptian or foreign universities, compared to only 34,000 in 2009. Likewise, approximately 18,000 Egyptians earned master's level degrees in 2017. This figure is slightly down from the approximately 21,500 master's level degrees earned in 2015, but well above the steady 8,000 – 9,000 master's level degrees earned in years 2009 to 2011. Finally, an estimated 8,000 – 9,000 Egyptians earn PhDs each year from both Egyptian and foreign universities. This is roughly double the number of earned PhDs from just 6 years ago (Central Agency for Public Mobility and Statistics, 2019a). For reference, US academic institutions issued 35,791 PhD degrees to US citizens or permanent residents in 2017 (National Science Foundation, National Center for Science and Engineering Statistics, 2018).

While data on university-level learning outcomes in Egypt are scarce, high unemployment rates among university graduates (34.0% vs. 12.6% overall unemployment; Ghafar, 2016) indicate a wide gap in university learning outcomes and labor market needs and the Global Competitiveness Report of the World Economic Forum (2018) ranks the "skillsets of university graduates" in Egypt as 136th among 140 countries. Similarly, the research and discovery capacity of Egyptian universities and their faculty is impeded by limited resources and financing for higher education (Ministry of Planning, Monitoring and Administrative Reform [MPMAR] 2016). Finally, likelihood of admission to the university, or programs within a university (e.g., engineering, medicine), can be impacted by inequalities at the primary and secondary education levels (e.g., weaker schools, access to supplementary education, etc.), which limit enrollment of students from rural, less-educated, and/or less wealthy households in Egyptian universities (Assaad & Krafft, 2015; Buckner, 2013). In turn, university students reportedly require an average of seven years to find meaningful employment once they graduate (Amin, 2014; Mohamed et al., 2019). Prospects for female university graduates are significantly lower than their male colleagues with unemployment levels in female university graduates up to five times those of males (Barsoum et al., 2014). It is critical to note, however, that Egypt has a considerable informal economy with some, including Egypt's Central Bank, estimating that parallel economies contribute to 40% of the country's GDP (Khalid, 2018). Thus, unemployment estimates may not be surveys of all individuals contributing to the whole economy.

Numerous factors likely contribute to low student success as gauged by employment rates among Egyptian university graduates. Chief among those factors, however, is the acknowledged

mismatch in skills needed in the labor market and what is taught to and learned by students in the university (Ghafar, 2016). Bridging this skills/knowledge gap in higher education is a priority of the Egyptian government and a focal point in Egypt's development strategy as it pertains to higher education (MPMAR, 2016).

This mismatch may be rooted in the "massification" of Egyptian higher education that began in earnest decades ago, when increasing access to higher education was, at least in part, a reflection of the need for more university-educated public-sector workers. Indeed, until the early 1990s, all Egyptians graduating from university were guaranteed public sector employment (Barsoum, 2015). This guarantee no longer exists, but Egyptian higher education still remains on some levels focused on providing students credentials, which in the past, were necessary for public sector employment. This is reflected in "number of graduates" as a key metric to measure Egyptian higher education quality. Compounding the issue, job opportunities in Egypt's public sector have decreased with the central government's goal of significantly reducing public sector employment (Eman, 2018); it is probable that private sector labor markets seek employees with attributes beyond academic credentials.

Theoretical Framework

The challenges described above inform Egypt's development strategy for higher education as described in the Sustainable Development Plan: Egypt's Vision 2030 (MPMAR 2016), which outlines aims of a) improving quality of curricula and teaching and organizational structures to produce programs meeting global standards (primarily via national accreditation processes), b) ensuring accessibility and quality "classrooms in rural and urban areas, for males and females, and for all classes of society"(pg. 204), and c) integrating labor market needs into curricula in effort to develop "students that are able to seize market opportunities and even create such opportunities" (pg. 204).

As such, the research described here was guided by a conceptual framework of employability, with the aim of better defining skills, attributes, or other factors that determine the capacity of Egyptians studying agriculture at the tertiary level to find meaningful employment in their fields of study upon graduation. Employability is rooted in human capital theory (Becker, 1964) where an individual's skills, knowledge, experience, or personality traits may collectively translate into economic value in a given labor market. For this research, employability was defined as the set of attributes that allow a graduate to "access a job, maintain it, or find another" (Hillage & Pollard, 1998; Suleman, 2018). Ultimately, the study aimed to measure the gaps in skills (technical, behavioral, or other) in Egyptian university graduates that limit their potential to find meaningful employment in their fields of study. These data would then allow educators to better shape curricular and other learning initiatives in agriculture education at the tertiary level to meet goals of increasing students' post-graduation opportunities.

Methods

All protocols and questionnaires were reviewed by the Purdue University Institutional Review Board and deemed exempt (#1906022352). Individual questionnaires were developed for current Egyptian agriculture university students, current Egyptian agriculture university professors, and potential employers (Egyptian agriculture private sector) of agriculture university graduates. Questionnaires were initially created in English and reviewed by a panel of experts (US university faculty) for soundness and Egyptian nationals for cultural appropriateness and revised accordingly. Questionnaires were then translated to Arabic and revised by a panel of

Egyptian nationals. Revised Arabic versions were then reviewed by Egyptian university faculty, both for soundness and cultural appropriateness. Revised Arabic versions were then re-translated to English to ensure that Arabic versions of the questionnaires retained the spirit of the English versions. Digital Arabic versions of all questionnaires were created using Qualtrics XM software (Seattle, Washington). Both hard-copy and digital versions of each questionnaire were then piloted with Egyptian nationals to ensure mechanical soundness. Questionnaires were distributed to recipients as part of meetings aimed at introducing stakeholder groups to different university-led curriculum initiatives with the options of completing written forms available in either English or Arabic or the digital Arabic version.

Respondents were asked to provide (depending on respondent group) their major, university, year of study, gender, academic rank, number of university graduate employees, gender, frequency with which the respondent supervised/worked with recent agriculture university graduates, agriculture sector represented, among other descriptors. All groups were presented with 35 skills across different categories (critical thinking and problem-solving skills, integrative/creative thinking skills, analytical/technical skills, and communication skills) and were asked their opinions as to the value of each skill in new employees. Students were asked to self-assess their competency levels across the same 35 skills. Professors and employers were asked to assess competency levels of new agriculture university graduates across those skills. Professors and employers were also asked their opinions on employment opportunities across 24 agriculture disciplines or fields. The 24 fields were collected from employee recruiting sites targeting agriculture university graduates.

Identification of skills most valuable to employers and professors was done by factor analysis and tested for appropriateness using Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin (KMO) measure of sampling accuracy tests. Factors were extracted by principal component analysis and rotation matrices were generated using Varimax with Kaiser Normalization using SPSS software as were reliability coefficients for questions relating to skill values and competency levels (IBM, Inc., Armonk, NY). When statistically appropriate, data were analyzed and compared using two tailed t-test for pairwise comparisons or ANOVA with Tukey post-hoc separation of means or least square differences using SAS software (SAS Institute, Inc., Cary, NC). Values were considered statistically different at $P < 0.05$. Skills gaps were measured as (Vreyens & Shaker, 2005): *Skills gap = value of skill in new employees – students' competency level in the same skill.* Data from open-ended questions (e.g., What are the three areas in agriculture with most potential for job opportunities for university graduates?) were coded to identify major themes and sub-themes across responses (Saldaña, 2009).

Results

Paper survey and digital survey data obtained from students, professors, and employers were cleaned, merged, and compared for differences in responses. No significant differences were found in responses between the two platforms. A total of 1,483 questionnaires were received representing a) 974 student responses (64% female; 36% male), b) 417 professor responses (32% female; 68% male), and c) 92 employer responses (7% female; 93% male). Of the 974 student responses, 61.6%, 30.6%, 4.8%, and 3.1% were from Cairo University, Assiut University, Benha University, and Suez Canal University, respectively. Student responses represented 12 majors or fields of study with greatest representation from students studying Biotechnology – English Medium (21.5%) and Food Sciences (15.1%). Of the 417 professor responses, 30.7%, 26.5%, 20.8%, 19.5%, and 2.6% were from Ain Shams University, Suez

Canal University, Cairo University, Assiut University, and Benha University, respectively. Professor responses represented 19 fields of study with the greatest representation from animal production (14.3%) and agricultural microbiology (11.9%). While 72.2% of the employers indicated they had hiring responsibilities in their position, a slight majority (51.5%) indicated they hired 1 – 5 university graduates each year. Likewise, 94.9% of employers responded that they either "sometimes" (35.9%), "often" (35.9%), or "almost always" (23.1%) work directly with new university graduates.

Areas for Employment

We asked professors and employers which agriculture sectors they felt had the most potential job opportunities for university graduates in the next five years. Respondents were presented with a list of 24 agriculture sectors and asked to predict employment growth in each sector (1 = "definite growth", 2 = "probable growth", 3 = "neutral", 4: "probably no growth", and 5 = "definitely no growth"). Employers' rankings of agriculture sectors with most potential for job growth along with corresponding professors' ranking of the same sectors are presented in Table 1. In many cases, employers and professors shared similar opinions on the agriculture sectors with the most potential for job opportunities for new agriculture university graduates with both groups ranking poultry production and food/beverage processing highest numerically. Similarly, the two groups also ranked horticulture/protected cultivation and water resource management numerically high (Table 1).

Table 1

Areas of Potential Growth in Job Opportunities for New Agriculture University Graduates: Employer Perspective and Professors' Comparative Ranking

Sector	N	M	SD	Professor Rank
Animal production – poultry	56	1.80	0.8	1
Food and beverage processing	60	1.82	0.9	2
Energy, biofuels, alternative energy	63	1.87	0.9	15
Chemicals, pesticides, fertilizers	57	1.89	0.9	20
Horticulture – protected cultivation	58	1.90	0.9	3
Water resource management	57	1.93	1.0	6
Agriculture sales and marketing	58	1.93	0.9	18
Horticulture – vegetables	53	1.98	0.9	7
Post-harvest processing	57	2.00	1.0	12
Agronomy	60	2.02	0.9	11
Horticulture – fruits	55	2.02	0.9	8
Feed production	57	2.05	0.9	13
Agriculture education and research	53	2.06	0.8	21
Agriculture communication/promotions/public relations	53	2.11	1.0	24
Animal production – dairy	54	2.13	1.0	10
Animal production – aquaculture	55	2.15	0.9	4
Agriculture engineering (equipment/machinery)	57	2.25	0.9	22
Seed production	55	2.25	1.1	17
Pest management	57	2.28	1.0	14
Organic agriculture	56	2.29	1.1	9
Horticulture – ornamentals	54	2.31	1.0	19

Animal production - red meat	55	2.36	1.1	16
Biotechnology	54	2.44	1.2	5
Horticulture – other	47	2.57	0.9	23

Employers were also asked to list what they felt were the top three agriculture sectors for job growth in an open-ended question and their answers were coded to identify major themes and sub-themes (if present). Roughly equal percentages of employers identified animal production (24%) and horticulture (23%) as the top areas for potential jobs opportunities for university graduates in agriculture. Within animal production, sub-themes of poultry production (36%), general animal production (32%), and dairy production (14%) (other [e.g., fish, etc.] animal production: 27%) were identified. Within horticulture, fruit production (38%) and vegetable production (33%) were both identified as prominent sub-themes (other [e.g., general, ornamental] horticulture: 29%). Only a slightly lower percentage (18%) of employers identified food processing as a major area for growth, with sub-themes of general food processing (39%), post-harvest processing (22%), quality control/food safety (22%), and beverage processing (11%) (other [e.g., dairy, product development, etc.] food processing: 6%). Nine percent of employers' responses were related to water management, with irrigation technology constituting 98% of those responses (general water management: 2%). Finally, 8% of employers' responses were related to the areas of fertilizers, chemicals, and pest management (no sub-themes).

The majority of both employers (70.9%) and professors (70.2%) reported that students with bachelor's degrees would be most competitive for jobs identified above. This was in contrast to master's level degrees (employers: 21.7%; professors: 8.6%), PhD degrees (employers: 7.0%; professors: 2.5%), or other types of academic and technical qualifications (employers: 0.4%; professors: 8.6%).

Employers strongly agreed (M = 1.4, 1 = "strongly agree", 2 = "agree", 3 = "neither agree nor disagree", 4 = "disagree", and 5 = "strongly disagree") they would hire more graduates if those graduates possessed skills specific to the employers' sectors. However, employers also agreed (M = 2.1, 1 = "strongly agree", 2 = "agree", 3 = "neither agree nor disagree", 4 = "disagree", and 5 = "strongly disagree") with the statement that they preferred to hire males for the types of jobs they offer. It should be noted, however, that our results could be influenced by the underrepresentation of female employers (6.6%) in our sample set. Likewise, our informal observations during surveying indicated that while some private sector employers clearly employ many more males than females, numerous private sector companies actively employ as many female university graduates as male university graduates.

Skills Needed

Students, professors, and employers were presented with 35 skills and asked to rate value of each skill (1 = "high", 2 = "average", 3 = "low", 4 = "very low") in new employees. Reliability coefficients were 0.944, 0.971, and 0.976 for students, professors, and employers, respectively. With employers' responses, factor analysis produced an initial KMO measure of 0.82 and chi-square (X^2), degrees of freedom (*df)*, and significance values (Barret's Test of Sphericity) of 1868.0, 595.0, and < 0.001, respectively. Principal Component Analysis of employers' responses identified five components. The first component comprised of 11 skills (of 35) and explaining 59.0% of the variation in the analysis (Table 2). With professors' responses, factor analysis produced an initial KMO measure of 0.82 and chi-square (X^2), degrees of freedom (*df*), and significance values (Barret's Test of Sphericity) of 6580.0, 595.0, and < 0.001,

respectively. Principal Component Analysis identified four components. The first component comprised of 17 factors (skills; of 35 total) and explaining 52.0% of the variation in the analysis (Table 2). Our results mirrored those of other studies (Matturro, 2013; Naiem et al., 2015) in that the majority of skills valued by employers represented behavioral competencies (e.g., functioning as part of team, time management, ability to plan/organize, etc.).

Table 2
Principal Component Analysis of Value of Different Skills in New Employees.

Employers' Perspective Component One Factors (59.0% of Variation)	Professors' Perspective Component One Factors (52.0% of Variation)
1. Ability to function in a team	1. Working with others from diverse backgrounds
2. Ability to access different resources for information	2. Ability to manage complex tasks/projects
3. Working with others from diverse backgrounds	3. Proactivity to tasks
4. Self-motivation to learn new things and work	4. Knowledge of industry or potential employer
5. Ability to make ethical decisions	**5. Adaptability to changes in the field or workplace**
6. Knowledge of ethics and best practices in field	6. Knowledge of and ability to apply technical skills specific to job
7. Familiarity with the latest technologies	**7. Self-motivation to learn new things and work**
8. Adaptability to changes in the field or workplace	**8. Ability to function as part of a team**
9. Customer service	9. Time management
10. Problem identification/solving	10. Ability to plan and organize
11. Ability to apply academic knowledge to real scenarios	11. Knowledge of and ability to apply technologies specific to job
	12. Ability to access different resources for information (e.g., internet, databases, etc.)
	13. Knowledge of ethics and best practices in field
	14. Ability to make ethical decisions
	15. Conflict management
	16. Ability to work across disciplines
	17. Ability to work independently

Note. Bold = factors found in components one of both employers and professors.

Students, professors, and employers were asked to provide assessments of students' competency levels across the same 35 skills. Reliability coefficients were 0.908, 0.971, and 0.976 for students, professors, and employers, respectively. Of note, professors assessed recent graduates' competency levels significantly ($P < 0.05$) higher than employers assessed recent graduates' competency levels across all 35 skills. Likewise, students' self-assessed competency levels were significantly ($P < 0.05$) higher than employers' assessment of recent university graduates across all 35 skills. Finally, students' self-assessed competency levels were significantly ($P < 0.05$) higher than both professors' and employers' assessment of recent university graduates in 26 of the 35 skills presented (data not shown).

Nevertheless, according to employers, new agriculture graduates appear sufficiently skilled in traditional areas such as oral communication, written communication, and applied math skills. Employers also found the for the jobs the employers offer, students are sufficiently skilled in English. Likewise, employers did not express a preference for students completing English-

language bachelor's programs over students in traditional Arabic-language programs. It should be noted that higher levels of proficiency in English may be of more value for students wishing to pursue advanced degrees, especially for graduate programs outside of Egypt. Employers indicated that skills levels of students were low in some key behavioral competencies, including time management, ability to plan and organize, conflict management, and ability to manage complex tasks.

Calculating the absolute difference between the value of various skills to employers and the perceived level of competency in recent graduates in those same skills illustrated skills gaps (Vreyens & Shaker, 2005; Table 3). This method for measuring skills gaps identified a) skills that are important to employers; and b) skills in which agriculture university students may need more development. Additionally, this method identified areas where students do not need development as a) they may already be highly competent in that area (e.g., ability to access different resources for information); and/or b) they may have a low level of competence, but the skill is not important to employers (e.g., proficiency in languages outside of English and Arabic). By this measurement, the five biggest skills gaps in new university graduates according to employers were time management, ability to plan and organize, conflict management, knowledge of industry or potential employer, and ability to manage complex tasks/projects (Table 3).

Table 3
Skills Gaps in New University Graduates According to Potential Employers

Competency	Emp Value	Skill Level	Skills Gap	Emp Value Rank
Time management	1.62	2.84	-1.22	11
Ability to plan and organize	1.61	2.76	-1.15	9
Conflict management	1.88	3.02	-1.14	29
Knowledge of industry/potential employer	1.74	2.84	-1.10	21
Ability to manage complex tasks/projects	1.80	2.89	-1.09	24
Knowledge of/ability to apply technologies specific to job	1.53	2.59	-1.06	5
Creativity	1.77	2.79	-1.02	22
Familiarity with latest technologies	1.68	2.70	-1.02	16
Human resource management	1.95	2.92	-0.97	31
Adaptability to changes in the field or workplace	1.58	2.52	-0.94	7
Ability to interpret data and make inferences	1.81	2.75	-0.94	25
Ability to apply academic knowledge to real scenarios	1.79	2.72	-0.93	23
Ability to work across disciplines	1.63	2.56	-0.93	13
Ability to function as part of a team	1.42	2.35	-0.93	1
Self-motivation to learn new things and work	1.42	2.34	-0.92	2
Proactivity to tasks	1.62	2.53	-0.91	12
Knowledge of/ability to apply technical skills specific to job	1.60	2.51	-0.91	8
Problem identification and solving skills	1.72	2.62	-0.90	19
Analytical skills	1.83	2.73	-0.90	26
Working with others from diverse backgrounds	1.66	2.56	-0.90	15
Customer service	1.73	2.62	-0.89	20
Organizational management	1.87	2.74	-0.87	28
Knowledge of subject matter	1.62	2.48	-0.86	10

Advanced computer programing skills	2.06	2.90	-0.84	32
Use of MS word, MS excel, email, internet	1.72	2.54	-0.82	18
Financial management	2.13	2.93	-0.80	34
Written communication	1.70	2.48	-0.78	17
Knowledge of ethics and best practices in field	1.57	2.34	-0.77	6
Ability to work independently	1.84	2.59	-0.75	27
Proficiency in English	1.89	2.62	-0.73	30
Oral communication	1.64	2.36	-0.72	14
Applied math skills	2.12	2.81	-0.69	33
Ability to make ethical decisions	1.51	2.19	-0.68	4
Proficiency in languages (excluding Arabic and English)	2.63	3.28	-0.65	35
Ability to access different resources for information	1.50	2.14	-0.64	3

Note. Skills gap = value – skill level; lower values equate to larger gaps.

In a study similar to ours, Vreyens and Shaker (2005) characterized skills gaps among recent university agriculture graduates from Al-Azhar University, Cairo University – Giza, Cairo University – El Fayoum, Assiut University, and Minia University. The group surveyed 254 employers and 1,000 graduates of faculties of agriculture in Upper Egypt across three agriculture sectors (animal production, horticulture, and food technology/processing), asking each group to identify the most critical skills for graduates entering jobs in the private sector labor market and the level of competence (according to employers) or level of preparedness (graduates' self-assessment) across the different skills. Responses from recent graduates and employers as to the importance of different skills were similar to one another in many cases, such as analyzing information and applying time management skills. Interestingly, however, the largest skills gaps (i.e., widest gap in importance of the skill to the job and the level of competence) according to employers were not sector-specific, but still somewhat technical, such as analyzing information, applying time management skills, developing a basic budget, and accessing the internet for resources/information. Unlike our study, Vreyens and Shaker asked new employees to identify skills they now find are important for employment, but for which they were ill-prepared upon graduating. According to the results from Vreyens and Shaker (2005), students' top five responses included ability to "analyze information", "speak effectively with a target audience", "think creatively", "apply problem-solving skills", and "apply time management skills" (p. 232).

Other groups have quantitatively defined skills gaps as they exist in different sectors in Egypt, from accounting (Anis, 2017) to computer science (Naiem et al., 2015). Naiem et al. (2015) postulated that behavioral skills are neglected in science and engineering, making it difficult to incorporate into curricula, often because they are not considered during the grading process. In a survey of 136 computer and software engineering students, respondents were aware of the importance of soft skills and generally wanted to develop such skills but did not feel well-equipped in them (Naiem et al., 2015).

Conclusions, Recommendations & Implications

This research was in support of efforts to build agriculture curricula in Egyptian tertiary education that address current and emerging challenges in Egyptian agriculture. Central to these efforts is developing workforce-ready graduates able to make a more immediate impact in fields important to Egyptian agriculture and growth. Toward this end, this study was conducted to not

only identify areas of job growth for university graduates, but to also identify the skills and attributes that may increase graduates' employability in these areas of agriculture.

In terms of Egyptian agriculture sectors with most potential for job opportunities for university graduates, professors' perspectives largely mirrored employers' perspectives in that both groups felt that poultry production and food/beverage processing were sectors for greatest job opportunities for university graduates. These assertions are supported by current trends and needs in food production in Egypt. As of 2019, poultry meat consumption in Egypt was 12.1 kg/capita and is expected to reach 13.8 kg/capita by 2028 (Organization for Economic Cooperation and Development, 2020). Expected increases in poultry consumption have to be coupled with improved processing capacities, efficiencies, and biosecurity (Shatokhin et al., 2017). Furthermore, the opinions of employers and professors are aligned with the goals of Egypt's Vision 2030 sustainable development strategy, which includes improved poultry production as a component of economic development initiatives (MPMAR, 2016). Specifically, the strategy calls for improved control of avian influenza, facilitation of new operations in desert areas, and increases in slaughter/processing capacity, among others (MPMAR, 2016). Taken together, these data support the need for more highly trained poultry scientists to meet these demands and challenges.

While employers and professors each ranked poultry production as the sector with the most potential for employment opportunities for university graduates, they also each ranked food and beverage processing as second most important sector. Egypt possesses one of the fastest growing food markets in the world, in large part due to the surge in population growth and increased tourism. In 2017 there were over 7,000 food processing and manufacturing companies in Egypt responsible for 17 billion USD in sales (Al-Habbal & Beillard, 2018 and 2019). However, quality and variety of goods are limited, and Egypt's strategic development plan calls for application of biotechnology to processing of foods sold both domestically and internationally (MPMAR, 2016). Although Egypt has trade deficits in agricultural products, the demand for domestic food and beverage products is increasing. As the country continues to experience more political and economic stability, Egyptian consumers may have more loyalty to domestic products, further driving demand for locally produced food and beverage products (*The Food and Beverage Market Entry Handbook: Egypt*, 2019).

Finally, both employers and professors identified protected horticulture (employers' rank: #6/35; professors' rank: #3/35) as having significant potential for job growth. Egypt recently implemented a mega-project consisting of 1,302 greenhouses across 100,000 feddans (1 feddan = 1.04 acre = 0.42 hectares) with the goal of achieving the production equivalent of one million feddans of conventional, unprotected farming (Egypt State Information Service, 2018). In August 2019, the Egyptian government initiated the project's second phase, which includes 1,300 additional greenhouses (Egypt State Information Service, 2019) supporting respondents' assessment of an increased need for graduates skilled in greenhouse management across Egypt.

Aggregating the factors (skills) that collectively contribute the majority of the variance in our model with results from similar studies described above allowed us to create a composite of an Egyptian agriculture university graduate with enhanced employability. Such a graduate would be "familiar" with the latest technologies, but able to apply academic knowledge to real scenarios. As important, the employable graduate would be highly ethical, skilled in teamwork and problem-solving, able to work with others from diverse backgrounds, and motivated to learn new things with the ability to identify resources to do so.

Thus, our data indicate that employability of new agriculture university graduates is heavily dependent on the graduate attaining enhanced behavioral competencies or skills. Behavioral competencies have been defined as "…abilities, and traits that pertain to personality, attitude, and behavior rather than to formal or technical knowledge" (Moss & Tilly, 1996). Behavioral and technical skills, however, are not mutually exclusive as behavioral competencies afford an employee the capacity to demonstrate and organize their technical skills more effectively (Rao, 2014). Thus, delivery of curricula aimed at increasing graduates' employability should employ pedagogies that allow students to practice behavioral competencies in the process of learning course content and technical skills. Experiential learning (Kolb et al., 2014), authentic learning (Knobloch, 2003), or other pedagogies that encourage learning in context, active learning, teams, concrete experiences, and/or reflective observation would likely produce Egyptian university graduates with greater capacity to apply learning beyond the classroom.

Several groups have integrated experiential learning or similar pedagogies in Egyptian agriculture education and reported on their efficacy, primarily at the secondary education level. Barrick et al. (2011), in response to stakeholders' assessment of the importance of internships/placement projects as employment determinants, developed a program where 90 Egyptian agriculture technical school (ATS) instructors incorporated student internship experiences into their curricula. Instructors self-assessment indicated some difficulties in implementing such pedagogies, namely ability to "explain the relationship between internship and classroom instruction", "identify the role of teachers in planning and conducting internships", and "explain the process of learning by doing" as well as the importance of continued training and availability of supplemental resources to ensure program success.

Myers et al. (2012) surveyed 160 ATS instructors from 34 different schools in Upper Egypt who had received active learning training (e.g., case studies, field exercises, and concept maps) with the goal of identifying stages of concern among teachers implementing these programs. Teachers with less than three years of experience with active learning indicated needing more training or educational materials to more successfully implement active learning strategies. Teachers also expressed concerns about the value of active learning, which suggested a need for clearer understanding of the benefits of active learning among practitioners. The authors concluded that, along with improved teacher training, incentives for teachers using active learning methods could promote their use (Myers et al., 2012).

In effort to measure the benefits of experiential learning in the Egyptian context, Shoulders et al. (2011) conducted an assessment of the impact of ATS internship programs on students, parents, headmasters, teachers, and agribusiness owners. The authors identified various benefits, including increases in disposable income, better relationships between schools and families, ability to apply knowledge gained from internships in the home, and increased perceived value in education, among others (Shoulders et al., 2011).

Finally, Swanson, Cano, Samy et al. (2007) introduced experiential learning in 25 agriculture technical secondary schools in Upper Egypt as a means to transition students' skills beyond knowledge recall to more complicated cognitive skills like critical thinking and practical skill training. Experiential was introduced through training sessions, instructional materials, international study tours, and restructuring of school farms to promote better practical skills development (Swanson, Cano, Samy et al., 2007). After one year of implementation (and assessment and revision), 96% of professors were satisfied or very satisfied with the partnerships with many reporting the development of new courses, improved teaching, and increased

perception of the value of public-private partnerships in Egyptian educational institutions (Swanson et al., 2007).

While studies examining the efficacy of experiential or student-centered learning in tertiary agriculture education are scarce, several groups have introduced such teaching strategies in other fields of study at the university level. El-Nachar and Eldeen (2003) used experiential-learning to introduce university architecture students to key concepts and practices in sustainability. The program provided students a practical knowledge base while also promoting interdisciplinary thinking (including scientific, critical, and metaphorical thinking) and student involvement in the community. The authors concluded that their results could be used as a framework for introducing students to other disciplines within architecture (El-Nachar & Eldeen, 2003). Lastly, El Bedawy (2017) used business simulations to introduce university students to realistic components of managing a business, including research and development, finance, marketing, and production. Students viewed the simulation to be an effective learning model, confirming its value as a business education tool. Students also reported improvements of behavioral competencies, such as working in a team and time management (El Bedawy, 2017).

It is important to note that according to employers' responses, the composite university graduate with highest employability in agriculture would also be male. The higher unemployment rates among all female university graduates vs. male university graduates certainly indicate that gender is a determinant in securing post-graduation employment in Egypt, and there may be numerous sub-determinants influencing this bias. As an example, Egyptian female university students have traditionally been over-represented in fields that may not be as employable (e.g., some humanities) as other fields of study (e.g., engineering; Megahed, 2010). However, our results are the first to our knowledge that indicate that in the field of agriculture, all other attributes being equal, employers indicate that they prefer to hire male graduates over female graduates for the jobs they offer.

Yet our results could be influenced by the underrepresentation of female employers (6.6%) in our sample set. Likewise, our informal observations during surveying indicated that while some private sector employers clearly employ many more males than females, numerous private sector companies actively employ as many female university graduates as male university graduates. Thus, it would be of interest to compare characteristics of those companies hiring greater numbers of female graduates with those companies where male university graduates are overrepresented. It may be possible, through a positive deviance approach, to identify factors among businesses with more favorable hiring practices (e.g., education programs, types of employment, etc.) that lead to greater opportunities for female graduates within those companies.

Taken together, our results, along with those of previous groups, more clearly define the factors that increase the employability of agriculture university students upon graduation. Most of these factors fall outside of traditional knowledge of course content and extend into the application of that knowledge in the workplace, along with the motivation and ability to learn new areas. Agricultural education has always lent itself well to experiential learning platforms (Ebner et al., 2019; Thompson et al., 2019), which, if incorporated into tertiary level agriculture, could allow students to hone skills desired by employers while learning course content.

Experiential learning and similar pedagogies, however, are not yet widespread in Egyptian agriculture universities based on limited published material on their implementation. Experiential learning, however, is not without challenges. In the Egyptian context, challenges could include fitting assessment of learning into current grading structures, low incentivizes to incorporate such pedagogies into courses, and obtaining resources to allow sustainability.

Although outside the scope of this paper, our research also identified ways in which employers were willing to contribute to curriculum development and delivery, namely through provision of internships, short-term research projects, and mentorships. Given the interest employers demonstrate in hiring more graduates if they possessed specific skills and characteristics relevant to the position, some of these challenges could be overcome by leveraging relationships with private sector partners to provide such experiences and facilitating students' participation in employment training opportunities. With such training, students can acquire job-oriented skills and competencies, build relationships with prospective employers, and expand their networks, which together can potentially increase their employability.

References

Al-Habbal, I., & Beillard, M. (2018). *Food processing ingredients annual 2018*. United States Department of Agriculture Foreign Agricultural Service. https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Food%20Processing%20Ingredients_Cairo_Egypt_2-22-2018.pdf

Al-Habbal, I., & Beillard, J. (2019). *Egypt's food processing ingredients landscape*. United States Department of Agriculture Foreign Agricultural Service. http://agriexchange.apeda.gov.in/MarketReport/Reports/Food_Processing_Ingredients_Cairo_Egypt_4-1-2019.pdf

Amin, G. (2014). *Egypt country report: Policies and mechanisms for integration into the workforce and job creation*. The Arab Republic of Egypt Ministry of Education. http://www.adeanet.org/min_conf_youth_skills_employment/sites/default/files/u24/Egypt%20Country%20Report_0.pdf

Anis, A. (2017). Auditors' and accounting educators' perceptions of accounting education gaps and audit quality in Egypt. *Journal of Accounting in Emerging Economies*, *7*(3), 337 - 351. https://doi.org/10.1108/jaee-08-2016-0070

Assaad, R., & Krafft, C. (2015). Is free basic education in Egypt a reality or a myth?. *International Journal of Educational Development*, *45*, 16 - 30. https://doi.org/10.1016/j.ijedudev.2015.09.001

Barrick, K., Samy, M., Roberts, G., Thoron, A., & Easterly, R. (2011). Assessment of Egyptian agricultural technical school instructors' ability to implement experiential learning activities. *Journal of Agricultural Education*, *52*(3), 6 - 15. https://doi.org/10.5032/jae.2011.03006

Barsoum, G. (2015). Striving for job security. *International Journal of Sociology and Social Policy*, *35*(5/6), 340 - 358. https://doi.org/10.1108/ijssp-01-2014-0006

Barsoum, G., Ramadan, M., & Mostafa, M. (2014). *Labour market transitions of young women and men in Egypt*. International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_247596.pdf

Becker, G. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. National Bureau of Economic Research.

Buckner, E. (2013). Access to higher education in Egypt: Examining trends by university Sector. *Comparative Education Review*, *57*(3), 527 - 552. https://doi.org/10.1086/670665

Central Agency for Public Mobility and Statistics. (2019a). *Egypt in figures: Education 2019 (annual bulletin)*.

Central Agency for Public Mobility and Statistics. (2019b). *Total number of students enrolled in government universities and Al-Azhar*.

Ebner, P., Rahimi, M., McNamara, K., & Ghoryar, M. (2019). Experiential learning effectively supports workforce-oriented agricultural education in Afghanistan. *NACTA Journal*. https://search.proquest.com/docview/2374122427?accountid=13360

Egypt State Information Service. (2018). *Sisi inaugurates 100,000-feddan project at Mohamed Naguib military base in Matrouh*. https://sis.gov.eg/Story/124473?lang=en-us

Egypt State Information Service. (2019). *Sisi opens 2nd phase of greenhouse national project*. https://www.sis.gov.eg/Story/141142/Sisi-opens-2nd-phase-of-greenhouse-national-project?lang=en-us

El Bedawy, R. (2017). Experiential learning for supporting learning effectiveness in business education: A case study from Egypt. *International Journal of Business and Management*, *12*(5), 159. https://doi.org/10.5539/ijbm.v12n5p159

El-Nachar, E., & Eldeen, H. (2003). In response to the challenges of sustainability experiential learning: A paradigm for sustainability-oriented architectural education. In *Architectural Education for the New Millennium: Issues, Innovation and Traditions*. International Union of Architects Architectural Education Commission 1st International Conference, Alexandria, Egypt. https://www.cpasegypt.com/pdf/Heba_SafyEldin/Researches/10.pdf

Eman, A. (2018). Egypt struggles with bloated public sector. *The Arab Weekly.* https://thearabweekly.com/egypt-struggles-bloated-public-sector

Ghafar, A. A. (2016). *Educated but unemployed: The challenge facing Egypt's youth*. Brookings Institution. https://www.brookings.edu/wp-content/uploads/2016/07/en_youth_in_egypt-1.pdf

Hillage, J., & Pollard, E. (1998). *Employability: developing a framework for policy analysis*. Department for Education and Employment. http://www.academia.edu/download/43539201/Employability_Developing_a_framework_for20160309-24658-1ix1nw2.pdf

Khalid, T. (2018, December 12). *Egypt wants World Bank, IMF to include informal sector in GDP*. Reuters. https://af.reuters.com/article/africaTech/idAFB2N1YE000

Knobloch, N. 2003. Is experiential learning authentic? *Journal of Agricultural Education 44*, 22 – 34. http://www.academia.edu/download/52817836/44-04-22.pdf

Kolb, D., Boyatzis, R., & Mainemelis, C. (2014). Experiential learning theory: Previous research and new directions. In R. Sternberg & L. Zhang (Eds.), *Perspectives on Thinking, Learning, and Cognitive Styles* (p. 228). Routledge.

Matturro, G. (2013). Soft skills in software engineering: A study of its demand by software companies in Uruguay. *2013 6th International Workshop on Cooperative and Human Aspects of Software Engineering, CHASE 2013 - Proceedings.* http://doi.org/10.1109/chase.2013.6614749

Megahed, N. (2010). *Access to the university and women's participation in higher education in Egypt*. Middle East Institute. http://www.mei.edu/sites/default/files/publications/EducationVPVol.II_.pdf

Ministry of Planning, Monitoring and Administrative Reform. (2016). *Sustainable development strategy: Egypt's vision 2030*. http://sdsegypt2030.com

Mohamed, R., Skinner, M., & Trines, S. (2019). *Education in Egypt*. World Education News and Reviews. https://wenr.wes.org/2019/02/education-in-egypt-2

Moss, P., & Tilly, C. (1996). "Soft" skills and race: An investigation of black men's employment problems. *Work and Occupations*, *23*(3), 252 - 276. http://doi.org/10.1177/0730888496023003002

Myers, B., Barrick, R., & Samy, M. (2012). Stages of concern profiles for active learning strategies of agricultural technical school teachers in Egypt. *The Journal of Agricultural Education and Extension*, *18*(2), 161-174. http://doi.org/10.1080/1389224x.2012.655968

Naiem, S., Abdellatif, M., & Salama, S. (2015). Evaluation of computer science and software engineering undergraduate's soft skills in Egypt from student's perspective. *Computer and Information Science*, *8*(1). http://doi.org/10.5539/cis.v8n1p36

National Science Foundation, National Center for Science and Engineering Statistics. (2018). U.S. citizen and permanent resident doctorate recipients, by broad field of study, ethnicity, and race: Selected years, 1997 – 2017. In *Doctorate Recipients from U.S. Universities: 2017* (pp. 19 - 301). Author. https://ncses.nsf.gov/pubs/nsf19301/data

Organization for Economic Cooperation and Development. (2020). *Meat consumption*. https://data.oecd.org/agroutput/meat-consumption.htm

Rao, M. (2014). Enhancing employability in engineering and management students through soft skills. *Industrial and Commercial Training*, *46*(1), 42 - 48. http://doi.org/10.1108/ict-04-2013-0023

Saldaña, J. (2015). An introduction to code and coding. In J. Saldaña (Eds.), *The Coding Manual for Qualitative Researchers* [eBook edition]. SAGE. https://us.sagepub.com/en-us/nam/the-coding-manual-for-qualitative-researchers/book243616

Shatokhin, Y., Gammal, M., & Prikhodko, D. (2017). Executive Summary. In, *Broiler poultry industry: Investment challenges and opportunities* (pp. 11 - 12). Food and Agriculture Organization of the United Nations. http://www.medagri.org/docs/group/71/Egypt%20Poultry%20Sector%202017.pdf

Shoulders, C., Barrick, K., & Myers, B. (2011). An assessment of the impact of internship programs in the agricultural technical schools of Egypt as perceived by participant groups. *Journal of International Agricultural and Extension Education*, *18*(2). http://doi.org/10.5191/jiaee.2011.18202

Suleman, F. (2018). The employability skills of higher education graduates: Insights into conceptual frameworks and methodological options. *Higher Education*, *76*(2), 263 - 278. http://doi.org/10.1007/s10734-017-0207-0

Swanson, B., Barrick, R., & Samy, M. (2007). Transforming higher agricultural education in Egypt: Strategy, approach and results. *Proceedings of the 23rd Annual Meeting*. Association for International Agricultural and Extension Education. https://www.aiaee.org/attachments/article/791/332.pdf

Swanson, B., Cano, J., Samy, M., Hynes, J., & Swan, B. (2007). Introducing active teaching-learning methods and materials into Egyptian agricultural technical secondary schools. *Proceedings of the 23rd Annual Meeting*. Association for International Agricultural and Extension Education. https://www.aiaee.org/attachments/article/790/343.pdf

The Food and Beverage Market Entry Handbook: Egypt. (2019). *European Union*. https://ec.europa.eu/chafea/agri/sites/chafea/files/handbook-egypt-2019_en.pdf

Thompson, L. R., Ebner, P., Indrea, A., Constantinescu, A., & Borlea, F. (2019). Returning to Romania: Building on a service learning course focused on enhancing skills used in engagement. *NACTA Journal, 63*(1), 146 - 155. https://search.proquest.com/docview/2374114187?accountid=13360

Vreyens, J., & Shaker, M. (2005). Preparing market-ready graduates: Adapting curriculum to meet the agriculture employment market in Egypt. *Proceedings of the 21st Annual Conference*. Association for International Agricultural and Extension Education. https://www.aiaee.org/attachments/article/961/040.pdf

World Bank. (2019). *Population, total – Egypt, Arab Rep.* [Infographic]. Author. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=EG

World Economic Forum. (2018). *The global competitiveness report*. http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf