Analysis of the labor insertion of graduates from FACENA Engineering programs within the framework of CyMAT

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Abstract:

This work is carried out within the framework of the research project "Working Conditions and Environment of Students from the Professional Training Course and Graduates of the Current Program of the Engineering Courses of the School of Exact and Natural Sciences and Surveying of the National University of the Northeast (FACENA- UNNE)". Among the objectives outlined, we seek to investigate the working conditions and environment (CyMAT, Spanish acronym) of the students of the last five years of the FACENA engineering programs, exploring the job profile required by companies and organizations in the field, considering the socioeconomic context of the Northeast region of Argentina (NEA, Spanish acronym). For the development of this work, the labor insertion of graduates from the Electrical Engineering and Electronic Engineering programs is analyzed, taking into account the socioeconomic

and demographic situation in the region. It should be noted that the School where students graduate is located in the city of Corrientes, Argentina.

Development

This overview is presented within the development of the research project "Working Conditions and Environment of Students from the Professional Training Course and Graduates of the Current Program of the Engineering Courses of FACENA UNNE". Among the objectives outlined, we seek to investigate the working conditions and environment of the students of the last five years of the FACENA engineering programs, exploring the job profile required by companies and organizations in the field, considering the socioeconomic context of the NEA.

Let us start from the beginning by defining that, according to Neffa (2015):

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The working conditions and environment (CyMAT) are constituted by the sociotechnical and organizational factors of the production process implemented in the establishment (or working conditions) and by the risk factors of the working environment. Both groups of factors constitute the demands, requirements and limitations of the job position, whose synergic or combined articulation gives rise to the global burden of the prescribed work, which is assumed, assigned or imposed on each worker, causing immediately or mediately direct and indirect effects, positive or negative, on the life of employees and on their physical, mental and/ or psychological health. These effects depend on the activity or task actually done, on the personal characteristics, the respective individual adaptation capacities and the resistance of the individuals. Both factors are ultimately determined by the current work process, which in turn is the result of social relations and the interrelationship between the variables that act at the level of the socioeconomic context and the characteristics of the establishments/ agencies/companies. The work process is what defines the specific nature of the tasks to be carried out by the work group and by each of those who occupy the positions. (Neffa, 1986)

Currently, one can speak of an evolution in the conception of working conditions and environment, referring to psychosocial risks at work, which can be analyzed as follows:

Psychosocial risk factors at work refer to the conditions present in a current employment situation in companies or organizations, which operate in a specific historical, economic and social context and essentially to the configuration of the work process (labor force, objects and means) as determining factor. They are directly related to other determining factors: the risks of the Environment (physical, chemical and biological, technological and safety agents), and the Working Conditions (which include the content, the organization of the work, the duration, the configuration of the time, the remuneration system, the characteristics of the means of production and the impact of technologies, social and welfare services offered by the company, the salary relationship, the ways of managing individual force, the application of ergonomics and the possibilities of participation in the prevention of risks and organizational decisions).

These two great factors interact and develop according to the social relationships (with hierarchy, colleagues, subordinates, clients and users), all of which act through psychological and physiological mechanisms that can negatively affect and end up damaging the physical, psychological and mental health of the worker, as well as their

performance in the company, having a significant impact on productivity, quality and competitiveness. Finally, they have a macroeconomic impact on the social security system, affecting public expenditure on health. A multicausal model is assumed (some already existing and others that will be developed) which modifies reality. The appearance of ailments, damages, diseases or disorders has in practice various causes, and brings about various effects.

For the analysis of the socioeconomic and demographic context, the data issued by the National Institute of Statistics and Censuses (INDEC, Spanish acronym) "Technical reports / vol. 3 No. 232, of the third trimester of the year 2019, Labor market - Rates and socioeconomic indicators (Permanent Household Survey, EPH, Spanish acronym)" were used.

In order to identify some of the terms we use, it is necessary to define "EAP", Economically Active Population, made up of people who have an occupation or who are actively looking for it despite not having it. It is composed of the employed population plus the unemployed population.

According to INDEC, the employed population is made up of all the people who have at least one occupation, and who, during a reference week, have worked at least one hour in an economic ac-

tivity. The criterion of one hour worked, in addition to preserving comparability with other countries, allows to capture the many casual or low-intensity occupations carried out by the population.

In order to discriminate, within the employment level, what part corresponds to low-intensity employment, those who work fewer hours, for example the underemployed, can be subtracted from total employment.

The unemployed population are those who do not have a job, but who are actively seeking work and are willing to work. This concept does not include other forms of precarious work such as people who have a temporary job and are actively seeking work; people working short hours involuntarily; people who have stopped looking for a job because of the lack of employment opportunities; people who have below-minimum wage jobs or below their qualifications, among others.

On the other hand, there is an employed or "seeking" underemployed population, which comprises employed people who are looking actively for work or who want to work more hours, due to dissatisfaction or need for a higher income. The underemployed population not seeking work includes subjects who are willing to work more hours but, for involuntary reasons, are not engaged in an active job search for other paid activities.

The inactive population are people who do not have a job and are not looking for one.

We also consider the rate of unemployment, calculated as the ratio between the unemployed and the economically active population.

Analysis and results

Having defined and identified some basic concepts, the data necessary to analyze the socioeconomic context of the NEA, the framework within which this research project is conducted and where the study population do their activities, are shown below:

Geographical area Population (in thousands)	TOTAL	Economically Active Population (EAP)	Employed	Unemployed	Employed, seeking work	Underemployed
Corrientes	377	159	149	10	37	28
Formosa	250	83	79	4	6	6
Posadas	368	165	160	5	29	22

Table 1: NEA population in the area covered by the EPH (in thousands) Total 31 urban agglomerations Third trimester of 2019- INDEC 2019

When the socioeconomic context of the NEA is analyzed, it can be observed that the highest unemployment rate (10,000) and the highest number of employed people looking for another job (37,000) are in the city of Corrientes. Furthermore, the highest unemployment rate in the region is registered in the city of Corrientes (6.4%), followed by Formosa (4.3%) and Posadas (Misiones) (3.1%).

In the Northeast, 24.5% of the EAP completed higher or university education

In a changing context with social, economic, labor, technological, scientific and educational restrictions, the importance of engineering as a profession connected with the development of a country is undoubtable due to, among other aspects,

the possibility of participating actively in innovation and implementation processes of science and technology advance (Formento, 2009).

Given the socioeconomic situation of the region and applying the concepts of CyMAT and Psychosocial Risks at Work (RSPT, Spanish acronym), both government institutions and professional associations state that there is a big demand for engineers in their workforce which is not satisfied. Small and medium-sized enterprises and good and services undertakings require assistance from engineers, but they do not manage to find professionals with experience in the business world. This is a highly required profile nowadays: entrepreneur engineers with business management skills.

Table 2.2	Socioeconomic factors of a population aged 14 or older in a total of 31 urban agglomerations, regions and conglomerates by size. Third trimester 2019									
Factor	Total of 31 urban agglomerations (¹)	Agglomerations of the interior [without Greater Buenos Aires] (¹)	Greater Buenos Aires (GBA)	Cuyo	Northeast (NEA) (¹)	Northwest (NOA)	Pampeana	Patagonia	of 500,000 and more inhabitants	of less than 500,000 inhabitants (¹)
Activity rate	59.2	57.8	60.3	58.0	52.6	59.0	58.3	56.6	60.1	55.1
Women	49.2	48.6	49.7	49.0	42.3	50.3	49.0	46.5	50.1	45.2
Men	70.2	68.2	71.8	67.9	63.6	68.8	68.9	68.0	71.2	66.0
Household heads	57.5	55.7	59.0	56.7	53.6	58.4	54.7	55.6	58.0	55.2
Women up to 29 years old	40.1	38.6	41.5	40.7	30.8	37.9	40.6	33.7	42.0	32.3
Women from 30 to 64	58.2	58.4	58.1	59.3	58.5	59.1	59.9	64.8	59.1	54.3
Men up to 29 years old	55.9	52.8	58.5	51.8	45.4	50.5	55.9	50.5	57.7	48.2
Men from 30 to 64	91.6	91.2	91.9	92.0	85.3	91.9	91.9	89.8	92.1	89.6
Employment rate	53.4	53.2	53.6	54.2	50.1	54.0	53.1	52.9	53.8	51.8
Women	43.9	44.2	43.5	44.6	40.0	45.6	44.2	43.7	44.2	42.5
Men	64.0	63.2	64.6	64.7	61.0	63.4	63.1	63.3	64.4	62.1
Household heads	53.7	52.7	54.6	54.4	52.2	55.4	51.3	53.1	53.9	53.0
Women up to 29 years old	31.0	31.4	30.7	30.3	26.2	30.4	32.7	29.2	31.9	27.3
Women from 30 to 64	53.2	54.3	52.3	55.3	37.1	55.0	55.3	52.2	53.5	52.0
Men up to 29 years old	45.9	45.4	46.3	43.0	40.8	43.0	46.7	44.4	46.7	42.5
Men from 30 to 64	86.5	86.7	86.0	88.5	83.6	87.2	86.7	84.8	86.4	86.0
Unemployment rate	9.7	8.0	11.1	6.5	4.6	8.5	9.0	6.6	10.5	6.0
Women	10.8	9.0	12.4	8.9	5.3	9.3	9.7	6.0	11.8	6.1
Men	8.9	7.3	10.1	4.6	4.1	7.8	8.4	7.0	9.5	5.9
Household heads	5.6	4.5	6.4	3.4	2.3	4.4	5.3	3.8	6.1	3.4
Women up to 29 years old	22.6	18.8	26.0	18.9	14.8	19.8	19.5	13.4	23.9	15.5
Women from 30 to 64	7.3	5.9	8.5	5.8	2.4	5.9	6.7	4.1	8.1	3.6
Men up to 29 years old	17.9	14.1	20.9	7.3	10.1	14.8	16.4	12.1	19.1	11.8
Men from 30 to 64	5.8	5.0	6.4	3.8	2.1	5.1	5.6	5.5	6.2	4.0
Hourly underemployment rate	12.7	12.8	12.6	15.3	13.7	13.0	12.9	6.5	13.1	10.9
Hourly overemployment rate	25.3	25.6	25.0	25.6	28.7	25.6	24.6	28.8	24.8	27.6
Job seekers rate	28.3	27.7	28.6	28.2	22.3	31.2	28.1	19.4	29.5	22.6
EAP education level	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Uncompleted primary education	3.7	3.7	3.6	3.7	4.0	3.9	3.7	3.1	3.7	3.3
Completed primary education	13.0	12.5	13.3	13.5	10.8	13.8	12.3	10.8	13.0	12.6
Uncompleted secondary education	16.6	17.2	16.2	21.2	16.5	16.5	16.0	20.0	16.5	17.2
Completed secondary education	27.7	28.0	27.5	24.5	29.7	28.9	27.9	31.8	27.1	30.7
Uncompleted higher or university education	15.0	15.0	15.1	14.8	14.1	16.1	15.2	11.8	15.6	12.5
Completed higher or university education	23.6	23.3	23.9	22.0	24.5	20.6	24.7	22.4	23.7	23.2
Uninstructed	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.2	0.3	0.3
DK/NA/REF	0.1	0.0	0.1	—	0.0	—	—	—	0.1	0.0
Employed population										
Occupational category	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Salaried workers	72.7	72.2	73.0	70.4	71.2	71.9	71.9	78.6	72.6	72.8
Non-salaried workers	27.3	27.8	27.0	29.6	28.8	28.1	28.1	21.4	27.4	27.2
DK/NA/REF	—	—	—	—	—	—	—	—	—	—
Salaried with no retirement deduction	35.0	36.4	33.8	41.7	36.2	43.0	35.0	20.1	35.6	32.2

(¹) The results of the third trimester of 2019 do not include the Greater Resistencia agglomeration. Consequently, this report reflects results that represent 98.5% of the 31 urban agglomerations usually covered by the EPH [see point 4.2 "About geographical coverage" in the methodological Annex to this report].

Source: INDEC, Permanent Household Survey

Image 1: Socioeconomic data of subjects older than 14. Third Trimester of 2019- INDEC

Methodological aspects

In order to acquire knowledge and accomplish the complex objectives formulated at this stage of the project, the Mixed Method is adopted. This is a combination of a quantitative and a qualitative approach within the same research work with the aim of gaining a deeper understanding of the research difficulties, getting more reliable data, comprehending processes and correlations, and having a context

to frame the action (Fielding, 2012).

The study population consists of graduates from the Electrical and Electronic Engineering programs in the city of Corrientes, Argentina, and the unit of analysis includes subjects who graduated in the last three years and are working in the NEA.

The unit of analysis used at this stage of the study was 20 subjects, representing about 38% of the graduates in the last three years.

The data collection techniques were open-ended, semi-structured interviews, document analysis and visits to professional development sites to verify their conditions.

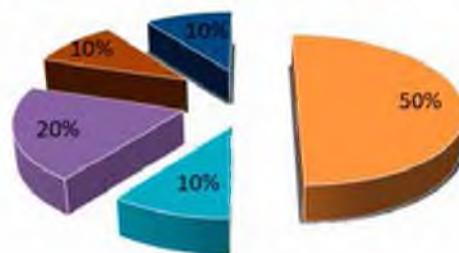In order to interpret the data collected, the following graphs are presented for further analysis:
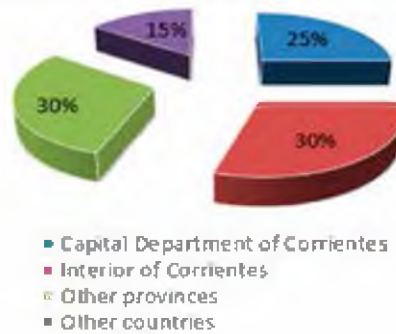
Graph 1: Demographic data

From the group of the engineering graduates interviewed, 50% choose to stay and work in the area of Greater Corrientes; 20% of them in the closest provinces such as Chaco, and 30% in other provinces (Graph 2).

Graph 2: Demographic data

Form of Hiring

- Dependent employe
- Independent worker
- Fellow
- Informal/Contract

10%
10%
25%
55%

Graph 3: Forms of hiring

According to professional practice, 55% are dependent employees with contracts. It was also found that 25% of them decide to start or continue a self-owned enterprise in the area providing goods and/or services; 10% are research fellows, and 10% are informally employed under a contract.

Regarding the socioeconomic context, according to INDEC reports and the quantitative and qualitative data collected for this study, it could be stated that in the area with the highest unemployment rate, there is a high number of employed subjects in the group of engineering graduates interviewed.

The findings are organized in two main sections. In the first section, the data collected from a quantitative analysis concerning the work history of the program graduates is shown, as well as the Working Conditions and Environment (CyMAT).

Data show a good labor insertion of graduates from the Electrical and Electronic Engineering programs, indicating that both of them foster employability and the insertion of graduates into companies, industries, public agencies in the area and self-own enterprises.

Graduates who are hired have qualified personnel positions: work supervisor or inspector; as independent workers, they generally repair and set up electronic and refrigerating devices, or work in private construction projects, etc. No cases of engineers having permanent positions were reported; some of them are research fellows in public institutions.

Other contextual factors considered at this stage are the possible causes affecting labor insertion as perceived by graduates

Within this category, we included the opinions of engineers, who con-

sider that the economic crisis in our country together with the peculiarities of the area present difficulties to a successful labor insertion. Some of the following quotes show their perceptions:

"We live in an area with low industrial development, which reduces the demand for engineers."

"Some companies require experienced subjects to fill their positions, and it is difficult for recent graduates or junior engineers to meet this requirement..."

Suggestions on how to enhance labor insertion of future graduates

The suggestion arising from the perspective of the subjects interviewed is to create more contact opportunities between students and companies (a point mentioned by some of them). This proposal consists of two points: on the one hand, the creation of new instances of interaction between the University (which trains engineers) and the industry, and the improvement of existing agreements regulating these interactions; on the other hand, the possibility for updating the current curricula (internships and higher level courses). In any case, the idea is to improve future engineers' chances of getting into the labor market before graduating and gaining an insight as to what real work in the area is like.

Conclusions

At this stage of our research, we sought to get knowledge about the situation and the labor insertion of recent graduates from the UNNE Electrical and Electronic Engineering programs in the NEA. The results showed a high employment rate within this professional sector even though they stated they faced some difficulties to enter the labor market given the economic situation in the country and the geographical area; they also expressed some discontent with working conditions (remuneration, workload, safety conditions, level of participation) and lack of support from the State to start self-owned enterprises.

For the next stage, it will be possible to detail the working conditions and risks of graduates and students of the engineering professional or higher level course during the production of goods and/or services, considering the grades required at the regional market.

It has been a great achievement to strengthen the research team and their relation with the study population and the challenges of engineering work, deepening theoretical and empirical knowledge and answering some of the questions posed.

It is worth mentioning the relevance of analyzing the impact of CyMAT on the

labor market and work dimensions in a disrupting situation such as natural disasters (droughts or floods in the area), and the volatility of production internationalization, given paradigm shifts or changes in macroeconomic conditions.

Biological hazards such as the COVID-19 outbreak could affect professional practice, the creation of self-owned enterprises, labor insertion of the professional course students and engineers graduated from FACENA.

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