

# Differentiated Analysis of the Occupational Integration of Engineer Graduates from the Faculty of Agricultural Sciences of the University of Abomey-Calavi into Agricultural Entrepreneurship between 1980 and 2020

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## ABSTRACT

Unemployment, underemployment, and overemployment are issues affecting graduate, undergraduate, and non-graduate young people in both developed and developing countries in the world. Agricultural entrepreneurship is among the most important employment alternatives proposed to young people, particularly in developing countries. Agricultural engineer graduates are among the people exposed to employment issues, so one would expect them to be mostly represented in agricultural entrepreneurship, given that they are agricultural specialists. This paper fills the knowledge gap about the extent to which agricultural engineer graduates occupationally integrate agricultural entrepreneurship in developing countries, especially in the Republic of Benin. The study focused on the period of 1980 to 2020 and on the engineer graduates from the Faculty of Agricultural Sciences (FSA) of the University of Abomey-Calavi, the oldest and the still most important high agricultural engineering education faculty of Benin. 510 agricultural engineer graduates from this faculty were surveyed via emails, phone calls, and face-to-face interviews. The gender and occupational integration data collected underwent frequency and percentage calculations, and the findings are presented in graphs and tables. Findings highlight that only about 1.8% of female and 6% of male agricultural engineer graduates of the studied faculty integrated agricultural entrepreneurship over the study period. 1.37% of other engineers tried out agricultural entrepreneurship before abandoning it. Thus, agricultural entrepreneurship is not yet an important employment solution for agricultural engineer graduates in Benin. Further conditions may be proposed to attract these professional graduates, whose presence in agricultural entrepreneurship could add more value to the quality and quantity of agricultural food supplied to consumers.

**Keywords:** Agricultural entrepreneurship, employment of agricultural engineer graduates, food security, gender analysis.

## 1. INTRODUCTION

For many decades, youth unemployment and underemployment have been an important socio-economic issue for all governments and development institutions in the world, including for public decision-makers of the republic of Benin (AFDB, 2016; FAO, 2017a, 2017b; Filmer & Fox, 2014; Fox *et al.*, 2016; ILO, 2012, 2017a, 2017b, 2017c; Kilimani, 2017; Makwela, 2017; von Braun & Kofol, 2017). To address these employment issues, agricultural entrepreneurship has been considered as an alternative for graduates as well as non-graduate youth, especially in most developing countries whose economies essentially depend on agriculture (AFDB, 2016; FAO, 2017a, 2017b; Filmer & Fox, 2014; Fox *et al.*, 2016; Kilimani, 2017; Makwela, 2017). Indeed, most young people, including

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university graduates, encounter difficulties in finding stable employment, which particularly explains the high unemployment, underemployment, and even overemployment rates among young graduates. According to [INSAE \(2016\)](#), only 11.2% of graduates aged between 15 and 29 have made a successful transition from school to work. This means that graduates are heavily affected by the problems of unemployment and underemployment, and this also applies to some agricultural graduates.

In Benin, the government, through its action programs for the 2021–2026 period ([President's Office of the Republic of Benin, 2016, 2021](#)), recognizes the agricultural sector as one with high potential for wealth and job creation and relies on it to meet employment challenges ([MPD, 2018](#)), notably by promoting agricultural entrepreneurship. Would this government agricultural entrepreneurship solution really contribute to the reduction of unemployment and underemployment of agricultural engineer graduates in Benin? How many female and male agricultural engineer graduates really enter agricultural entrepreneurship in Benin? To our knowledge, no study has yet specifically focused on these precise questions. This paper fills in this knowledge gap by exploring the extent to – and the yearly trends with – which female and male agricultural engineer graduates from the oldest and main agricultural education faculty of the republic of Benin integrated agricultural entrepreneurship between 1980 and 2020. It is structured in five sections. After this first introductory section, the second one presents the methodology adopted for the study; the third and fourth sections respectively present and discuss the study results; then, the final section presents the study's conclusion and some implications.

## 2. RESEARCH METHODOLOGY

This section describes the study context and discusses the sampling, data collection, and analysis tools and methods.

### 2.1. Background to the Study

This subsection justifies the choice of the Faculty of Agricultural Sciences (FSA) as a case study and briefly describes how this faculty operates. Such a description is expected to help readers understand the study context and its findings.

#### 2.1.1. Justification for the Choice of FSA as a Case Study

The Faculty of Agricultural Sciences (FSA) is the Republic of Benin's oldest institution of higher education in agronomy, founded in 1975. Its infrastructure includes laboratories, experimental farms, a library, and other academic resources that enable students to acquire practical skills relevant to agricultural entrepreneurship. The history of this faculty in agricultural education makes it a benchmark institution for students and partners in the agricultural sector in Benin and West Africa. It offers a wide range of professional education programs covering crop, animal, food, nutrition, environment management, rural sociology, economy, and extension sciences and techniques. The faculty has also maintained good relationships with its partners in Benin's agricultural sector, such as farmers, agri-food processing companies, government agencies, and non-governmental organisations. This maintained proximity supports the reinforcement of students through academic and professional internships and their transition to agricultural entrepreneurship.

#### 2.1.2. Brief Description of Education and Degrees Offered to Students by the Faculty

Nowadays, the FSA offers two education programs to students: an engineering program in place since 1975 and a vocational (Bachelor-Master-Doctorate; *LMD*) program launched in 2007 to meet a higher education reform requirement. These programs cover crop production, animal production, human nutrition and food technologies, natural resources and environment management, economics, socio-anthropology, and communication for rural development. Students are exposed to theoretical courses, practical activities, and on-farm and real-life rural internships during their studies. Both lecturers and students are encouraged to conduct interdisciplinary action and development research projects aimed at finding solutions to agricultural challenges. It should be noted that the engineering program was suspended in 2007 with the advent of the vocational bachelor-master-doctorate (*LMD*) program, but it was re-established in 2014. This study focused only on engineering graduates because another paper addresses the vocational *LMD* undergraduates and graduates.

### 2.2. Study Sample

The study sample was drawn from a list of students in the engineering program who graduated between 1980 and 2020. We focused on this period for the study because we could not access the list of the 1975–1979 engineer graduates. This list obtained from the faculty's registration office included information on the names, genders, e-mail addresses, and telephone numbers of 1,111 (including 149

women) engineer graduates. Criteria considered to distinguish between agricultural entrepreneurs and non-agricultural entrepreneurs among these graduates were:

- Holding an agricultural engineering degree from the FSA,
- Being an active individual who owns a company involved in the production and marketing of agricultural products, with the primary aim of making personal profits.

From this basis, we tried to contact each graduate by telephone and/or e-mail, depending on the available contacts. During this process, which took place from November 2020 to February 2021, we made the following observations:

- 15 of the engineer graduates died, and,
- only 74.25% (825 out of 1,111) of the telephone and e-mail addresses were valid.

In total, we could reach only 510 of the target engineer graduates by telephone and e-mail (i.e., 62% of the 825 valid addresses). These 510 graduates formed the basis of our research unit. This initial telephone and email communication enabled us to identify target agricultural engineer graduates who were entrepreneurs.

### 2.3. Data Collection Methods and Tools

Data collection took place from November 2020 to March 2021. Data collected included the number of agricultural engineers and entrepreneurs who graduated from the FSA and their genders. These data were collected with a questionnaire put online through the Kobo digital data collection software and administered to the targets via face-to-face interviews, telephone calls, and e-mail exchanges, according to the convenience of the targets.

### 2.4. Methods and Tools for Data Processing and Analysis

Data collected were transcribed into MS Excel 2019 sheets and cleaned to facilitate analysis. The cleaned data were then subjected to frequency, mean, and standard deviation calculations using STATA version 15 software. Results from these calculations are presented in the form of tables and graphs, as shown in this paper. Contents of these tables and graphs are analysed in light of their links with the study topic. The general trends in the results concerning the existing literature and the study focus are discussed.

## 3. FINDINGS

This section successively addresses:

- The evolution of the number of engineers who graduated at the FSA per gender and year,
- The overall rate of occupational integration of the agricultural engineer graduates of the FSA in agricultural entrepreneurship,
- The evolution of the rate of integration of engineer graduates in agricultural entrepreneurship over time (between 1980 and 2020),
- The differentiated evolution of the rate of integration of the studied graduates in agricultural entrepreneurship between 1980 and 2020.

### 3.1. Differentiated Trends of Graduation of Engineers at the FSA between 1980 and 2020

Fig. 1 shows the evolution of the percentages of agricultural engineer graduates from the FSA per gender between 1980 and 2020.

Fig. 1 shows two curves, one for male and one for female engineers. These two curves evolve with more or less marked fluctuations throughout the study period.

The curve for women shows seven peaks in the academic years 1981–1982, 1986–1987, 1995–1996, 1997–1998, 1998–1999, 2006–2007 and 2014–2015. The highest rate (50%) of female engineers was recorded in the 1998–1999 academic year. This curve also shows ten academic years in which the rate of female engineer graduates was zero (1983–1984, 1983–1984, 1988–1989 to 1994–1995, and 2002–2003 to 2005–2006).

The curve for men highlights four peaks in the academic years 1980–1981, 1983–1984, 1985–1986, and 2007–2008. There are also three high curve plates between 1988–1989 and 1994–1995; 1995–1996 and 1996–1997, and between 2002–2003 and 2005–2006.

Comparative analysis of the two curves shows that, overall, male engineer graduates dominated the number and percentage-wise women engineers at the studied faculty of agricultural sciences (FSA) over the academic years, with an exception in the 1998–1999 academic year when both genders shared the same number of graduates.

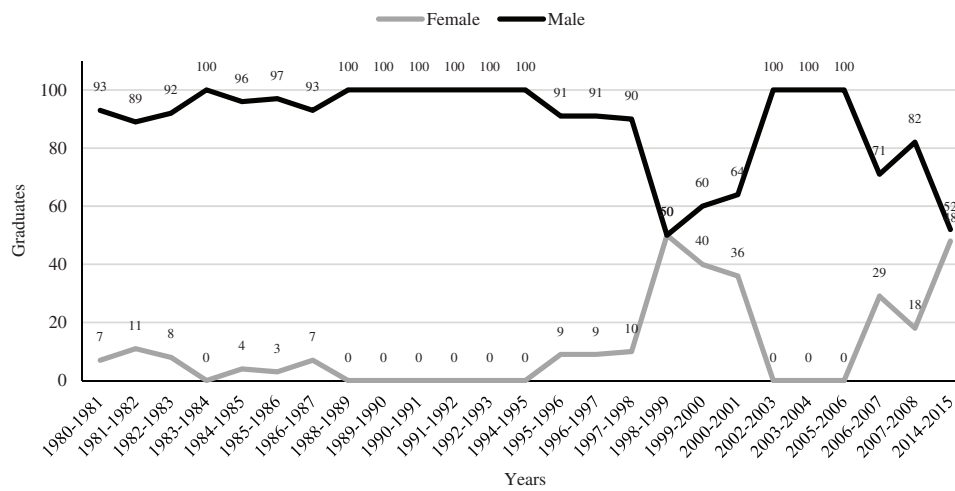


Fig. 1. Differentiated trends of graduation of agricultural engineers at the FSA between 1980 and 2020.

TABLE I: OVERALL TRENDS OF INTEGRATION OF SURVEYED ENGINEERS INTO AGRICULTURAL ENTREPRENEURSHIP

Business profile	Frequency	Percentage
Agricultural entrepreneur	40	7.84
An agricultural entrepreneur who gave up	7	1.37
Non-agricultural entrepreneur	463	90.78
All graduates	510	100

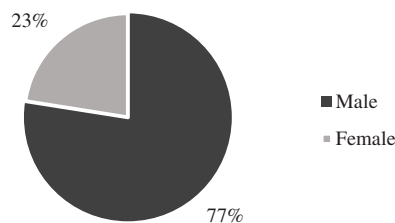


Fig. 2. Gender distribution of engineer graduates from the FSA integrated in agricultural entrepreneurship (N= 40).

3.2. Overall Integration Rate of Engineers Studied in Agricultural Entrepreneurship between 1980 and 2020

Table I below shows the numbers and the rates of integration or non-integration of the engineers studied in agricultural entrepreneurship.

Examination of Table I reveals that, of the 510 engineers surveyed, 7.84% were agricultural entrepreneurs. Considering that the surveyed engineers come from 25 graduating cohorts, one can observe that, on average, each cohort includes about 1.6 agricultural entrepreneurs.

Fig. 2 shows the overall distribution of engineer graduates integrating agricultural entrepreneurship per gender.

According to Fig. 2, male engineer graduates from the FSA engage in agricultural entrepreneurship at least three times more than their fellow females. In all, female engineers who are entrepreneurs represent about 1.78% (9/510) of the total number of agricultural engineers surveyed.

3.3. Overall Trends of Integration of the Studied Engineers into Agricultural Entrepreneurship between 1980 and 2020

Fig. 3 illustrates the evolution of the integration rate of the engineers studied in agricultural entrepreneurship between 1980 and 2020.

Analysis of this figure indicates that the integration rate for the studied graduates has been irregular, moving up and down, with seven peaks (in 1981, 1985, 1991, 1996, 1998, 2001, and 2008) and twelve zero rates recorded over twelve years (in 1984, 1987, 1989, 1990, 1992, 1993, 1995, 1997, 1999, 2000, 2003 and 2004).

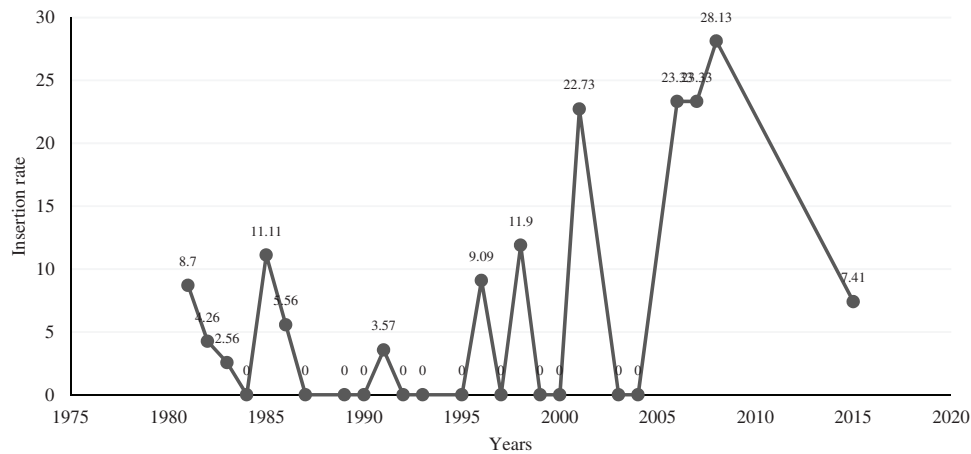


Fig. 3. Overall trend of the integration of engineer graduates from the FSA into agricultural entrepreneurship between 1980 and 2020.

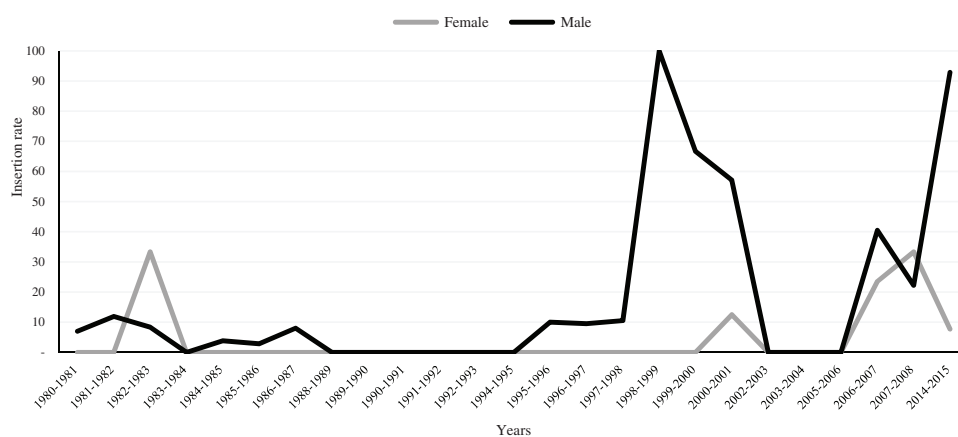


Fig. 4. Evolution of the rate of integration of engineer graduates from the FSA into agricultural entrepreneurship per gender and year.

### 3.4. Trends of Integration of the Studied Engineers into Agricultural Entrepreneurship per Gender between 1980 and 2020

Fig. 4 shows the evolution of the integration rate of the studied engineer graduates into agricultural entrepreneurship per gender and academic year.

According to Fig. 4, the rate of integration of women engineers into agricultural entrepreneurship varied between 0% and 33%. Meanwhile, for male engineers, this rate varied between 0% and 100%.

## 4. DISCUSSION

This paper takes stock of the occupational integration of engineer graduates from the Faculty of Agricultural Sciences of the University of Abomey-Calavi (FSA/UAC) into agricultural entrepreneurship, according to gender, from 1980 to 2020. This section highlights and discusses the key findings.

### 4.1. Importance of Reliable Graduates' Database

The sampling frame used was obtained from the department in charge of the recording and the management of learners' data, known as the Registration and Statistics Department of the Faculty of Agricultural Sciences (FSA). With the means at its disposal, this department has been able to create and manage the Faculty's learners' database since its inception. Without such a database, this study would have used an approximation approach to reconstruct the list of the studied engineer graduates, and such an approximation could have affected the quality of the findings and analyses, as well as that of the decisions that they would involve.

### 4.2. Relatively Low Number of Engineers Graduating at the FSA

Considering that Benin is a country with a predominantly agricultural economy, with over 60% of its population working in the agricultural sector (Directorate of Agricultural Statistics, 2019), some people



would have expected more agricultural engineers to graduate from Benin's oldest and largest agronomy faculty than they are at present. When one considers the country's total population of 12,996,895 (Countryeconomy.com, n.d.), and the number of agricultural engineer graduates from the FSA (1,111) between 1980 and 2020, one can realise that this faculty has graduated one engineer for about 11,698 inhabitants by 2020. This ratio of 1 engineer for 11,698 inhabitants is far below those of 55/10,000 (i.e., about one engineer for 200 inhabitants) and 36/10,000 (i.e., about one engineer for 250 inhabitants) observed respectively in Canada and France (Atangana, 2019), which are developed countries. One can also note that the average annual number of engineers educated and graduating from the FSA was 27.77 in 2020, considering the 40 years covered by the study. This trend in Benin confirms, to some extent, the statements from Atangana (2019, 2021), according to which Africa lacks engineers and should manage to close the gap to develop.

In general, the ratio of female engineers to male engineers has been relatively low, reaching 50% only once in 40 years (1998–1999). This is an irregular or unsteady trend that is difficult to explain without referring to the social context, which still seems to weakly promote the enrolment and the participation of girls and women in education and careers related to science, technology, engineering, and mathematics (STEM) (Ministry of Social Affairs and Microfinance, 2019).

#### 4.3. *Less than 10% of Agricultural Engineer graduates from the FSA Engage Themselves in Agricultural Entrepreneurship*

The study results revealed that 7.84% and 1.37%, respectively, of the agricultural engineer graduates from the FSA are agricultural entrepreneurs and former agricultural entrepreneurs. These findings suggest that, in general, the relatively few engineers who graduate from the FSA may have enough employment opportunities that they consider more advantageous than self-employment in agricultural entrepreneurship. As agronomy is a vast and versatile field, the graduates may have access to a variety of employment opportunities outside agricultural entrepreneurship, such as research and development, agricultural project implementation and management, consultancy, teaching, and agricultural policing (Dedehouanou, 2008). They may also be attracted by those opportunities and choose their jobs according to their interests and skills. Furthermore, graduates may be reluctant to enter agricultural entrepreneurship due to uncertainties associated with weather conditions, fluctuations in agricultural commodity prices, and the quality of the legal environment.

The relatively low proportion of agricultural graduates in agricultural entrepreneurship could indicate a need to strengthen incentives to promote entrepreneurship, particularly in a context where agriculture is essential to quality food and nutrition and the country's economy. However, it should be noted that the rate of 7.84% is higher than the one in Dedehouanou (2008) study in Benin, according to which only 1% of the FSA engineer graduates were agricultural entrepreneurs. Thus, it can be inferred that the occupational integration rate of agricultural engineers into agricultural entrepreneurship in Benin has always been low, although it has increased over the years. This increase in the integration rate could be attributed to the increasing rates of unemployment and underemployment. According to INSAE (2011), unemployment and underemployment rates were 1.6% and 63.2%, respectively, in 2010, while MPMEPE (2020) reported respective rates of 2.3% and 72% in 2020. Indeed, public administration was the main source of employment for agricultural engineer graduates from the FSA, with an integration rate of 49.39% in 2005 (Dedehouanou, 2008).

#### 4.4. *Low Representation of Women Engineers in Agricultural Entrepreneurship*

Analysis of the occupational integration rate by gender revealed a greater propensity for male agricultural engineers (77.5%) to enter the agricultural sector as entrepreneurs than for women (22.5%). This corroborates the findings of Bel (2009), according to which only 24% of agricultural entrepreneurs are women, while Rachdi (2016) reported an even lower figure, with only 10% of women entrepreneurs. This low integration rate can be explained by several factors, such as a lack of female managerial models (Bel, 2009; Jouad & Moufdi, 2021), difficulties in reconciling work and family life (Bel, 2009; Chasserio et al., 2016), and difficult access to financial resources. The work from Bel (2009) revealed a reluctance of the banking sector towards women business leaders. Similarly, studies by UNIDO (1999) in Mali, de Beaufort (2011) in France, and Jouad and Moufdi (2021) indicate that women face greater difficulties than men in accessing financial resources. Indeed, 49.7% of women feel they face financial obstacles in carrying out their projects (de Beaufort, 2011). Another obstacle to women's entrepreneurship is technology (UNIDO, 1999). According to UNIDO (1999), traditional technologies are often archaic, while new ones are difficult to access and not often specifically adapted to women entrepreneurs. In addition, this author highlights women's difficulty in accessing information as another obstacle to their entrepreneurial projects.

## 5. CONCLUSION

This article aimed to describe the employment situation of agricultural engineer graduates from the Faculty of Agricultural Sciences (FSA) in relation to agricultural entrepreneurship in the Republic of Benin. It covered 510 graduates over the study period of 1980 to 2020. The study methodology consisted of a survey of the target group, which allowed to collect the data required for the study. Data collected were analysed using MS Excel 2019 and STATA version 15. The study results highlighted the following facts: a small number (40/510, i.e., 7.84% including 9/510 or 1.8 women) of agricultural engineer graduates enter agricultural entrepreneurship; and, of the 7.84% of engineer graduates agricultural entrepreneurs, men (77.50%) are more represented than women (22.50%). Information such as this enriches the literature on agricultural entrepreneurship and could help to promote it more effectively. In addition, it may help to guide educational policies and programs, encourage a significant improvement in the integration of agricultural engineer graduates in agricultural entrepreneurship, and promote gender equity in this field. These results also underline the importance of a better understanding of the factors influencing the occupational integration of agricultural engineer graduates into agricultural entrepreneurship. Future research could investigate the factors that explain the integration of agricultural engineer graduates into agricultural entrepreneurship.

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