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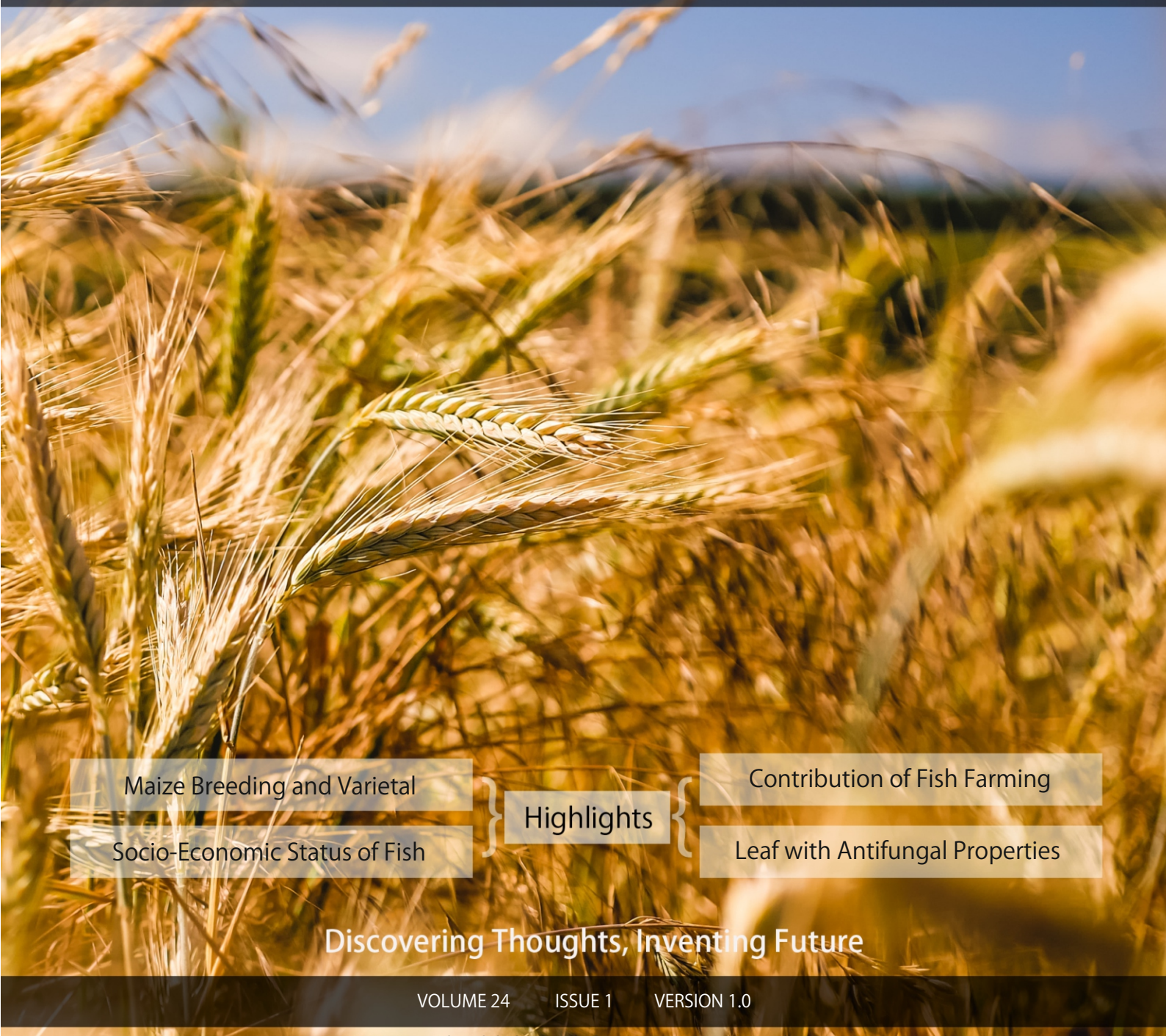

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Highlights

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Discovering Thoughts, Inventing Future

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The Contribution of Fish Farming to the Socio-Economic Status of Fish Farmers in Ebonyi State, Nigeria

By Igwe, J. A., Olaide, S. Umoh, C. D. & Okeke, PA

Zhejiang Ocean University

Abstract- This study investigated the contribution of fish farming to the socio-economic status of fish farmers in Ebonyi State, Nigeria. Multi-stage sampling techniques was used and 96 farmers were chosen at random. Structured questionnaires were used to collect data, which was then analyzed using descriptive statistics and multiple regression models. The results of socio-economic characteristics revealed that the majority of fish farmers (82.3%) were male, married (62.5%), well-educated, and between the ages of 31 and 40 (43.8%). Benefits derived and constraints faced by farmers had a significant influence on their socio-economic status at $p \leq 0.025$ and $p \leq 0.007$ respectively.

Keywords: benefits-derived, contribution, ebonyi State, fish farming, Nigeria, Socio-economic status.

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The Contribution of Fish Farming to the Socio-Economic Status of Fish Farmers in Ebonyi State, Nigeria

Igwe, J. A. [α], Olaide, S. [σ] Umoh, C. D. [ρ] & Okeke, PA [ω]

Abstract- This study investigated the contribution of fish farming to the socio-economic status of fish farmers in Ebonyi State, Nigeria. Multi-stage sampling techniques was used and 96 farmers were chosen at random. Structured questionnaires were used to collect data, which was then analyzed using descriptive statistics and multiple regression models. The results of socio-economic characteristics revealed that the majority of fish farmers (82.3%) were male, married (62.5%), well-educated, and between the ages of 31 and 40 (43.8%). Benefits derived and constraints faced by farmers had a significant influence on their socio-economic status at $p \leq 0.025$ and $p \leq 0.007$ respectively. The most significant constraints were the high cost of conventional fish feeds, limited access to credit, and the unavailability of fingerlings. The study suggests that farmers be trained in feed formulation, breeding, and other farm management activities to boast production in the study area.

Keywords: benefits-derived, contribution, ebonyi State, fish farming, Nigeria, Socio-economic status.

I. Introduction

Fish is an essential source of animal protein and food security. As an animal protein, it is one of the cheapest, most available and affordable source of quality protein (Omitoyin & Osakuade, 2021). On average, fish and its products account for over 40 percent of total animal protein intake in Nigeria (Egun & Oboh, 2022). It also supplies vitamins, minerals and oils with low level of cholesterol (Odoh *et al.,* 2019). Aside the indispensable role of fish in nutrition and food security, it is a great source of employment and income for farmers' families and different categories of people in its value chain (Subasinghe *et al.,* 2021). Nigerians consume 40% of their animal protein from fish, which is one of the least expensive sources of animal protein (Omitoyin & Osakuade, 2021).

Author α: College of Fishery, Department of Aquaculture Zhejiang Ocean University, Zhoushan 316000, China.
e-mail: jamesigwe94@gmail.com
Author σ: School of Marine Sciences, Ningbo University, Ningbo, 315832, PRC. e-mail: Olaidesaheed65@gmail.com
Author ρ: Institute of Deep-Sea Science and Engineering, University of Chinese Academy of Sciences (UCAS), Sanya, 57200, China.
e-mail: cathyumoh@gmail.com
Author ω: Department of Fisheries and Aquaculture, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.
e-mail: pa.okeke@unizik.edu.ng

In Nigeria, fish farming has a major impact on the prospects for employment. It does not only address the demand for fish consumption but also serves as a source of livelihood for individuals seeking employment opportunities in Nigeria. Studies have highlighted the investment and employment potentials in fish farming, emphasizing its role in creating job opportunities and contributing to economic development in Nigeria (Olabanji & Ali, 2009). It provides a range of professional options, such as jobs in fish farms and hatcheries, aquaculture, and roles like fish hatchery technicians. The industry helps to create jobs for Nigerian workers by offering jobs in sectors including feed production, vegetation management, and equipment manufacturing (Ogunji & Wuertz, 2023). The incorporation of job opportunities and a source of revenue for individuals raises the socio-economic status of farmers and their families in the society (Subasinghe *et al.,* 2021).

Studies on the relationship between fish production and Nigeria's GDP have been carried out; the results highlighted the significance of fish production as a driver of the nation's economic output (Uzonwanne *et al.,* 2023). Fish farming is a major contributor to Nigeria's GDP; in 2020, the sector's share of the country's GDP was 1.09%; in 2021, it was 3.24% in the first quarter (Babangonna, 2021; NBS, 2022).

Fish farming plays a vital role in reducing poverty and contributes significantly to the GDP of Ebonyi State. Economic analysis highlights the positive impacts of fish farming on the local economy which shows a significant reduction of poverty in Ebonyi State (Ozoemena *et al.,* 2022). Additionally, it has been determined that the fisheries sub-sector, which includes fish farming, contributes to the agriculture GDP of Ebonyi State, indicating its significance economically on a regional scale (Ogunji & Wuertz, 2023). It's important to note that fish farming's contribution to Ebonyi State's GDP illustrates its significance for both regional poverty alleviation and economic progress.

The main drawbacks to fish farming enterprise in Nigeria are low productivity, high feed costs, poor infrastructure, bad quality hatchlings, and no access to credit facilities (Akpabio & Inyang, 2007; Ogunremi, *et al.,* 2022; Ogunji & Wuertz, 2023). The limitations in the fish farming industry are also caused by a high mortality rate, a lack of technical skills in fish management and

feeding, a lack of novel technologies adopted, and inadequate extension services (Ogunremi & Olatunji, 2019; Onyeneke, *et al.,* 2020).

It is imperative that these limitations are recognised and addressed if Nigeria's aquaculture sector is to grow sustainably. Hence, the important to emphasise the goals of this research, which include to determine the contribution of fish farming to the socio-economic status of fish farmers in Ebonyi state, ascertain the benefits fish farmers derive from their involvement in fish farming, and identify the respondents' constraints to fish farming.

II. Materials and Method

The study was conducted in Ebonyi State, Nigeria. Ebonyi State is in Eastern part of Nigeria which lies between longitudes 7° 30' and 8° 30'E and latitudes 5 ° 40' and 6 °54'N with a total landmass of 5,935 square kilometers. The State shares a border with Benue State to the North, Enugu State to the west, Imo and Abia States to the south and Cross River State to the east. Ebonyi is primarily an agricultural region. The state produces large quantity of rice, yam, potatoes, maize, beans, vegetables, and cassava. People of the state also engage in production of fish, poultry and livestock such as goat, sheep, cows among others.

Ebonyi has thirteen local government areas as well as local development centres created by the state government. Ebonyi State has a humid tropical climate, with one rainy season and one dry season lasting for 8 and 4 months, respectively. The temperature typically ranges from 20 to 38 degrees Celsius during the dry season and from 16 to 28 degrees Celsius during the rainy season. Harmattan winds are common between December and January. The average annual temperature is 28 degrees Celsius, and the average annual humidity is 50-60%. The region receives an average annual precipitation of 2500mm.

Figure 1: Map of Ebonyi State, Nigeria Population and Sampling Procedure

The population for the study comprised of all fish farmers in Ebonyi State, Nigeria. Multistage sampling technique was used to select the sample for the study. In the first stage, all the 3 senatorial zones (Ebonyi North, Ebonyi Central and Ebonyi South) in the State were selected. In the second stage, random sampling was used to select 2 LGAs each from the senatorial zones, making a total of 6 LGAs from the 13 LGAs in the State. These LGAs include; Afikpo North and Afikpo South, Ebonyi, Ohaukwu, Ikwo and Ezza North. In the third stage, two communities each were randomly selected from the 6 LGAs, giving a total of 12 communities. In the fourth stage, a random sampling was used to select 1 village each from the town communities and finally, 8 fish farmers were also randomly selected to give a total of 96 fish farmers for the study.

a) *Data Collection, Analysis and Measurement of Variables*

Data for the study were obtained through the use a systematic random sampling technique using a well-constructed questionnaire. Descriptive and inferential statistics were used to analyze the data. The independent variables for this study include socio-economic characteristics, enterprise characteristics, fish farmer's involvement in fish farming, benefits of fish farming, constraints to fish farming while the dependent variable is socio-economic status.

Socio-economic characteristics were ascertained by asking the respondents to indicate their age, sex, marital status, level of education attained, household, religion, major occupation and income. Enterprise characteristics of the respondents were elicited by asking them to indicate their source of labour, source of finance, years of farming experience, training on fish farming, types of ponds used, pond stocking capacity, numbers of pond own, fish varieties, method of land acquisition. Fish farmers' involvement in fish farming activities was measured by asking the respondents to indicate their degree of involvement in fish farming activities such as always involved,

occasionally involved and not involved with the assigned numbers of 1, 2, 0 respectively.

The benefits fish farmers derived from fish farming were measured by asking them to indicate the level of benefits from information provided whether it is high, slight and not a benefit with the assigned numbers of 1, 2, 0. With regards to constraints to fish farming, the respondents were asked to indicate their constraints and its degree whether it is major, minor and not a constraint on the basis of information provided. Socio-economic status (dependent variable) was measured by using the scale constructed by Ayeloja *et al.* (2021). This was measured based on the possession of items and quantity for continuous items as a result of fish farmer involvement in fish farming, however, there is an indication of "YES" for possession of items and "NO" for non-possession of items that are categorical among the respondents.

III. Result and Discussion

a) Respondents' Socio-Economic Characteristics

The result of the respondents' socio-economic characteristics presented in table 1 is as follows;

Age is a key factor in productivity and profitability performance of the farmer (Ngeywo *et al.,* 2015). Age distribution of the respondents shows that 43.8% of the respondents were between the ages of 31 and 40 years and 25% of them were between the ages of 41 and 50 years. The implication of this finding believes that most of the respondents (43.8%) were in their economically active age and could make decision and enhance productivity with the hope to become better or venture into fish farming to improve their socio-economic status. This result is consistent with the finding of Adewuyi *et al.* (2010) and Ayeloja *et al.* (2021) from their studies on the analysis of profitability and contribution of fish farming to economic status of fish farmers in Ogun and Oyo states respectively.

Also, the majority of the respondents (82.3%) were male while 17.7% of the respondents were female. This means that males were more involved in fish farming than females which is in agreement with the findings of Ayeloja *et al.* (2021), Adeosun *et al.* (2019) and Adewuyi et al (2010). This could be due to the nature of fish farming which involved regular supervision and monitoring. This was also supported by Olaoye *et al.* (2014); Jambo and Bada, (2021) and Deji and Koledoye (2013) which reported that 80 percent of fish farmers in Ondo State, Nigeria were males.

According Abdulaziz *et al.* (2018), marital responsibility could make farmers make more rational decisions with high accuracy on their own, which could in turn increase their efficiency. Majority (62.5%) of the respondents were married, 24% of them were single, 8.3% are widowed and 5.2% of them divorced. This implies that majority of the respondents were married. On the respondents' religious affiliation, the result also showed that 86.5% of the respondents were Christians, 4.1% of the respondents were Muslims while 9.4 % of them practiced traditional religion. This supports the fact that the Christian religion is a popular religion among the respondents in the study area. This is in line with the finding of Adeosun *et al.* (2019).

Findings also revealed that 52.1% of the respondents had between 4 and 6 persons in their families and 30.2% of them had between 7 and 9 persons in their families. From these findings, it could be deduced that most of the respondents had significant household size which is likely to have influenced fish farming activities. The implication was that there could be more support from spouses and children of the farmers with a view to improving and increasing fish production. This also implied that the fish farmers were responsible and had more roles to play in their families and as such they would be eager to improve their agricultural productivity in order to earn more income. This is in agreement with Olawumi *et al.* (2010) who observed that married household with a reasonable size could provide cheap labor to the family. Also, Nnadi *et al.* (2014) who found that about 35.56% of fish farmers in Delta state have an average household size of greater than six.

In this study, it was also observed that 60.4% of the respondents have tertiary education, 26% of them have secondary education. This implies that most of the respondents attained level of education that qualified them as literate farmers and as such will improve their knowledge and performance in fish farming activities. This finding contradicts the finding of Ayeloja *et al.* (2021).

On the major occupation of the respondents, 41.7% practice fish farming as their main occupation while 19.8% of them are into teaching and civil service respectively. This implies that fish farming in the area is viewed as a profitable venture which makes people to take interest in it despite having other jobs. it is observed that 24% of the farmers earned between 400,000- 500, 000 naira, 23% of the respondents earn 100,000-200,000 while 20.8% earned between 200,000-300,000 naira.

Table 1: Distribution of the Respondents According to Their Socio-Economic Characteristics

Variables	Frequency	Percentage	Mean
Age			
21-30	16	16.7	
31-40	42	43.8	
41-50	24	25	
51-60	9	9.4	
61-70	5	5.2	
Total	**96**	**100**	**31-40**
Sex			
Male	79	82.3	
Female	21	17.7	
Total	**96**	**100**	**Male**
Religion			
Islam	4	4.1	
Christianity	83	86.5	
Traditional	9	9.4	
Total	**96**	**100**	**Christianity**
Marital Status			
Married	60	62.5	
Divorced	5	5.2	
Single	23	24	
Widowed	8	8.3	
Total	**96**	**100**	**Married**
Household Size			
1-3	10	10.4	
4-6	50	52.1	
7-9	29	30.2	
10-11	7	7.3	
Total	**96**	**100**	**4-6**
Level of Education			
No formal education	7	7.3	
Tertiary education	58	60.4	
Primary Edu.	6	6.3	
Secondary Edu.	25	26	
Total	**96**	**100**	**Tertiary education**
Major Occupation			
Teaching	19	19.8	
Trading	18	18.8	
Civil service	19	19.8	
Fish farming	40	41.7	
Total	**96**	**100**	**Fish farming**
Income (N)/Cropping Season			
1,000-100,000	13	13.5	
100,001-200,000	22	23	
200,001-300,000	20	20.8	
300,001-400,000	18	18.7	
400,001-500,000	23	24	
Total	**96**	**100**	**400,001-500,000**

Source: Field survey, 2023

b) Enterprise Characteristics of the Respondents

On the source of labour by the respondents, 44.8% of them used paid labour, 41.7% use family members while 13% of the respondents make use of self labour. This is contradicting to the findings of Onyekuru *et al.* (2019) and Nnadi *et al.* (2014) who observed that farmers depended on their family members for labour in Enugu and Delta states respectively.

Majority (61.5%) of the respondents started the business using personal saving while 5.2% got started with bank loan. This is similar to the finding of Ayeloja *et al.* (2021).On the respondents' years of experience, 43.7% of the respondents had between 1 and 5 years of experience with 56.2% of the respondents having formal

training on fish farming. This implies that majority of those in fish farming have not been in the business for a very long time. Oluwasola and Ige (2015) however, posited that fish farming experience was a significant determinant of net income in catfish production.

On the number of ponds 40.6% of the respondents have 3-4 ponds. On the stocking density, majority (30.2%) of the farmers stock 300-400 fishes. This implied that fish pond production enterprise in the area was mainly of small-scale type, and this supported the findings of Nunoo *et al.* (2012). Majority (49%) of the respondents used both concrete, 32.3% of the respondents used tarpaulin pond, 12.6% of the respondents used earthen pond only as holding/rearing structure. This result contradicts the finding of Ajayi (2013) and Ayeloja *et al.* (2021).

Table 2: Enterprise Characteristics of the Respondents

Variables	Frequency	Percentage	Mean
Source of Labour			
Family members	40	41.7	
Paid labour	43	44.8	
Self labour	13	13.5	
Total	**96**	**100**	**Paid labour**
Source of Finance			
Personal savings	59	61.5	
Family members	25	26	
Friends	2	2.1	
Farmers association	5	5.2	
Micro finance bank	5	5.2	
Total	**96**	**100**	**Personal savings**
Years of Experience			
1-5 years	42	43.7	
6-10 years	33	34.4	
11-15 years	13	13.5	
16-20 years	8	8.3	
Total	**96**	**100**	**1-5 years**
Types of Ponds Used			
Earthen	12	12.5	
Concrete	47	49	
Plastic tank	6	6.3	
Tarpaulin	31	32.3	
Total	**96**	**100**	**Concrete**
Pond stocking density			
200-300	18	18.8	
301-400	14	14.6	
401-500	29	30.2	
501-600	11	11.5	
Above 600	24	25	
Total	**96**	**100**	**401-500**
Number of Pond			
1-2	19	19.8	
3-4	39	40.6	
5-6	38	39.6	
Total	**96**	**100**	**3-4**

Sources: Field survey, 2023

Source and quantity of water available are one of the most important factors to be considered when selecting a site for aquaculture practice. The quantity of water needed for commercial aquaculture varies with the production method employed, type of aquaculture chosen, scale of operation, and species cultured Olaoye *et al.* (2013). Most (58.3%) of the respondents depend directly on either borehole as their major source of water, 28.1 percent depend on deep well as source of water, while 13.5 percent depend on river/stream. In terms of holding/rearing structure, Fish farmers in the study area preferred monoculture to polyculture system (75%). This may be as a result of poor market price for tilapia and also because of the abundance of catfish in the region. Majority of fish farmers adopt monoculture of African Catfish (*Clarias gariepinus*). This might be

because it has been observed that fishes grow better when cultured individually under monoculture system and also help the species to grow to its biggest size. Based on the types of species cultured, majority (86.5%) of the fish farmers in the study area culture mainly *Clarias spp*. under the influence of high market price, greater demand preferences, hardiness of the stock, fast growth, high feed conversion ratio high survival rate under captivity. This may be due to the fact that cat fish appears to be hardy and generally accepted by people. This finding is similar to Ayeloja *et al.* (2021) and Adeosun *et al.* (2019) respectively. On land acquisition 46.9% of the respondents inherited the land, 34.4 percent purchased the land they used for fish farming enterprise.

Majority (68.8%) of the respondents get their fish seed from fish hatcheries while (27.1%) of them source their fish seeds from own farms. This is an indication that they are not well trained to operate a personal fish hatchery, while minority (4.2 %) depend on governments' farms for fish seeds. The fact is that the fingerlings sourced from fish farms are more likely to be healthier and well breed. This finding disagrees with that of Olaoye *et al.* (2013) assessment of farming activities in Oyo state. On source of fish feed, majority (77.1%) depend on commercial feed, 20.7% use locally made fish feeds while a small fraction 2.1% produce their feed.

Based on culturing period (production of table size), (38.5%) of the respondent's culture their fish for four months, 37.5% cultured for six months, 16.7% cultured for three months, while a very low percentage (7.3%) of them cultured their fish for more than six months. Furthermore, majority (55.2%) of the respondent harvest twice a year, while 40.6% and 4.2% do harvest once and thrice respectively. The choice of culture period is usually influenced by factors such as timing towards festive period or due to the lack of feeds as explained by Okoye and Omorinkoba (1994).

Cooperative society is a social participation that helps farmers to pool their resources in order to have access to fisheries inputs and to have insights in their fishing issues. Membership of cooperatives is also a factor that influences the adoption of improved fisheries technologies and poverty alleviation. This shows that majority (54.2%) of the respondents in the study areas were members of cooperative societies while others do not belong to any registered or unregistered society which may be as a result of lack of awareness and interest. Hence, being a member of association /group could create peer pressure for farmers to adopt new technologies. This result is in line with the finding of Olaoye *et al.* (2013).

On the processing of fish, majority (72.9%) of the farmers process their fish supporting the fact that the farmers are well trained and also the believe in the study area that processed fish product cost more than fresh fish hence increasing the income of farmers. Majority (51%) of the farmers use electricity as source of power while 44.8% use generator. Furthermore, on the price/cost of fish in the region majority of the respondent's sale their fish between 1000-1,500/kg while 15.6% sale between 500-800/kg of fish. This might be attributed to the high cost of fish feed, fish seeds and perceived high cost of processed fish in the study area. Majority of the respondents did not receive specialized training on fish farming which can be reflected on their inability to breed/hatch and produce their own feed which have a significant impact on the price of fish in the area.

Table 2: Enterprise Characteristics of the Respondents (contd)

Variables	Frequency	Percentage	Mean
Source of water			
Stream/river	13	13.5	
Well	27	28.1	
Borehole	56	58.3	
Total	**96**	**100**	**Borehole**
Types of culture			
Monoculture	72	75	
Polyculture	17	17.7	
Integrated	7	7.3	
Total	**96**	**100**	**Monoculture**
Fish varieties			
Catfish	83	86.5	
Tilapia	6	6.3	
Common carp	7	7.2	
Total	**96**	**100**	**Catfish**
Method of land acquisition			
Inheritance	45	46.9	
Purchase	33	34.4	

Rent or lease	16	16.6	
Gift	2	2.1	
Total	**96**	**100**	**Inheritance**
Source of fingerlings			
Own farm	26	27.1	
Fish hatchery	66	68.8	
Government hatchery	4	4.2	
Total	**96**	**100**	**Fish hatchery**
Source of fish feed			
Commercial feed	74	77.1	
Local feed	20	20.7	
Own feed	2	2.1	
Total	**96**	**100**	**Commercial feed**
Culture period			
Three months	16	16.7	
Four months	37	38.5	
Six months	36	37.5	
Above 6 months	7	7.3	
Total	**96**	**100**	**Four months**
Harvesting/cropping time (per year)			
Once	4	4.2	
Two times	39	55.2	
Three times	53	40.6	
Total	**96**	**100**	**Three times**
Cooperative society			
Yes	52	54.2	
No	44	45.8	
Total	**96**	**100**	**Yes**
Processing of fish			
Yes	70	72.9	
No	26	27.1	
Total	**96**	**100**	**Yes**
Source of power			
Electricity	49	51	
Generator	43	44.8	
Solar power	4	4.1	
Total	**96**	**100**	**Electricity**
Cost of Fish (Kg)			
N 500-800	15	15.6	
N 800-100	14	14.6	
N 1000-1500	67	69.8	
Total	**96**	**100**	**1000-1500**
Training on fish farming			
Yes	54	43.8	
No	42	56.2	
Total	**96**	**100**	**No**

Source: Field Survey, 2023

c) *Contribution of Fish Farming to the Socio-Economic Status of the Respondents*

The socio-economic status of farmers in this study was measured according to the scale developed by Ovwigho (2000) and adopted by Ayeloja *et al.* (2021). The socio-economic status of the fish farmers was measured in terms of the number of items possessed for continuous items and categorical items by assigning YES and NO to them respectively. The value of 0 and 1 was assigned for possession of items and non-possession of items that are continuous and categorical. The result of the analysis based on the possession and non-possession of items among the respondents in the study area showed that the socio-economic status is high among the respondents with 67.7% and low level of socio-economic status with 32.3% among the respondents with the mean value of 34.17.

Table 3: Contribution of Fish Farming to the Socio Economic Status of the Fish Farmers

	Frequency	Percentage	Mean	Standard deviation	Min	Max
High	65	67.7	34.17	9.46	0.00	42.64
Low	31	32.3				

Source: Field Survey, 2023

d) Fish farmers Involvement in Farming Activities

Table 4 shows the involvement of fish farmers in fish farming activities; majority (70.8%) of the respondents always take part in spawning/breeding of fish while 26% of them are occasionally involved. Majority of the farmers were always involved in the sorting (62.5%), procurement of fish feeds (75%), treatment of water (60.4%), feeding of fish (63.5%) and changing of water. On the other hand, respondents were occasionally involved in harvesting of fish (53.1%), removal of water (58.3%), checking of water temperature (54.2%). This is attributed to the fact that the respondents participated in most of the farming activities and only used paid labour for some of the farm activities. This is in comparison with the finding of Olaoye *et al.* (2021).

Table 4: Fish Farmers' Involvement in Fish Farming Activities

Variable	Never	Occasionally	Always	Mean
Spawning	3 (3.1)	25(26)	68(70.8)	1.229
Sorting	3(3.1)	33(34.4)	60(62.5)	1.31
Procurement of Feed	6(6.3)	18(18.8)	72(75)	1.58
Stocking	-	48(50)	48(50)	1.50
Treatment of water	5(5.2)	33(34.4)	58(60.4)	1.29
Checking of Temperature	9(9.4)	52(54.2)	35(36.5)	1.44
Feeding of fish	2(2.1)	33(34.4)	61(63.5)	1.32
Diseases Control	6(6.3)	52(54.2)	38(39.6)	1.47
Removal of waste matter	-	56(58.3)	40(41.7)	1.58
Harvesting of Fish	-	51(53.1)	45(46.9)	1.53
Changing of Water	-	20(20.8)	76(79.2)	1.20

Source: Field Survey, 2023

e) Benefits Fish Farmers Derived from Fish Farming

Table 5 showed that the majority of the respondents with the mean value of 1.04, 1.11,1.36,1.18,1.39,1.31, 1.11, 1.14 and 1.15, benefitted highly from fish farming in terms of Improve protein in-take, provision of income, knowledge of fish farming, source of employment, increased food security, improvement in materials possession, alternative income source, improvement in social life and improvement in health status while the mean value of 1.17 shows that they slightly used fish farming as a collateral for loan. The observation from this supports the fact that fish farming brings an improvement in the socio-economic status of the respondents in the study area. This finding is in line with Ayeloja *et al.* (2021) and Engle (2008) who reported an improvement in the socio-economic status of farmers in line with the benefits they derive from fish farming.

Table 5: Benefit farmers derived from fish farming

Variables	High	Slight	Not a benefit	Mean
Improve protein in-take	90(93.8)	5(5.2)	1(1.0)	1.04
Provide income	85(88.5)	11(11.5)	-	1.11
Improve Knowledge of fish farming	61(63.5)	35(36.5)	-	1.36
Serves as source of employment	72(75)	21(21.9)	3(3.1)	1.18
Food Security increase	50(52.1)	42(43.8)	4(4.2)	1.39
Use as Collateral for credit	29(30.2)	42(43.8)	25(26)	1.17
Improve materials				

possession	56(58.3)	35(36.5)	5(5.2)	1.31
Improve health status	71(74)	14(14.6)	10(10.4)	1.15
Improves social Life	37(38.5)	36(37.5)	23(24)	1.14
Alternative income source	73(76)	17(17.7)	6(6.3)	1.11

Source: Field Survey, 2023

f) Constraints to Fish Farming

Factors affecting aquaculture production in the region were presented in table 6 in the form of major, minor and not a constraint. Losses at farm also arises from predators such as snakes, monitor lizards, birds and improper harvesting, post-harvest and processing techniques, inefficient marketing due to lack of farmers' investment in marketing activities, which might reduce the revenue generated by farmers along the fish value chain (Agbebi and Fagbenro, 2006).

Nkwocha and Nkwocha (2013) noted that feed type, availability, and high price is a major obstacle to intensive aquaculture profitability in Nigeria. Majority (47.9%) of the respondents perceived that lack of access to credit as a major constraint. Also land acquisition (71.9%), high price of conventional feed (75%) and poor extension services (47.9%) were also a major problem faced by the respondents. In the same vein theft (59.4%), unavailability of fingerlings (52.1%), inadequate water supply (60.4%), disease outbreak (82.3) and mortality of fish (74.0%) were minor problems encountered by farmers. The problems faced by farmers in this study is in accordance with the problems identified by Ajayi (2013), Ume *et al.* (2016) and Ayeloja *et al.* (2021) but disagrees with that of Olaoye *et al.* (2013).

Table 6: Constraints to Fish Farming

Variables	Major	minor	Not a constraint	Mean
Lack of access to credit facility	46(47.9)	35(36.5)	15(15.6)	1.20
Poor extension services	42(47.9)	40(41.7)	10(10.4)	1.32
Theft	16(16.7)	57(59.4)	23(24.0)	1.35
Pollution of water sources	\24(25.0)	57(59.4)	15(15.6)	1.43
Land acquisition	69(71.9)	19(19.8)	8(8.3)	1.11
High price of conventional feed	72(75.0)	20(20.8)	4(4.2)	1.26
Unavailability of fingerlings	35(36.5)	50(52.1)	11(11.5)	1.40
Inadequate water supply	33(34.3)	58(60.4)	5(5.2)	1.55
Disease attack	9(9.4)	79(82.3)	8(8.3)	1.73
Mortality of fish	18(18.8)	71(74.0)	7(7.3)	1.66

g) Result of Correlation Analysis of the Benefits Respondents Derived from Fish Farming and their Socio-Economic Status

The result of the analysis in Table 7 shows that there is a significant relationship between the benefits respondents derived from fish farming and their socio-economic status (r=0.073; p=0.025). It implies that the benefits the respondents gained in ventures into the fish farming business led to an improvement in their socio-economic status. This finding corroborates the finding of Ayeloja *et al.* (2021) who opined that the increase in the socio-economic status of the farmers in Oyo state is as a result of the benefit they gained from fish farming.

Table 7: Result of correlation analysis of the relationship between the benefits respondents derived from fish farming and their socio-economic status

Variables	R-value	p-value	Decision
Benefit derived	0.073	0.025	Significant

Source: Field Survey, 2023

h) Result of Correlation Analysis of the Respondents' Constraints to Fish Farming and their Socio-Economic Status

The result of the analysis in Table 8 shows that there is a significant relationship between the respondents' constraints to fish farming and their socio-economic status (r=0.239; p=0.007). this implies that the constraints to fish farming have a negative effect on the level of socio-economic status of the respondents because these problems affect production and profit making of the farmers. This is similar to the finding of Ume *et al.* (2016) in Anambra state.

Table 8: Result of Correlation Analysis of the Respondents' Constraints to Fish Farming and Their Socio-Economic status

Variables	R-value	p-value	Decision
Benefit derived	0.239	0.007	Significant

Source: Field Survey, 2023

IV. Conclusion and Recommendation

Based on the finding from this study, it can be concluded that fish farming in Ebonyi state is in its developmental stage and is largely on a small scale. The farmers are in their productive age, however, majority of them were male and most of the respondents had 4-6 persons in their family. Farmers attained high level of education giving them edge to understand the strategies involved in the business. The major variety of the fish reared by the farmers was catfish which provides an alternative source of income to them. The contribution of fish farming to the socio-economic status of fish farmers was high, however, the major problem faced by the farmers was lack of access to credit facilities and high price of conventional feeds. There was a significant relationship between the benefit farmers derive from fish farming and socio-economic status.

Based on the findings obtained from this study, we recommend;

- The government should establish fish feed production plant and organize seminar/workshop programme for fish farmers to trained them on the formulation of fish feeds so as to reduce cost of procurement and increase their profit.
- Extension officers should be trained more on the economic dimension of fish farming and not only the technical aspects which will be delivered to fish farmers to enable them understand the economic aspect of their farm thereby leading to efficient use of resources/farm inputs.
- The government should establish hatchery to provide fingerlings to the farmers.
- The government should also make available credit facilities to farmers.

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Normalized Cumulative Ranks for Maize Breeding and Varietal Recommender System

By Santosh Vishwakarma & Shri Niwas Singh

Aquaculture Zhejiang Ocean University

Abstract- Nine varieties of maize (Zea mays L.) namely H4226, RAJAJI, TMMH826, TATA 849, KAVERI 25K-60, RMH 1818, KANAK, BISCO-940 and RASI 4640 were evaluated on thirteen parameters in a randomized block design with three replications. The objectives of the experiment were to select suitable plant types based on considering all the thirteen parameters, suggesting scope for further improvement and recommending suitable maize ideotypes for cultivation by farmers of this region. Normalized cumulative ranks analysis found BISCO-940, KAVERI 25K-60, H4226, TATA 849 and TMMH826 to be top five varieties that could be recommended to farmers for cultivation on the criteria of less number of leaves per plant, small and narrow leaves with high venation, early tasseling and silking, dwarf plant types with lower cob placement, long cobs with less number of bracts for ease of peeling off the cobs and thick cobs with more kernels and kernel rows.

Keywords: composites, hybrid maize, normalized cumulative ranks, synthetics and varietal recommender system.

GJSFR-D Classification: LCC: SB193

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Normalized Cumulative Ranks for Maize Breeding and Varietal Recommender System

Santosh Vishwakarma [α] & Shri Niwas Singh [σ]

Abstract- Nine varieties of maize (*Zea mays* L.) namely H4226, RAJAJI, TMMH826, TATA 849, KAVERI 25K-60, RMH 1818, KANAK, BISCO-940 and RASI 4640 were evaluated on thirteen parameters in a randomized block design with three replications. The objectives of the experiment were to select suitable plant types based on considering all the thirteen parameters, suggesting scope for further improvement and recommending suitable maize ideotypes for cultivation by farmers of this region. Normalized cumulative ranks analysis found BISCO-940, KAVERI 25K-60, H4226, TATA 849 and TMMH826 to be top five varieties that could be recommended to farmers for cultivation on the criteria of less number of leaves per plant, small and narrow leaves with high venation, early tasseling and silking, dwarf plant types with lower cob placement, long cobs with less number of bracts for ease of peeling off the cobs and thick cobs with more kernels and kernel rows. There is scope for further improvement in the top performer variety BISCO-940 in characters like cob length, & early tasseling and silking. All these three characters could be improved by crossing BISCO-940 with a single variety TMMH826. If this cross proves to be a heterotic combination then a hybrid maize variety could be thought or synthetics and composites could be developed from top five best performers. Thus, normalized cumulative ranks analysis is an excellent versatile tool for plant breeding and varietal recommender system.

Keywords: composites, hybrid maize, normalized cumulative ranks, synthetics and varietal recommender system.

I. Introduction

Maize (*Zea mays* L.) is grown globally in a wide range of environments. However, local field conditions of farmers might suit some specific varieties and farmers might try to look for such suitable varieties based on their criteria of selection. Donald 1968 gave the concept of crop ideotype and since then a lot of crop-ideotypes have been suggested. Here in this experiment, we examine nine maize varieties on thirteen characters *viz.*, leaves/plant, leaf length, leaf width, days to tasseling, days to silking, leaf venation, plant height, cob length, cob placement, number of bracts, number of kernel rows, kernels per row and cob diameter. The idea is to look for maize ideotype with less number of leaves per plant, small and narrow leaves with high venation index, early tasseling and silking, dwarf plant types with lower cob placement, long cobs with less number of bracts for ease of peeling off the bracts from cob and thick cobs with more kernels and kernel rows.

II. Materials and Methods

Nine maize varieties as listed in tables were evaluated on thirteen parameters as mentioned above in the introduction. The data were recorded on five randomly selected plants in each replication. The average values are given in table 1. These values were ranked to make them unitless so that the transformed data become additive. All the ranks of a variety were summed to get cumulative rank (CR) and CR values were divided by minimum value to get normalized cumulative ranks (NCR). These are given in table 2. On sorting table 2 on CR or NCR values in increasing order, we get table 3.

Table 4.1: Average values of three replications

Sort order (rows) VARIETY (down)	Leaves / plant	Leaf length (cm)	Leaf width (cm)	DAYS TO TASSELING	DAYS TO SILKING	LEAF V. INDEX	PLANT HEIGHT	EAR LENGTH	COB PLACEMENT	NO. OF BRACTS	No. of kernel rows	kernels /row	COB DIAMETER
	1	1	1	1	1	0	1	0	1	1	0	0	0
H4226	11	34.46	5.18	48	52	3.09	153.5	37.26	41.23	13	17	33	3.83
RAJAJI	13	47.03	5.8	50	53	2.58	127.1	41.17	53.55	11	14	31	3.85
TMMH826	13	43.09	4.16	47	51	3.6	107	42.64	44.6	12	15	27	3.75
TATA 849	12	34.92	4.66	52	54	2.79	116.4	38.41	44.45	12	15	33	3.84
KAVERI 25K-60	12	28.87	3.77	55	59	4.51	121.7	39.99	44.83	10	15	31	3.77
RMH 1818	11	35.06	5.03	52	55	2.78	108.3	37.91	48.42	10	13	32	4
KANAK	12	34.45	4.4	63	66	3.41	104.6	34.04	41.61	9	14	16	3.77
BISCO-940	12	28.9	3.82	63	66	3.66	94.91	34.03	32.9	11	15	33	3.95
RASI 4640	12	33.46	5.17	61	64	2.32	114.6	35.42	45.8	10	14	33	4.18

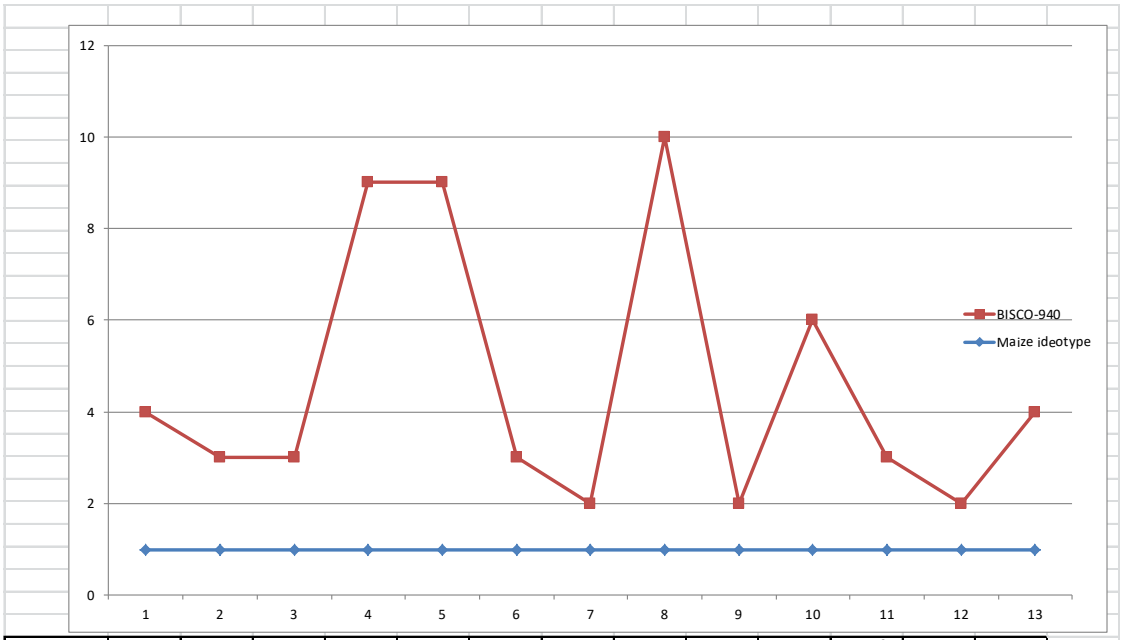
Author α σ: Department of GPB, BRDPG College, Deoria, U.P. 274001, India. e-mail: singhshriniwas769@gmail.com

Sort order (rows) VARIETY (down)	Leaves / plant	Leaf length (cm)	Leaf width (cm)	DAYS TO TASSELING	DAYS TO SILKING	LEAF V. INDEX	PLANT HEIGHT	EAR LENGTH	COB PLACEMENT	NO. OF BRACTS	No. of kernel rows	kernels /row	COB DIAMETER	CR	NCR
	1	1	1	1	1	0	1	0	1	1	0	0	0		
H4226	1	5	8	2	2	5	9	6	2	9	1	1	6	57	1.21
RAJAJI	8	9	9	3	3	8	8	2	9	5	6	6	4	80	1.7
TMMH826	8	8	3	1	1	3	3	1	5	7	2	8	9	59	1.26
TATA 849	3	6	5	4	4	6	6	4	4	7	2	1	5	57	1.21
KAVERI 25K-60	3	1	1	6	6	1	7	3	6	2	2	6	7	51	1.09
RMH 1818	1	7	6	4	5	7	4	5	8	2	9	5	2	65	1.38
KANAK	3	4	4	8	8	4	2	8	3	1	6	9	7	67	1.43
BISCO-940	3	2	2	8	8	2	1	9	1	5	2	1	3	47	1
RASI 4640	3	3	7	7	7	9	5	7	7	2	6	1	1	65	1.38

Table 4.2: Ranks, cumulative ranks and the normalized cumulative ranks

III. Results and Discussion

Table 3 shows the preference order of varieties that should be considered by farmers for selecting suitable maize ideotype for cultivation in their fields in this region. Thus top five varieties namely BISCO-940, KAVERI 25K-60, H4226, TATA 849 and TMMH826 could be recommended for trials. As per table 3, the most suitable variety BISCO-940 could be improved further by paying attention to characters like cob length (ranking 9th) and days to tasseling and days to silking (both ranking 8th) by crossing it with TMMH826 (ranking 1st in all these three characters). The equal values of CR (and hence NCR) of H4226 and TATA 849 indicate that although both these varieties are equally good, yet they may differ in their ranks of various characters like plant height and number of bracts. If, by chance, the cross between BISCO-940 and TMMH826 proves to be heterotic, then a hybrid between these may be thought of and tried. Otherwise synthetic and composite varieties could be tried involving top few varieties. Thus, this analysis opens up a lot of potentials in maize breeding and recommending suitable maize ideotypes. Inbreds could also be analyzed like this to make single cross hybrids or try other potentials. This analysis has been used in many other crops also (Singh 2017, 2018; Singh and Kant 2022, Singh et al. 2018; Singh and Tiwari 2020 and Yadav et al. 2020). The top performer maize variety of this experiment BISCO-940 is also compared graphically as shown in Figure 1 with the maize ideotype being imagined. This graph shows scope for further improvement in most of the characters of the top performer maize variety BISCO-940 except plant height, cob placement and kernel rows. This means that BISCO-940 is at par with maize ideotype in these three characters only. Rest of the characters need maize breeders' attention to improve this variety further.



Characters	Leaves/ plant	Leaf length (cm)	Leaf width (cm)	DAYS TO TASSELING	DAYS TO SILKING	LEAF V. INDEX	PLANT HEIGHT	Cob LENGTH	COB PLACEMENT	NO. OF BRACTS	No. of kernel rows	kernels /row	COB DIAMETER
Maize ideotype	1	1	1	1	1	1	1	1	1	1	1	1	1
BISCO-940	3	2	2	8	8	2	1	9	1	5	2	1	3

Figure 1: BISCO-940 compared graphically with the maize ideotype being imagined here

Sort order (rows) VARIETY (down)	Leaves / plant	Leaf length (cm)	Leaf width (cm)	DAYS TO TASSELING	DAYS TO SILKING	LEAF V. INDEX	PLANT HEIGHT	EAR LENGTH	COB PLACEMENT	NO. OF BRACTS	No. of kernel rows	kernels /row	COB DIAMETER	CR	NCR
	1	1	1	1	1	0	1	0	1	1	0	0	0		
BISCO-940	3	2	2	8	8	2	1	9	1	5	2	1	3	47	1
KAVERI 25K-60	3	1	1	6	6	1	7	3	6	2	2	6	7	51	1.09
H4226	1	5	8	2	2	5	9	6	2	9	1	1	6	57	1.21
TATA 849	3	6	5	4	4	6	6	4	4	7	2	1	5	57	1.21
TMMH826	8	8	3	1	1	3	3	1	5	7	2	8	9	59	1.26
RMH 1818	1	7	6	4	5	7	4	5	8	2	9	5	2	65	1.38
RASI 4640	3	3	7	7	7	9	5	7	7	2	6	1	1	65	1.38
KANAK	3	4	4	8	8	4	2	8	3	1	6	9	7	67	1.43
RAJAJI	8	9	9	3	3	8	8	2	9	5	6	6	4	80	1.7

Table 4.3: Same as table 2 but after sorting on CR or NCR values in increasing order

IV. Summary and Conclusions

On critical examination of tables 1, 2 and 3, it could be safely concluded that top few (say five) varieties namely BISCO-940, KAVERI 25K-60, H4226, TATA 849 and TMMH826 could be recommended to farmer of this region for trials. On the other hand, maize breeders may try hybrid, synthetic and/or composite varieties involving these varieties in various combinations. This analysis could also involve screening inbreds, mutants and all kinds of variants for maize breeding.

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Agrotech Ecosystems: Towards an Analysis of Capabilities and Innovation Outcomes in R & D Centers at the National University of the Center of the Province of Buenos Aires, Argentina

By Dra. Camio, María Isabel, Mg. Arditi, Andrea Belén, Sr. Vicente, Joaquín & Dra. Carattoli, Mariela

Abstract- The growing global demand for food, coupled with the challenges posed by conventional production methods to sustainability, as well as the emphasis on value addition at the source and differentiation, make it imperative to incorporate new technologies into agricultural enterprises. These new technologies, known as Industry 4.0 technologies, are giving rise to the AgTech phenomenon by expanding capabilities.

There are regions where technology hubs or parks are situated, featuring the presence of large companies, as well as technological small and medium-sized enterprises (SMEs), research and development (R&D) centers, and extension and transfer institutions, indicating the existence of "ecosystems" coexisting with other actors in the pursuit of agro-oriented innovations.

Keywords: *capabilities - innovation - R&D centers - U-I linkages – AgTech.*

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Agrotech Ecosystems: Towards an Analysis of Capabilities and Innovation Outcomes in R & D Centers at the National University of the Center of the Province of Buenos Aires, Argentina

Ecosistemas Agrotech: hacia un Análisis de Capacidades y Resultados de Innovación en Centros de I+D de la Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina [1]

Dra. Camio, María Isabel [α], Mg. Arditi, Andrea Belén [σ], Sr. Vicente, Joaquín [ρ] & Dra. Carattoli, Mariela [ω]

Resumen- La creciente demanda mundial de alimentos, y los retos que imponen los métodos de producción convencionales a la sustentabilidad, así como el agregado de valor en origen y la diferenciación, hacen imprescindible la incorporación de nuevas tecnologías en las empresas agropecuarias. Estas nuevas tecnologías, denominadas tecnologías de la Industria 4.0, están generando una expansión de nuevas capacidades dando lugar al fenómeno AgroTech.

Existen regiones en las cuales se sitúan polos o parques tecnológicos, con presencia de grandes empresas, también PyMEs tecnológicas, centros de I+D, instituciones de extensión y transferencia, que denotan la existencia de "ecosistemas" que coexisten con otros actores en pos de la generación de innovaciones orientadas, en este caso al agro.

Este estudio se inserta en una investigación más amplia cuyo propósito es mapear la oferta y demanda de tecnología para el Ecosistema Agrotech e identificar el grado de acople entre oferta y demanda en la región de influencia de la Universidad Nacional del Centro de la Provincia de Buenos Aires (UNICEN). Como resultado, se espera un prototipo de una plataforma online georreferenciada que integre información de los actores, y que brinde una medida de cuán acoplada/desacoplada está la oferta y la demanda tecnológica.

Particularmente este trabajo se centra en identificar los resultados y las capacidades (tecnológicas y relacionales) de los núcleos científico-tecnológicos de la UNICEN orientados al desarrollo de tecnologías para el sector AgroTech. El estudio incluye el análisis de fuentes secundarias: las Memorias Académicas del último trienio de 13 Núcleos de Actividades Científico-Tecnológicas (en adelante NACTs) de la UNICEN, y la realización de entrevistas en profundidad a los referentes institucionales y a los líderes de los NACTs con resultados significativos en AgroTech. Para el análisis de las capacidades se proponen un conjunto de dimensiones y variables condicionantes asociados a los determinantes de vinculación Universidad-Industria (en adelante U-I) (Carattoli, 2020).

Palabras clave: capacidades - innovación - centros I+D - vinculación U-I – AgroTech.

Abstract- The growing global demand for food, coupled with the challenges posed by conventional production methods to sustainability, as well as the emphasis on value addition at the source and differentiation, make it imperative to incorporate new technologies into agricultural enterprises. These new technologies, known as Industry 4.0 technologies, are giving rise to the AgTech phenomenon by expanding capabilities.

There are regions where technology hubs or parks are situated, featuring the presence of large companies, as well as technological small and medium-sized enterprises (SMEs), research and development (R&D) centers, and extension and transfer institutions, indicating the existence of "ecosystems" coexisting with other actors in the pursuit of agro-oriented innovations.

This study is part of a broader research initiative aimed at mapping the supply and demand for technology within the AgTech Ecosystem and identifying the degree of alignment between supply and demand in the influence region of the National University of the Center of the Province of Buenos Aires (UNICEN). As a result, the expectation is to develop a prototype of a georeferenced online platform that integrates information from various actors and provides a measure of how aligned or misaligned the technological supply and demand are.

Specifically, this work focuses on identifying the outcomes and capabilities (technological and relational) of the scientific and technological cores at UNICEN oriented towards the development of technologies for the AgTech sector. The study includes the analysis of secondary sources: the

Autores α σ ρ ω: Universidad Nacional del Centro de la Provincia de Buenos Aires, Facultad de Ciencias Económicas, Centro de Estudios en Administración, Tandil, Buenos Aires, Argentina.
e-mail: belen.arditi@econ.unicen.edu.ar

[1]Una versión preliminar de este trabajo fue presentada ante el XX Congreso Latino - Iberoamericano de Gestión Tecnológica y de la Innovación - ALTEC 2023, realizado de manera presencial del 20 al 22 de septiembre de 2023 en la ciudad de Paraná, provincia de Entre Ríos, Argentina. Argentina fue sede a cargo de la Asociación Latino-Iberoamericana de Gestión Tecnológica y de la Innovación (ALTEC) y la Universidad Nacional de Entre Ríos (UNER), con el apoyo institucional de la Secretaría de Ciencia y Tecnología del Gobierno de Entre Ríos, y otras instituciones auspiciantes de la Argentina.

Academic Reports of the last three years from 13 Scientific and Technological Activity Cores (hereafter NACTs) at UNICEN, and conducting in-depth interviews with institutional representatives and leaders of NACTs that have achieved significant results in AgroTech. For the analysis of capabilities, a set of dimensions and conditioning variables associated with the determinants of University-Industry linkage (hereafter U-I) are proposed, following the framework by Carattoli (2020).

Keywords: capabilities - innovation - R&D centers - U-I linkages – AgTech.

I. Introducción y Marco Conceptual

a) *Tecnologías de la Industria 4.0 y Ecosistemas AgroTech*

El término Industria 4.0 se remite originalmente al "Plan Industria 4.0" de Alemania, y hace referencia a la difusión de nuevas tecnologías en la digitalización y supervisión de procesos de producción. Ciertos autores la definen como "la Cuarta Revolución Industrial" (Schwab, 2017, p. 7), basada en la mayor ubicuidad y movilidad de Internet, que permite la difusión de sistemas de producción ciber-físicos.

Esto ha dado lugar en los últimos años a la aparición de nuevos sectores intensivos en conocimiento, en los que la tecnología es transversal, con un impacto en el funcionamiento de sectores tradicionales de la economía, como la sanidad, la educación, las finanzas y la agricultura (Arditi, Camio, Velazquez & Errandosoro, 2023). En este último caso, esto ha derivado en la aparición del sector AgroTech. Resultan valiosos los aportes de estudios específicos en nuestro país en el sector Agrotech (Lachman, López, Tinghitella, & Gómez Roca, 2021; Navarro et al, 2019).

Tilney, Leclerc & Demarest (2015, p. 2) de AgFunder, conceptualizan el término AgroTech como "las tecnologías individuales o una combinación de tecnologías relacionadas con equipo agrícola, clima, optimización de semillas, fertilizantes e insumos de cultivos, riego, sensores remotos -incluidos drones, gestión de explotaciones agrícolas y, grandes datos agrícolas- que tienen como objetivo mejorar o innovar en la industria global de la alimentación, la agricultura, la ganadería y otras actividades de base biológica".

El sector AgroTech puede ser analizado desde una perspectiva holística del Ecosistema Emprendedor. Este término hace referencia a la interconexión social del conjunto de actores y de factores cuya dinámica aumenta las probabilidades de éxito de los emprendimientos (Isenberg, 2010) y eleva el nivel de innovación y competitividad impactando positivamente en el crecimiento económico de un territorio (Navarro et al., 2019). La evidencia indica que existe cierto nivel de desconexión en el ecosistema AgroTech entre la oferta de tecnología y las necesidades de la demanda de acceso a tecnologías de alto potencial (Trigo et al., 2018; Navarro et al., 2019).

Incluso, desde el punto de vista de la demanda, es fundamental que quienes la componen puedan conocer las alternativas brindadas por los oferentes. En este contexto, las universidades desempeñan un rol importante en prácticas de innovación abierta (Carattoli, Camio, & Marone, 2019), no sólo en la provisión de conocimiento en el marco de vinculaciones universidad-industria (en adelante, U-I), sino en procesos de co-creación de innovaciones en contextos de modelos de cuádruple hélice.

b) *Capacidades y Resultados de Innovación a partir de la Vinculación Universidad-Industria*

Los procesos de adopción tecnológica no son lineales, y el tiempo transcurrido entre el desarrollo de una tecnología y su demanda puede durar años. Resulta clave el rol de instituciones, como las universidades, que vinculen las empresas con los desarrollos tecnológicos.

En el estudio de la vinculación U-I existen diferentes enfoques con distintos abordajes, que definen las aproximaciones al fenómeno desde diferentes perspectivas y plantean propuestas de operacionalización a través de un conjunto de dimensiones e indicadores. Sin ánimo de ser exhaustivos, se explicitan aportes de distintas investigaciones en línea con los objetivos del presente trabajo.

El Manual de Indicadores de Vinculación de la Universidad con el Entorno Socioeconómico - Manual de Valencia (Albornoz, Barrere, Castro, & Carullo, 2017), resulta referencia central para abordar este aspecto. A partir de una perspectiva sistémica de la innovación y la teoría del enfoque organizacional, se consideran tres vectores implicados en las actividades de transferencia de conocimientos: el contexto, los resultados y los procesos. Asimismo distingue entre "capacidades" (lo que las universidades tienen) y "actividades" (lo que las universidades hacen).

En este modelo, las dimensiones consideradas pueden sintetizarse en: Caracterización Institucional (estructura organizacional, trayectoria histórica, población universitaria y recursos financieros, dimensión y orientación de I+D); Capacidades para las actividades de vinculación (incluye indicadores de desarrollo institucional, de propiedad intelectual e infraestructura física e índices respecto a la la creación de empresas); y Actividades de vinculación (I+D contratada y en colaboración con entidades no académicas).

Los vínculos U-I desde la perspectiva de la intensidad de su interacción permite considerar un aporte (Brown, 2007; Perkmann, Neely, & Walsh, 2011) que propone indicadores de medición del desempeño divididos en categorías que se corresponden con las fases del proceso de colaboración U-I. Tales indicadores se clasifican en insumos o factores de

entrada, actividades, productos e impactos. Como factores de entrada se consideran los recursos, capacidades de los investigadores (cantidad de citas) y motivación de los investigadores. El indicador más directo de la vinculación U-I es el nivel de financiación de la industria hacia la investigación universitaria. Dentro de las actividades, se indica la intensidad de la colaboración, la que facilita conocimientos tácitos frente al intercambio formal de resultados de investigación codificados. Dentro de los productos, se consideran los indicadores de resultados (patentes, publicaciones conjuntas de científicos de la universidad y la industria) y en los indicadores de impacto se incluyen tanto los de tipo económico como los ambientales.

Otra perspectiva teórica que combina la literatura de vinculación U-I, con la literatura de redes, propone un modelo conceptual que relaciona la fuerza del vínculo, las modalidades de vinculación y los beneficios de la vinculación (Carattoli, 2020). La autora analiza y explica los alcances de diferentes Modalidades: Tradicional (unidireccional), de Servicios (distinguiendo entre servicios estandarizados y no estandarizados), Bidireccional (mayor intensidad de la relación y generalmente formalizadas) y Comercial (las universidades logran comercializar sus resultados de investigación - patentes, licencias de tecnología, spin-off, incubadoras, etc.- y obtener recursos).

En términos de obstáculos o desafíos de la vinculación U-I se encuentra cierto consenso entre diversos autores en relación a la falta de recursos y capacidades universitarias (procedimientos administrativos lentos) y que las empresas que en ocasiones desconocen o desconfían que la vinculación les aporte valor real a su negocio (Carattoli, 2020). Se resalta también que las universidades tienden a orientarse hacia la investigación a largo plazo impulsada por la curiosidad, mientras que las empresas están interesadas en los resultados a corto y mediano plazo (Perkmann, Neely & Walsh, 2011).

II. Metodología

a) Contextualización

El sitio de investigación es la Universidad Nacional del Centro de la Provincia de Buenos Aires (en adelante UNICEN). La UNICEN, creada en Argentina en el año 1974 cuenta con 10 Unidades Académicas localizadas en sus tres sedes en las ciudades de Azul, Olavarría y Tandil y una Unidad de Enseñanza en la ciudad de Quequén. Estas dependencias brindan 63 carreras de grado, 10 de pregrado y una importante oferta de diplomaturas, maestrías y doctorados. Al año 2017 se registraron más de 15.000 estudiantes de grado y 1.165 estudiantes de postgrado (UNICEN, 2017, p.10).

En cuanto a actividades de investigación, se resalta que el 43,9% de la planta estable docente de la UNICEN realiza actividades de investigación (UNICEN, 2017, p.11), las cuales se desarrollan en 43[2] Núcleos de Actividades Científico-Tecnológicas (en adelante, NACTs) y 5 Grupos de Actividades Científico-Tecnológicas de distintas disciplinas. El ranking de Universidades de Scimago 2023, posiciona a la UNICEN en el puesto 156 entre 418 universidades rankeadas de Latinoamérica, siendo el componente más valorado el de innovación y obtención de patentes[3] que denotan la existencia de transferencia de tecnología hacia el sector productivo.

b) Diseño metodológico, alcance, fuentes de datos, recolección y análisis

El alcance del proyecto es exploratorio-descriptivo, y busca avanzar en la identificación de capacidades y resultados de innovación para el sector AgroTech en el marco de la UNICEN, pretendiendo especificar cuáles y cómo son las relaciones que existen entre los NACTs con el sector AgroTech.

Para el cumplimiento del objetivo de este trabajo de identificar los resultados y las capacidades (tecnológicas y relacionales) de los NACTs de la UNICEN orientados al desarrollo de tecnologías para el sector AgroTech, se realiza una investigación cualitativa, encuadrada dentro de un diseño de estudio de caso, en virtud de que se apunta a estudiar un fenómeno en el marco de un contexto definido en el cual se evidencia una interacción entre los componentes de un sistema y sus características.

El sitio de investigación es la UNICEN, y la unidad de análisis son los NACTs que ejecutan proyectos de I+D y realizan actividades orientadas al sector AgroTech. Se realizó una clasificación inicial de los NACTs a partir de un criterio propuesto por el BID (Vitón, 2019), el cual distingue las 9 tecnologías principales[4] y los 9 tipos de innovaciones[5] (Vitón et al, 2017) más importantes orientadas al sector AgroTech. De esta forma, se seleccionaron 13 NACTs que cumplían tal requisito.

[2]http://secat.unicen.edu.ar/index.php/nucleos/#1576608950595-e6cf584c-860b.

[3]https://www.scimagoir.com/rankings.php?sector=Higher+educ.&country=Latin+America&year=2017.

[4]El Banco Interamericano de Desarrollo el cual distingue 9 tecnologías de la Industria 4.0 más demandadas por el sector agropecuario: Biotecnología (Biotec.), Big Data, TICs y mobile (TICs), Datos abiertos, Tecnologías Limpias (TL), Robótica, Internet de las Cosas (IoT), Biometría e Inteligencia Artificial (IA) y Realidad Virtual (RV).

[5]El BID distingue las siguientes áreas de innovación en el sector Agrotech: Nuevos sistemas de producción (NSP), Automatización/ mecanización de labores, Genética y protección de cultivos (Genética), Big data y agricultura de precisión (BD y AP), SSI para la toma de decisiones (SSI), Plataformas de compra-venta servicios y financiamiento, Tecnologías en la cadena de logística y distribución de alimentos Productos y servicios, Bioenergías y biomateriales (Bioenergía).

Se utilizaron fuentes de información secundarias y primarias a fin de obtener datos cuantitativos y cualitativos de la vinculación U-I, como proxy de las capacidades tecnológicas, relacionales y los resultados de innovación que tienen los NACTs orientados al sector AgroTech. La inclusión de datos cuantitativos y cualitativos en el análisis y la combinación de múltiples fuentes de información, se sustenta por lo que proponen diversos autores (por ejemplo Jensen et al., 2009; Seppo & Lilles, 2012) en relación a que los datos cuantitativos son una fuente importante de información y son relativamente fáciles de recopilar y analizar, pero la obtención de datos cualitativos en entrevistas permiten comprender mejor los cambios y también mapear los problemas y las dificultades quizás antes de que los problemas aparezcan en las estadísticas. El uso de las múltiples fuentes de evidencia, radica en la importancia que destacan diversos autores de la literatura como Yin (1984, 2003), Blaikie (1991), Stake (1994), Martínez Carazo (2006), en el proceso de triangulación de los datos para eliminar los sesgos del investigador y de esta manera garantizar la validez y fiabilidad del estudio.

Como primer paso, se avanzó en la enumeración de indicadores para la descripción institucional, las capacidades tecnológicas, las capacidades relacionales y los resultados de innovación AgroTechs a partir de indicadores recogidos de la literatura de vinculación U-I (Ibornoz, Barrere, Castro, & Carullo, 2017; Perkmann, Neely, & Walsh, 2011; Brown, 2007).

A partir de esto, se obtuvieron datos cuantitativos y cualitativos de fuentes secundarias, como ser las Memorias Académicas[6] de los 13 NACTs de la UNICEN del último trienio (2020-2022) y se realizaron 10 entrevistas en profundidad a referentes de NACTs con vinculaciones mediante diferentes mecanismos con el sector AgroTech; en las mismas se indagó en las modalidades de vinculación con el sector, los resultados de innovación del NACTs y los desafíos y obstáculos existentes en la vinculación con el sector.

Tabla N° 1: Entrevistados por NACTs - UNICEN

Rol del entrevistado	Centro de I+D	Facultad
Investigador	PROANVET	Cs. Veterinarias
Investigador	TECSE	Cs. Veterinarias
Investigador	ISISTAN	Cs. Exactas
Investigador	CRESCA	Agronomía
Investigador	MEVET	Cs. Veterinarias
Investigador	INTELYMEC	Ingeniería
Director	IHLLA	Rectorado
Investigador	PROANVET	Cs. Veterinarias
Investigador	CISAPA	Cs. Veterinarias
Investigador	FISFARVET	CS. Veterinarias

Fuente: Elaboración propia

[6] Las Memorias Académicas son documentos elaborados por los NACTs que sistematizan las actividades científico-tecnológicas anuales realizadas por el personal docente e investigador que conforman el núcleo a partir del uso de una plataforma web unificada del Plan Integral de Fortalecimiento de los Recursos Humanos de Organismos de Ciencia y Tecnología, que pertenecen a la Administración Pública Nacional. Estas Memorias incluyen los cargos, la formación de Recursos Humanos, la producción científica, actividades de extensión y financiamiento.

Los resultados se exponen combinando el modelo propuesto por Ibornoz, Barrere, Castro, & Carullo (2017) del Manual de Valencia, con el modelo de Vinculación U-I basado en procesos (Perkmann, Neely, & Walsh, 2011; Brown, 2007). Los mismos se estructuran en torno a 4 dimensiones: *Insumos o factores de entrada,* que incluye el contexto institucional y las capacidades tecnológicas; *Actividades de vinculación (en proceso)*, las cuales incluyen las capacidades relacionales y las modalidades de vinculación de los NACTs; los *Productos,* que son los resultados de innovación medidos en términos de productos, prototipos, y demás bienes creados y orientados al sector Agrotech; y los *Impactos* (económicos y socioambientales).

A fin de clarificar la operacionalización de la metodología para cumplimentar el objetivo planteado se expone en la Tabla N° 2. La información para dar respuesta a estos indicadores de capacidades tecnológicas, capacidades relacionales y los resultados de innovación AgroTech de los NACTs de la UNICEN se obtiene de las Memorias y de acuerdo a lo propuesto por varios autores que estudian indicadores de vinculación Universidad-Industria (Perkmann, Neely, & Walsh, 2011; Seppo & Lilles, 2012; Albornoz, Barrere, Castro, & Carullo, 2017).

Tabla N° 2: Indicadores y Operacionalización de Variables de Capacidades Tecnológicas, Relacionales y Resultados de Innovación Vinculados a la Literatura de U-I

CONTEXTO INSTITUCIONAL	
Actividades de vinculación de la Universidad, RRHH afectados, estructura organizacional, regulaciones.	
CAPACIDADES TECNOLÓGICAS	**CAPACIDADES RELACIONALES**
Proyectos de I+D AgTech por NACT y descripción en el trienio.	Fuente de Financiamiento de organizaciones externas al SCyT: Nombre de las organizaciones.
Financiamiento público: nombre de instituciones que financian proyectos de I+D.	Vinculación con organizaciones externas al SCyT: nombre de las organizaciones.
Recursos Humanos: Doctores y Becarios de grado y postgrado del SCTN. (Planta estable al 2022)	Formalización de la vinculación: SI (si existen convenios, acuerdos u otro) NO (si no existe)
Producción científica: Libros, Partes de Libros, Artículos Científicos, y Trabajos en eventos CT publicados en el trienio.	Tipo de Vinculación: descripción de la actividad.
Premios y Distinciones: cantidad en el trienio	Publicaciones Conjuntas: SI-NO
Citación: Cantidad de citas de director y codirector -si existe- del NACT (Fuente: Google Scholar).	
RESULTADOS DE INNOVACIÓN	
Tipo de Resultado: Producto – Servicio Estandarizado – Servicio no Estandarizado	Descripción del Resultado
RESULTADOS DE INNOVACIÓN	
Tipo de Impacto: Económico – Socioambiental	Descripción de las características de los impactos.

Fuente: Elaboración propia en función de los modelos propuesto por Ibornoz et al. (2017) y Perkmann et al. (2011)

Para el análisis de la información se realizaron tablas con información cuali-cuantitativa y se trianguló la información con los informes cualitativos de cada NACTs en análisis. Las entrevistas a los referentes de

NACTs fueron transcritas y se extrajeron fragmentos centrales en relación a la temática en estudio.

III. Resultados

En el avance hacia la *caracterización institucional* y particularmente de la política de investigación surge que la UNICEN plantea como meta alcanzar el afianzamiento y la promoción de conocimientos científicos y las innovaciones tecnológicas transferibles. Para lograr esto, en los últimos años, la UNICEN ha transitado por un proceso de fortalecimiento de sus grupos de investigación, hecho que ha conducido a la conformación de Unidades Ejecutoras de doble y triple dependencia (con el Consejo Nacional de Investigaciones Científicas y Técnicas -CONICET- y la con la Comisión de Investigaciones Científicas de la Provincia de Buenos Aires -CICPBA-, respectivamente) y la creación del Centro Científico Tecnológico Tandil (CCT Tandil) también con el CONICET. Estos grupos han participado de diferentes convocatorias generadas desde la Universidad, a través de la Secretaría de Ciencia, Arte y Tecnología (SECAT) a efectos de acceder a financiamiento que permita su desarrollo.

La SECAT se encuentra conformada internamente por la Subsecretaría de Ciencia, Arte y Tecnología y la Subsecretaría de Vinculación y Transferencia (SUBVyT) creada esta última en acuerdo con el CCT Tandil, a fin de promover, coordinar y supervisar todas las actividades y proyectos institucionales de Vinculación y Transferencia, dentro de los cuales se destaca el Fortalecimiento de la gestión de la Propiedad Intelectual (PI) a través del Acuerdo de Cooperación Institucional con el Instituto Nacional de la Propiedad Industrial (INPI). Otra división importante que remarca la trayectoria institucional de la UNICEN en relación a la vinculación con el medio es el Centro de Innovación y Creación de Empresas (CICE). Creado en el año 2009, bajo dependencia de la SECAT, su misión consiste en estimular procesos de creación de nuevos proyectos, emprendimientos y asistencia en organizaciones existentes, impulsando la innovación desde el ámbito de la UNICEN hacia toda la región. Los datos más relevantes se sintetizan en la Tabla N° 3.

Tabla N° 3: NACTs, Proyectos de I+D AgroTech y Fuente de Financiamiento CT del Proyecto I+D

CONTEXTO UNICEN				
960 docentes con categoría de investigadores. NACTs de doble y triple dependencia (UNICEN - CICPBA - CONICET). Centro Científico Tecnológico Tandil (CONICET). Subsecretaría de Vinculación y Transferencia con programa de Fortalecimiento de Propiedad Intelectual con convenio con Fortalecimiento de Propiedad Intelectual con convenio con INPI. Centro de Innovación y Creación de Empresas				
NACT (FACULTAD)	**PROYECTOS I+D**	**TECNOLOGÍAS**	**INNOVACIÓN**	**FINANCIAMIENTO**
BIOLAB (Agronomía)	Evaluación de la diversidad biológica y funcional de hongos provenientes de suelos agrícolas bajo un sistema agroecológico y un sistema de siembra directa en la zona Centro y Sur de PBA, Argentina.	s.e	s.e	UNICEN - ANPCYT
	Avances en el manejo sostenible de la sanidad en cultivos de flores y hortalizas del AMBA.	Biotec.	NSP	UBA
CEA (Económicas)	Mapeo de actores e identificación de grado de ajuste entre la oferta y la demanda tecnológica en el Ecosistema AgTech en la región de influencia de la UNICEN.	Datos Abiertos	SSI	UNICEN
CISAPA (Veterinarias)	Desarrollo científico integrado en salud animal.	s.e	Genética	CONICET - UNICEN
	Estudio de la suplementación con probióticos sobre la performance de crecimiento, la microbiota intestinal y la respuesta inmune de los cerdos.	Biotec.	NSP - Genética	UNL
	Identificación de péptidos inmunodominantes en cepas Escherichia coli productor de toxina Shiga aisladas de bovinos para el diseño de una quimera multiepitope.	Biotec.	Genética	ANPCYT - UNICEN
	Producción de carne de cerdo local, agregado de valor y desarrollo sostenible en pos de una Economía Circular.	s.e	PySIA	UNICEN
	Impacto de actividades ganaderas en la calidad microbiológica del agua. Un enfoque en la resistencia a antimicrobianos.	Biotec.	NSP	FONCYT ANPCYT
	Estudios sobre la infección por el virus de la leucosis bovina (BLV) en células mamarias y su relación con Staphyloccocus aureus	Biotec.	NSP - Génetica	ANPCYT

CRESCA (Agronomía)	Programa de Investigación y transferencia tecnológica: Cadena Agroalimentaria Espárrago: bajo un enfoque sistémico.	s.e	PySIA	UNICEN - UNSL - UCA
	Análisis de la integración agrícolo-ganadera de sistemas mixtos del centro de la provincia de Buenos Aires	TICs - IA	NSP	UNICEN
	Efecto del cambio climático asociado a Fusarium graminearum y su potencial impacto sobre la calidad panadera del trigo	Biotec.	PySIA - Genética	FONCYT
	Revalorización de subproductos de la industria agroalimentaria como ingredientes funcionales saludables a base de cereales en el marco de la Economía Circular.	TL	PySIA - Bioenergía	UNLP - CIDCA - CONICET UNICEN
	Aportes ecosistémicos de la integración de la ganadería en planteos agrícolas.	TICs IA	NSP	
	Articulación e integración de campos experimentales y demostrativos en el sur de la provincia de Buenos Aires hacia una producción agropecuaria sustentable	TICs	NSP	INTA
FISFARVET (Veterinarias)	Desarrollo científico en salud animal	Biotec.	NSP	CONICET - UNICEN
	Dispositivos para identificaciónde enfermedades infecciosas en el cerdo: herramienta para la terapia de precisión	IoT - Robótica	Mecanización – BD y AP	UNICEN - CIC-CONICET-
	Evaluación del bienestar animal, caracterización productiva, genética y de la sostenibilidad de sistemas pecuarios en la región de influencia de la UNCPBA	TICs	PySIA - Genética	UNICEN
	Modelación productiva, económica y ambiental de sistemas modales de producción de carne de base pastoril de la cuenca del Salado Bs. As. y del norte de Santa Fe.	TICs	BD y AP	ANPCYT – UNICEN -CIC-CONICET
	Impacto del uso del orujo de oliva sobre la permeabilidad intestinal de cerdos	Biotec.	NSP	UNICEN
	Reducción del uso de antimicrobianos en el tratamiento de diarreas mediante el empleo de vacunas y manejo calostral estratégico en lechones de granjas en Colombia	Biotec.	NSP	-
MEVET (Veterinarias)	Desarrollo y caracterización biomecánica de una bioprótesis de pericardio bovino	Biotec.	Mecanización	UNICEN
	Avances sobre la endocrinología de la reproducción en llamas (Lama glama): estudios sobre la funcionalidad del cuerpo lúteo y el reconocimiento materno de la preñez	Biotec.	Génetica	ANPCYT
	Impacto de la restricción nutricional de ovejas durante la preñez sobre los tejidos reproductivos de hembras prepúberes.	Biotec.	NSP	UNICEN
IHLLA (Rectorado)	Adaptación al cambio climático con aprendizaje automático: oportunidades para la producción de cultivos	TL	Genética	UNMDP
	Maíz en el centro-sudeste de la provincia de Buenos Aires: enfrentando escenarios climáticos actuales y futuro	Biotec.	s.e	UNMDP
	Modelos de apoyo a la toma de decisiones ambientales en base a Aprendizaje Profundo	TICs	s.e	UNICEN
	Proc.de salinización de aguas subterráneas y relación con suelos y vegetación en la Pampa Deprimida de BA.	TL	s.e	ANPCYT - UNICEN
NUCEVA (Agronomía)	Sensores remotos y SIG como herramienta para caracterizar de servicios ecosistémicos en la región pampeana.	IoT - Robótica	BD y AP	UNICEN
CIISAS (Agronomía)	Sistemas de compostaje de estiércol de feedlot: caracterización y valoración agronómica del producto final	s.e	Bioenergía	UNICEN -LIMA -YA UNICEN
	Alternativas de manejo de la nutrición de un cultivo bioenergético, para la reducción de uso de agroquímicos	Biotec.	Bioenergía	
	Desarrollo de la Agricultura Inteligente en relación con prácticas de trabajo y adecuado manejo del agua y del suelo	s.e	BD y AP	UNICEN
	Economía circular en la cadena de valor de la bioenergía: incorporación de Arundo donax en un sistema bioenergético de origen agropecuario.	TL	Bioenergía	UNICEN

	Integración de un cultivo energético de segunda generación, Arundo donax L., a la cadena de valor de la bioenergía.	TL	Bioenergía	UNICEN
	Resistencia a herbicidas en malezas de los sistemas agrícolas de la zona centro de la provincia de Buenos Aires.	TICs	Genética	UNICEN
TECSE (Ingeniería)	Calidad de granos, nuevas aplicaciones y alternativas tecnológicas	TICs	s.e	ANPCYT
	Estudio integral de los granos argentinos para potenciar su aprovechamiento industrial	s.e	s.e	ANPCYT
	Producción de Carne de Cerdo local, agregado de valor y desarrollo sostenible en pos de una Economía Circular	s.e	s.e	UNICEN
	Procesamiento de granos para la extracción de aceites y uso de los subproductos como fuente de ingredientes bioactivos: un enfoque sustentable.	TL	PySIA	ANPCYT
ISISTAN (Exactas)	Desarrollo de un aparejo móvil IoT basado en visión computacional e IA, para la determinación automática del grado de terminación y condición corporal de bovinos.	IoT - IA	Genética - SSI	FONCYT
	Expresión facial de las emociones en equinos sangre pura de carrera: base de datos propia, abierta, clasificación y análisis de mod.computacionales e indicadores de comportamiento.	Datos Abiertos	s.e	UNICEN
	Herramienta de software para productores ganaderos que utiliza Machine Visión para estimar el estado corporal y peso de los animales.	TICs - IA	SSI - Automatización	CONICET-UNICEN
	Sistema semi-automático de calificación biométrica de vacas lecheras y modernización de la plataforma de gestión de datos de A.C.H.A. mediante IA y computación móvil.	IA	SSI - Automatización	ANPCYT
	Desarrollo de un Sistema Automático de Evaluación Biométrica del Ganado Lechero: Vacas Funcionales para cada Sistema Productivo	IA	SSI - Automatización	UNICEN
PROANVET (Veterinarias)	Alternativas tecnológicas destinadas a mejorar la eficiencia de la transferencia de embriones en caprinos.	Biotec.	Genética	FONCYT INTA
	Evaluación del bienestar animal, caracterización productiva, genética y de sostenibilidad de sistemas pecuarios en la región de la UNCPBA	Biotec.	Genética	UNICEN
	Propuesta de indicadores de bienestar que contribuyan a la sostenibilidad en tambos de la Cuenca Mar y Sierras.	s.e	s.e	UNICEN
	Sustentabilidad de la producción ganadera bovina de pastizales naturales: mod.y detección de indicadores.	s.e	s.e	AUDEAS-CONADEV
	Desarrollo de un sistema de bajo costo para la cuantificación de gas metano proveniente de efluentes de producción ganadera intensiva.	TL - TICs	Automatización	UNICEN
	Programa Argentino de Prueba de Reproductores Bovinos de Leche (PROAR)	Biotec.	Genética - NSP	UNICEN - MAGyP
	Estrategias para la mejora productiva, agregado de valor y sostenibilidad de la producción Apícola	s.e	s.e	UNICEN
INTELYMEC (Ingeniería)	Integración de un cultivo energético de segunda generación, Arundo donax L., a la cadena de valor de la bioenergía.	TL	Bioenergía	UNICEN
	Arundo donax L. como fuente de bioenergía para la sustitución de combustibles fósiles.	TL	Bioenergía	UNICEN

Fuente: Elaboración propia a partir de las Memorias Académicas de los NACTs (2020-2022)

En relación con identificación de *capacidades tecnológicas* de los NACTs de la UNICEN orientados al desarrollo de tecnologías para el sector AgroTech, se detallan13 NACTs de diferentes unidades académicas de la UNICEN que llevan adelante 53 proyectos de I+D orientados al sector AgroTech. Estos proyectos (enumerados y detallados en la Tabla N° 3) son financiados por diferentes instituciones del Ministerio de Ciencia, Tecnología e Innovación de Argentina, como la Agencia Nacional de Promoción Científica y Tecnológica, el CONICET, la Comisión de Investigaciones Científicas de la Provincia de Buenos Aires (CICPBA), y diferentes universidades nacionales públicas y privadas.

La Tabla N° 4 a continuación hace referencia a otras capacidades tecnológicas asociadas a la formación de recursos humanos, la producción científica, los premios obtenidos y la cantidad de citas de los NACTs. Al 2022 los NACTs estaban conformados en promedio por 12 doctores y 14 becarios de grado y posgrado. Se destaca la producción científica realizada en el período así como la obtención de premios y menciones en el 77% de los NACTs. En cuanto a la cantidad de citas de los directores y codirectores de los Centros de I+D[7], se evidencia mayor cantidad de citas en centros de Cs. Exactas (ISISTAN) y Cs. Veterinarias (FISFARVET).

Tabla N° 4: Capacidades Tecnológicas de los NACTs de la UNICEN

NACTs	RECURSOS HUMANOS		PRODUCCIÓN CIENTÍFICA				PREMIOS	CITACIÓN
	DOCTORES	BECARIOS	ARTÍCULOS	LIBROS	PARTES DE LIBROS	T. EN EVENTOS CT PUBLICADOS		
BIOLAB	8	7	X		X	X	0	s.d.
CEA	12	18	X			X	3	429
CISAPA	17	19	X			X	6	s.d.
CRESCA	10	22	X		X	X	8	81
FISFARVET	24	17	X		X	X	6	9069
IHLLA	18	19	X	X		X	0	2553
MEVET	9	1	X			X	4	421
NUCEVA	7	9	X	X	X	X	0	s.d.
CIISAS	1	6	X	X	X	X	2	s.d.
TECSE	11	13	X		X	X	2	s.d.
ISISTAN	16	12	X		X	X	17	4148
PROANVET	15	9	X		X	X	3	596
INTELYMEC	9	26	X		X	X	3	2934

Fuente: Elaboración propia a partir de las Memorias Académicas de los NACTs (2020-2022)

Respecto a las *capacidades relacionales,* se pudieron identificar 5 NACTs que han formalizado sus vínculos con organizaciones por fuera del Sistema Científico-Tecnológico con el financiamiento de proyectos de I+D. La tabla N° 5 exhibe los NACTs, pertenecientes a las facultades de Agronomía, Cs. Veterinarias, Cs. Exactas e Ingeniería, los proyectos, el tipo de innovación y la tecnología trabajada, y las organizaciones que han financiado tales actividades. Estas organizaciones han sido de carácter privado, como empresas, y cooperativas, y otras entidades sin fines de lucro como cámaras, fundaciones y asociaciones específicas que se encuentran fuera del Sistema Científico-Tecnológico Nacional

[7]Es de destacar que este dato no pudo obtenerse en la totalidad de los NACTs debido a que en gran parte de éstos, los referentes de estos centros no cuentan con perfiles en Google Scholar.

Tabla N° 5: Financiamiento de Proyectos de I+D fuera del sistema C-T

NACT (FACULTAD)	PROYECTOS I+D	TECNOLOGÍAS	INNOVACIÓN	FINANCIAMIENTO
CIISAS (Agronomía)	Economía circular en la cadena de valor de la bioenergía: incorporación de Arundo donax en un sistema bioenergético de origen agropecuario.	TL	Bioenergía	Bioeléctrica Gral Alvear S.A. (BGA)
	Integración del cultivo energético de seg. generación, Arundo donax L., a la cadena de valor de bioenergía.	TL	Bioenergía	Bioeléctrica Gral Alvear S.A. (BGA)
FISFARVET (Veterinarias)	Reducción del uso de antimicrobianos en el tratamiento de diarreas mediante el empleo de vacunas y manejo calostral estratégico en lechones de granjas en Colombia	Biotec.	NSP	Centro Internacional para Soluciones a la Resistencia Antimicrobiana (ICARS)
INTELYMEC (Ingeniería)	Integración de un cultivo energético de segunda generación, Arundo donax L., a la cadena de valor de la bioenergía.	TL	Bioenergía	Bioeléctrica Gral Alvear S.A. (BGA)
ISISTAN (Exactas)	Desarrollo de un aparejo móvil IoT (Internet de las Cosas) basado en visión computacional e inteligencia artificial, para la determinación automática del grado de terminación y condición corporal de bovinos.	IoT - IA	SSI - Genética	Asociación Criadores de Holando Argentino (ACHA)
	Herramienta de software para productores ganaderos que utiliza Machine Vision para estimar el estado corporal y peso de los animales.	TICs - IA	SSI - Automatización	Holy Data S.A.S. Fundación Sadosky
	Sistema semi-automático de calificación biométrica de vacas lecheras y modernización de la plataforma de gestión de datos de A.C.H.A. (Asociación Criadores de Holando Argentino) mediante inteligencia artificial y computación móvil.	IA	SSI - Automatización	Asociación Criadores de Holando Argentino (ACHA)
	Desarrollo de un Sistema Automático de Evaluación Biométrica del Ganado Lechero: Vacas Funcionales para cada Sistema Productivo	IA	SSI - Automatización	Asociación Criadores de Holando Argentino (ACHA)
TECSE (Ingeniería)	Producción de Carne de Cerdo local, agregado de valor y desarrollo sostenible en pos de una Economía Circular	s.e	s.e	Cagnoli S.A.
	Aportes tecnológicos para la generación de la cadena de valor de alpiste (Phalaris canariensis L.) apto para consumo humano	s.e	PySIA	Molino Olavarría S.A.

Fuente: Elaboración propia a partir de la lectura de las Memorias Académicas de los NACTs y de las entrevistas a investigadores

Existen vinculaciones entre los NACTs y organizaciones/empresas, las cuales pueden estar formalizadas o no, e incluso, pueden tener una contraprestación económica. En este sentido, se identifican 10 NACTs con indicadores de capacidades relacionales orientadas al sector AgroTech. Estos NACTs pertenecen a diferentes unidades académicas (Agronomía, Cs. Veterinarias, Cs. Exactas), de los cuales se destaca el PROANVET, el TECSE y el CIISAS con 15, 9 y 8 acciones de vinculación con organizaciones externas al Sistema Científico y Tecnológico Nacional, respectivamente. En general, las actividades de vinculación se encuentran formalizadas mediante acuerdos de colaboración o convenios específicos, aunque también algunas de ellas no son formalizadas por convenios. No se declaran en las Memorias Académicas publicaciones conjuntas y tampoco la existencia de oficinas de vinculación tecnológicas propias de los NACTs analizados (Tabla N° 6).

Tabla N° 6: Capacidades Relacionales NACTs UNICEN

NACT	PUB. CONJ.	VINCULACIÓN		
		ORG. NO SCyT	FORMAL	TIPO
CIISAS	s.e	Asociación de Laboratorios Agrop. Privados (ALAP)	SI	C-T. Investigación y transferencia de cultivos proteicos (arveja proteica).
		Agustín Quattrochio e hijos SA.	NO	Investig. sobre Agricultura de Precisión.
		Verttech SRL	NO	Investig. sobre crecimiento y rendimiento de clones de Arundo donax por micropropagación.
		REDCAI - División de Microbiología Agrícola y Ambiental - AAM	SI	Grupo de trabajo de compost, abonos y enmiendas.
		Schang Agroveterinaria	NO	Cooperación Técnica para desarrollo de Agricultura de Precisión
		Cementos Avellaneda SA	SI	C-T Investigación sobre Arundo donax un cultivo lignocelulósico como fuente alternativa a los combustibles fósiles.
		Nievas SA	SI	Desarrollo de herramientas para la descompactación de suelos bajo siembra directa.
		Círculo de Ing. Agrónomos de Tandil (CIAT)	SI	Capacitación en temas de mecanización agrícola.
CEA	s.e.	ORBITA – Ministerio de Producción de la Provincia de Bs. As.	SI	Cooperación. Informe Industria 4.0 en sector metalmecánico PBA.
CISAPA	s.e	Sanatorio Tandil - Hospital "Ramon Santamarina"	NO	Trabajos en colaboración. Análisis clínicos.
		Cooperativa Nuevo Amanecer - BioExt. S.A. - Inbio Highway	NO	Trabajos en colaboración. Controles y testeos de calidad.
CRESCA	s.e	AAPRESID	NO	Comportamiento de cultivos de servicios cuando son utilizados para pastoreo.
		Fundación Pro-Mendoza	SI	Asistencia Técnica a empresarios mendocinos a posicionar sus productos y servicios
		Ferticer Logística SRL - Agrotecnos SA - Sanatorio Azul SA - Transporte Ricardito - Agroservicios Senderos SA - Agronomía Olavarría	NO	Cooperación voluntaria para realizar aportes y dinamizar el sector agroindustrial.
		Chacras Experimentales de la Provincia de Buenos Aires	SI	Convenio Marco para el desarrollo de investigaciones y cultivos experimentales.
		Asociación Argentina de Producción Animal (AAPA)	SI	Membresía Individual.
FISFARVET	s.e	Pracma (Grupo Roemmers)	SI	Convenio I+D: Análisis de los compuestos presentes en el extracto de orujo de oliva que impacten potencialmente sobre la salud intestinal del cerdo.
		Cevesa S.A. - Bedson S.A.	SI	Servicios Tecnológicos de Alto Nivel
		Redimec S.R.L.	SÍ	Desarrollo de herramientas para la identificación de enfermedades en los sistemas intensivos de producción porcina.
		PROMITEC Santander - "Asociación por Colombia" - ICARS (Asociación Internacional de Lucha contra la Resistencia Antibiótica)	SI	Asistencia Técnica a empresarios colombianos para mejorar sus sistemas intensivos de producción porcina.
IHLLA		Instituto Correntino del Agua y del Ambiente	SI	C-T Isotopic and hydrological assessment of groundwater-wetland ecohydrological relationships under climatic and land use changes. Case study: Esteros del Iberá.
		Oficina de Riesgo Agropecuario MAGyP	SI	Colaboración. Mapas de estrés hídrico.

TECSE	s.e	Institut Charles Viollette. (Francia)	SI	Trabajos en colaboración
		Laboratorium fur Auftragsanalytik (Alemania)	SI	Trabajos en colaboración
		Red Internacional Chía-Link	SI	C-T. Estudio físico-químico, nutricional y tecnológico de la contribución de subproductos de chia como nuevos ingredientes en Europa.
		Molino Olavarría S.A.	SI	Colaboración
		Advanta Semillas SAIC	SI	Transferencias de material y confidencialidad.
		Consorcio Ciruelas -Fundación Pro-Mendoza	SI	Transferencia sobre factibilidad técnica de obtención de ciruelas pasas de bajo contenido calórico.
		Monsanto Argentina	SI	Cooperación, complementación y asistencia técnica.
		Asociación Argentina de Grasas y Aceite (ASAGA)	SI	C-T. Trabajos referidos a calidad de aceite de oleaginosas, descascarado de girasol, etc.
		GUNDEL Hnos.	SI	C-T. Control, monitoreo y adquisición de datos del silo Piloto del Grupo de Investigación TECSE.
ISISTAN		Holy Data	s.e	s.e
PROANVET	s.e	Mesa Ovina Mar y Sierras	SI	Membresía individual
		Consejo de Profesionales del Agro, Alimentos y Agroindustria (CPIA)	SI	Membresía individual
		Sociedad Latinoamericana de Invest. en abejas	SI	Integrante Comisión Directiva representando a Argentina
		Consejo Nacional Apícola de MAGyP	SI	Membresía individual
		Comisión Promotora de la Asoc. Argentina de Sociología Rural.	SI	C-T Complejidad de lo agroalimentario en el espacio social: innovación, calidad y territorio.
		Sistema Integrado de Gestión de la Lechería Argentina - MAGyP	SI	Trabajos en colaboración del Laboratorio de Calidad de Leche
		Cluster Porcino Tandil	NO	s.e
		Red Argentina de Laboratorios Lácteos de Calidad Asegurada.	SI	Trabajos en colaboración
		Asociación Criadores de Holando Argentino (ACHA)	SI	Cooperación Técnica. Formación de recursos humanos y evaluación del potencial genético de 500.000 animales inscriptos en el Sistema Nacional de Control Lechero.
		MOST (CEPIT)	NO	Trabajos en colaboración. Soluciones Informáticas
		INTERBULL	SI	Membresía individual
		Asociación Argentina de Criadores de Hereford	SI	Convenio de Cooperación mutua. Evaluación de bovinos.
		Fundación La Paloma - Asociación Tandilense de Equinoterapia	NO	Asistencia Técnica.
		GRASSFED Argentina	SI	Membresía individual
		Mesa Argentina de Carne	NO	Trabajos en colaboración.
		Sustentable		
INTELYMEC	s.e	Bioeléctrica General Alvear S.A.	NO	Cooperación Técnica. Integración de Arundo Donax a la cadena de valor de la bioenergía.
		Cementos Avellaneda S.A.	NO	Cooperación Técnica. Desarrollo de bioenergías para la sustitución de combustibles fósiles.

Fuente: Elaboración propia a partir de las Memorias Académicas de los NACTs (2020-2022)

Las entrevistas realizadas a investigadores y referentes de NACTs que orientan sus actividades hacia el desarrollo de tecnologías AgroTechs han permitido identificar diferentes *modalidades de vinculación U-I* entre los NACTs y las organizaciones con las que interactúan, las cuales conducen a resultados diversos en materia AgroTech. En este sentido, siguiendo la línea de vinculación U-I propuesta por Carattoli (2020), identificamos cinco modalidades de vinculación U-I: Tradicional, de Servicios estandarizados, de servicios

no estandarizados, Bidireccional (mayor intensidad de la relación y generalmente formalizadas) y Comercial (las universidades logran comercializar sus resultados de investigación - patentes, licencias de tecnología, spin-off, incubadoras, etc.- y obtener recursos).

En primer lugar, en relación a la modalidad tradicional, se identifican NACTs con capacidades tecnológicas y proyectos de I+D orientados al AgroTech, que no explicitan capacidades relacionales en sus memorias, ni vínculos con organizaciones públicas o privadas por fuera del sistema científico-tecnológico. Se asume, en este aspecto, que la modalidad de vinculación es tradicional, de carácter unidireccional, donde existe un trabajo del investigador de tipo intelectual, y orientado al desarrollo de publicaciones científicas, por sobre la vinculación con el medio y la transferencia de tecnología. Se destacan en este aspecto NACTs de la Unidad Académica de Agronomía, como el NUCEVA.

En relación a la modalidad de servicios, la misma se clasifica en servicios estandarizados y no estandarizados. Los servicios estandarizados, fueron identificados en NACTs de Agronomía y Medicina Veterinaria, los cuales se corresponden con ensayos rutinarios y/o experimentales en la producción de hortalizas y/o vegetales, como es el caso del BIOLAB en Agronomía; y también diversos servicios a terceros que se corresponden con análisis virológicos y toxicológicos en animales y también en humanos, por el NACT CISAPA, de Cs. Veterinarias y su rol activo en la detección de la presencia del genoma de SARS-CoV 2 durante la pandemia.

Con respecto a los servicios no estandarizados, se identificaron NACTs que prestaban servicios de baja complejidad y otros denominados STAN (servicios tecnológicos de alto nivel). Suelen ser consultorías, asistencia técnica y asesoramientos eventuales y específicos, para la resolución de problemas productivos o de gestión. En este sentido, se identificó esta modalidad en el PROANVET, en Cs. Veterinarias, a partir del asesoramiento en la producción de compost proveniente de residuos orgánicos equinos a una ONG, lo que luego derivó en la creación de un fertilizante orgánico. En relación a la modalidad de servicios no estandarizados, de alto nivel tecnológico, se destacan asociados a análisis de tratamiento de efluentes, en NACTs de Cs. Veterinarias como el CISAPA, otros desarrollos antibióticos en bovinos y cerdos por parte del FISFARVET, de la misma unidad académica.

Finalmente, se identifican tres NACTs que mantienen modalidades de vinculación bidireccional y comercial. Respecto de la modalidad bidireccional, la cual implica relaciones de largo plazo con organizaciones y/o empresas de la industria, se destaca el NACT PROANVET, de la Facultad de Cs. Veterinarias, y el Ihlla, dependiente del área de Rectorado de UNICEN. En el primer caso, destaca el vínculo ininterrumpido entre el PROANVET y la Asociación de Criadores de Holando Argentino, desde el año 1993 hasta la actualidad, donde se han avanzado en la realización de varios proyectos, siendo uno de los más importantes la aplicación móvil ACHA CIEL, una app de sistematización de datos de evaluación genética. En general, estas iniciativas han sido financiadas por fondos privados, en este caso provenientes de ACHA. Los entrevistados sostienen que se está buscando migrar este desarrollo tecnológico hacia el concepto de datos abiertos, lo que resulta a la fecha muy complejo por el alto costo que representa cambiar radicalmente el sistema.

Se resalta por otra parte, una modalidad de vinculación bi-direccional, dando lugar al consorcio de cooperación público-privado Ihreda, el cual es conformado por el Instituto de Hidrología de Llanuras (Ihlla), la empresa Redimec S.A y la Autoridad del Agua de la provincia de Buenos Aires. Este consorcio fue creado con la finalidad de realizar monitoreos meteorológicos e hidrológicos y desarrollar estaciones meteorológicas para prevenir las inundaciones y sequías, permitiendo a los productores agropecuarios tomar decisiones productivas en función de mediciones de humedad y otras variables ambientales. El consorcio ha sido creado a partir de un Fondo Argentino Sectorial (FONARSEC) y capitales públicos y privados.

Finalmente, en relación a la modalidad comercial de vinculación, se identifica la creación de un spin off desprendido del NACT FISFARVET, constituyendo una nueva empresa que desarrolla tecnologías orientadas al agro y con fines comerciales. Este es el caso de UNIAGRO S.A., spin off conformado por un grupo de docentes investigadores de campos interdisciplinarios (ingenieros agrónomos, veterinarios e ingenieros en sistemas) pertenecientes a distintos núcleos científico-tecnológicos de la UNICEN, el cual se orienta al desarrollo de tecnologías de ganadería de precisión. Si bien el spin-off fue creado en 2017, ha obtenido licencias por sus desarrollos tecnológicos así como premios y distinciones por ideas-proyectos relacionadas a la ganadería de precisión. Uno de los desarrollos es un producto denominado CControl. Ar, el cual es un prototipo hard-soft de una cámara que toma imágenes 3D de vacunos al paso y aplica algoritmos de Inteligencia Artificial para estimar la condición corporal del animal o su grado de terminación, el cual resultó premiado en categoría de prototipado, en el I Certamen de Agtech Ganadero de la Sociedad Rural Argentina en 2019.

UNIAGRO S.A. ha financiado sus resultados de innovación con fondos provenientes de fuentes públicas aunque los montos han permitido alcanzar un prototipo de productos pero no han alcanzado escalar hacia un producto mínimo viable, consideran como obstáculo las

limitaciones en la captación y retención de recursos humanos para llevar adelante las actividades, con restricciones de financiamiento para tal fin.

En términos de generación de *resultados de innovación*, los entrevistados coinciden que es posible desarrollar productos que existen a nivel global a costos más accesibles y con prestaciones diferenciadas pero igualmente con alto componente tecnológico.

Tabla N° 7: Resultados de los NACTs

NACT	RESULTADO	ACTIVIDAD	DESCRIPCIÓN
BIOLAB	Servicio estandarizado	Laboratorio de Valoración de Calidad Industrial de Trigo.	Ensayos rutinarios y/o experimentales para determinar características de productos y/o componentes de productos. Producción vegetal-cereales
CEA	Servicio No Estandarizado	Estudios Tecnológicos Orientados: Industria 4.0.	Servicio eventual. Asesoramientos, consultorías y asistencias técnicas. Asesoramiento para la resolución de problemas productivos o de gestión.
CIISAS	Servicio Estandarizado	Intensificación sostenible de la producción de trigo, maíz y carne bovina.	Asesoramientos, consultorías y asistencias técnicas. Asesorar para la resolución de problemas productivos o de gestión.
CISAPA	Servicio Estandarizado	Determinación de la expresión de citoquinas bovinas	Ensayos rutinarios y/o experimentales. Objetivo: realizar la adaptación o estandarización de procesos, productos y/o técnicas. Producción animal.
	Servicio Estandarizado	Diagnóstico Virológico	Servicios a terceros. Sanidad animal
	Servicio No Estandarizado	Análisis de efluentes en descomposición .	Servicio eventual. Asesoramientos, consultorías y asistencias técnicas. Asesoraramiento para la resolución de problemas productivos o de gestión.
	Servicio Estandarizado	Detección, titulación y rango de hospedador de bacteriófagos sobre cepas de Escherichia coli.	Servicio eventual a terceros. Ensayos rutinarios y/o experimentales para determinar características de productos y/o componentes de productos. Servicios Tecnológicos de Alto Nivel.
	Servicio Estandarizado	Detección de la presencia del genoma SARS-CoV2	Servicios a terceros. Salud pública.
	Servicio No Estandarizado	Análisis de pastura para determinar el avance del quitridio en pastizales serranos.	Servicios a terceros. Conservación de biodiversidad. Servicios Tecnológicos de Alto Nivel.
	Servicio No Estandarizado	Determinación de la actividad antiviral de productos sintéticos o biosintéticos, químicos o físicos.	Servicio eventual a terceros. Ensayos rutinarios y/o experimentales para determinar características de productos y/o componentes de productos.
CRESCA	Servicio Estandarizado	Análisis de suelos, compost y fertilizantes.	Ensayos rutinarios y/o experimentales. Asesoramiento para la resolución de problemas productivos o de gestión.
FISFARVET	Producto	CControl.ar	Prototipo hard-soft de una cámara que toma imágenes 3D de vacunos al paso y aplica algoritmos de IA para estimar la condición corporal del animal o su grado de terminación. Premiado en categoría de prototipado, I Certamen de Agtech Ganadero de la Sociedad Rural Argentina 2019.
	Producto	Sensor de Temperatura - Sensor de Tos	Prototipos de herramientas para la identificación precoz de enfermedades infecciosas en el cerdo (fiebre y tos).
	Servicio No Estandarizado	Estudio de la suplementación dietaria de aceites esenciales en cerdos.	Ensayos rutinarios y/o experimentales para determinar características de productos y/o componentes de productos. Servicios Tecnológicos de Alto Nivel (STAN)
	Servicio No estandarizado	Desarrollo de formulaciones de ivermectina de larga acción en bovinos.	Determinar características de productos y/o componentes de productos.

	Servicio Estandarizado	Determinar residuos y establecer tiempos de retiro de antimicrobianos en el cerdo.	Ensayos rutinarios y/o experimentales para determinar características de productos y/o componentes de productos. Servicios Tecnológicos de Alto Nivel (STAN)
	Servicio Estandarizado	Asesoramiento y diagnóstico toxicológico.	Servicios a terceros. Sanidad animal
INTELYMEC	Producto	Arundo donax L como fuente de bioenergía	Evaluar condiciones para la producción, manipulación y acopio de Arundo donax L, las opciones tecnológicas que optimicen su rendimiento energético y como fuente de energía térmica.
MEVET	Producto	Prototipo de bioprótesis de pericardio bovino.	Prototipo con pericardio bovino, con el objetivo de lograr una bioprótesis diseñada y testeada para ser utilizada como injerto.
	Servicio No Estandarizado	Estudio de biodisponibilidad absoluta de zoledronato en cerdos.	Desarrollo farmacéutico. Realizar la evaluación de tecnologías. Servicios Tecnológicos de Alto Nivel (STAN).
PROANVET	Producto	ACHA SICEL	App que sistematiza información de 500 productores que operan en Control Lechero Oficial de sus animales, inscripción, genealogía y calificaciones morfológicas.
	Producto	Cápsulas de Metano SF6 - Tubos de acero inoxidable para recolección de aire	Junto con la Facultad de Ciencias Exactas se ha innovado en el desarrollo de dos herramientas de mediciones de metano, mejorando su material y eficiencia a la hora de la cuantificación del gas metano.
	Producto	Prototipo de sensor de bajo costo para cuantificación de gas metano	Desarrollo, en conjunto con la Facultad de Ingeniería, de un sensor de bajo para la medición de gas metano provenientes de efluentes de producción ganadera intensiva.
	Servicio No Estandarizado	Apoyo y asesoramiento a la elaboración de compost con los excrementos equinos	Determinar características de productos y/o componentes de productos.
TECSE	Servicio Estandarizado	Caracterización de oleaginosas y	Ensayos rutinarios y/o experimentales para determinar características de productos y/o componentes de productos.
		subproductos.	
	Servicio No Estandarizado	Estudio de pre-factibilidad agrícola e industrial.	Servicio eventual. Realizar la evaluación de tecnologías. Asesoría, investigación, consultoría.

Fuente: Elaboración Propia a Partir de las Memorias Académicas de los NACTs (2020-2022)

En relación con el análisis de *impactos*, el caso de los servicios estandarizados, como informes de consultoría, ensayos o asistencias técnicas, los impactos se materializan en brindar diagnósticos específicos e información para la toma de decisiones a la organización vinculada, y por ejemplo, si esa organización es una institución pública, pueden ser de utilidad para la determinación de políticas públicas que contribuyan a dinamizar al sector o una vertical AgroTech.

En relación a los servicios no estandarizados, si la vinculación se mantiene en el tiempo puede conducir a un desarrollo tecnológico que suponga una mejora para el sector en términos productivos o socioambientales.

En relación a los productos desarrollados en el período, existen algunos en fase de prototipo y otros ya operando en el sector. Aquellos como CControl. Ar (FISFARVET) supone impactos productivos para los productores ganaderos pero cuenta con un obstáculo para el desarrollo a escala del producto, asociado a la falta de recursos humanos para trabajar en la actividad y al financiamiento disponible. La App desarrollada por PROANVET aporta a la trazabilidad del ganado vacuno Holando Argentino y facilita la toma de decisiones de los productores que operan en el Control Lechero Oficial.

El consorcio Ihreda a través de la realización del desarrollo de estaciones meteorológicas para prevenir las inundaciones y sequías, permite a los productores agropecuarios tomar decisiones productivas con impacto económico positivos y por la naturaleza del aporte contribuye en los impactos ambientales.

En tanto que el producto desarrollado por INTELYMEC supone impactos socioambientales importantes para el sector, vinculado a la posibilidad de

sustituir energía proveniente de combustibles fósiles por fuentes alternativas renovables como la caña de azúcar, y la implicancia de esta sustitución energética en industrias vinculadas como la cementicia.

IV. Conclusión

Este trabajo resulta un avance en la investigación cuyo propósito es mapear la oferta y demanda de tecnología para el Ecosistema Agrotech e identificar el grado de acople entre oferta y demanda en la región de influencia de la UNICEN.

Tomando como base aportes de la literatura que estudia la relación U-I, se expone una propuesta de operacionalización de las variables de capacidades (tecnológicas y relacionales), resultados e impactos para el análisis de los núcleos científico-tecnológicos orientados al desarrollo de tecnologías para el sector AgroTech.

En términos generales se identifica la explicitación de una política institucional con estructuras específicas para la vinculación y transferencia de tecnologías. Además se pudo identificar NACTs con capacidades tecnológicas desarrolladas desde estándares globales y con acciones que dan cuenta de capacidades relacionales que permitirían el planteo de hipótesis acerca de la permanencia y profundidad del vínculo.

Los resultados de este estudio resultan limitados al análisis de la información declarada en las Memorias Académicas del último trienio de 13 Núcleos de Actividades Científico-Tecnológicas (en adelante NACTs) de la UNICEN, y a la realización de entrevistas en profundidad a diez investigadores de NACTs con resultados significativos en AgroTech.

Emerge como cuestión recurrente la dificultad para encontrar información completa documentada de las actividades de vinculación. En los casos en los que se profundizó el análisis mediante entrevistas a los referentes de los NACTs se pudieron identificar acciones de vinculación no declaradas a priori en los informes de la Memoria. Esto resultaría un obstáculo al momento de contar con información actualizada que permita contribuir a desarrollar futuros vínculos que contribuyan a dinamizar el ecosistema.

A partir de los hallazgos encontrados y expuestos en este trabajo, se plantea la necesidad de continuar con la búsqueda de información de tipo cualitativa a través de otras entrevistas en profundidad, lo que permitiría avanzar en brindar mayores especificidades a fin de brindar una medida de cuán acoplada/desacoplada está la oferta y la demanda tecnológica en la región en análisis. Por otra parte, a partir de los hallazgos encontrados mediante el análisis de la información primaria recolectada se presentarán propuestas para que la sistematización de la información solicitada en las Memorias permitan dar cuenta a futuro, de una mayor especificidad del nivel de capacidades relacionales desarrolladas por los centros de investigación.

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Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

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Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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