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Agricultural and aquaculture extension program assessment in 2016 at Mexico City (CDMX)

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Abstract

In this document, we present an evaluation of the agricultural and aquaculture extension component in Mexico City, as part of one of the planning, monitoring and evaluation activities of the SAGARPA Rural Extension Support Project. A structured survey was prepared to be answered by the leading producers of the 11 agro-productive chain value selected to implement technological innovations.

Technical assistance, Chain values, Assessment, Extension and Innovations

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Introduction

The word extension (extensionismo in Spanish) has its origin in the Latin word extensio, onis, which means the action and effect of extending or extended (DRAE, 2016). On the other hand, the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), within its portal "SERMEXICANO" (2016) defines extension as "the service provided by education and research institution staff that facilitates access to knowledge, information and technologies to producers, rural economic groups and organizations and other actors in the agricultural, fisheries and aquaculture sector ".

The importance of the agricultural and aquaculture extension in Mexico City (CDMX) is mainly due to the huge market of almost nine million inhabitants (CONAPO 2015) that require a lot of food products from agricultural, livestock and aquaculture. During the period 2000 - 2015, the average annual growth rate for the CDMX population was 0.90%, which is the lowest in Mexico, and in contrast to the above.

The area sown in the CDMX for the same period have a decrease in their average annual growth rate of 2.75%, which in absolute terms will be of approximately 27.000 hectares to 17.500 hectares (INEGI 2015), which to a large extent is due to the pressure of the urban area. This ambivalent situation, that, on the one hand, in absolute terms, have an increase in population of nearly three million people in a period of 15 years and that on the other reduce the agricultural area that is intended for the supply of food crop, livestock and aquaculture, makes the CDMX is not self-sufficient, and with much, in themselves, makes it a net importer of food from all the states of Mexico. It is important to emphasise that the CDMX (before Federal District) is the core of the United Mexican States because within their limits are located the executive, legislative and judicial powers of the country.

The origin of the CDMX dates back to the Great Tenochtitlan founded in the year of 1325 (Wikipedia 2016). Tenochtitlan was a great agricultural producing area, and it made one of the largest contributions to rural development by means of the technology that became known as the production in the "chinampas". Chinampas were spaces of crops within the lake and were self-sufficient to supply food to the Aztec population. Other important sources of food were the various fish extracted from the lake and animal protein obtained mainly from the hunting of birds coming from the mountains of the Valley of Anahuac.

The CDMX is the smallest state in the country, 1,485 km^2, which represents only 0.08% of the total area of Mexico, with a political division composed of 16 municipalities as shown in Table 1.

Name	Area	Name	Area
Álvaro Obregón	96.17	Iztapalapa	117.00
Azcapotzalco	33.66	Magdalena Contreras	74.58
Benito Juárez	26.63	Miguel Hidalgo	46.99
Coyoacán	54.40	Milpa Alta	228.41
Cuajimalpa	74.58	Tláhuac	85.34
Cuauhtémoc	32.4	Tlalpan	312.00
Gustavo A. Madero	94.07	Venustiano Carranza	33.40
Iztacalco	22.30	Xochimilco	122.00

Table 1 Municipalities from CD**MX** and area in Km^2
Source: INEGI. 2014

The largest municipalities are in first place Tlalpan, following Milpa Alta and Xochimilco in third place, with the 21%, 15.4% and 8.2%, respectively of the territory. These municipalities account for 44.6% of the surface of the CDMX, and plus the Tlahuc municipality, they concentrate the agricultural and aquaculture activity which represents more than the half of the CDMX (50.3% of the total area). Because the extension and importance of these municipalities, all the activities from the extension program are focalized.

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The aim of this work was to evaluate the program of agricultural, livestock and aquaculture extension addressed to small producers within the levels I and II of the CDMX. The extension program is implemented by extension workers and with the support of universities (Autonomous University of Chapingo) and research centres (INIFAP), to display and validate before the federal authorities of the SAGARPA and state of the Government of the CDMX.

Methodology

The methodological process used for the evaluation of component extension was to take into account the main actions proposed within the project to support the Rural Extension of the SAGARPA, in which the INIFAP had as main activity the technological support, which consisted of the following stages:

Selection of the extension staff. To incorporate the SAGARPA's technical staff, in coordination with the Ministry of Rural Development and Communities Equity (SEDEREC), the Government of the CDMX launched a public open call. By a scoring process, professional careers related to the primary sector were pre-selected; then, an interview previously made was added the result of their interviews to their scoring sheet. Finally, according to the scores, the best agricultural, livestock and aquaculture technicians were selected as well as the coordinator of the extension staff.

Selection of value chains. To quantify and measure the importance of the primary activity within the CDMX, we conducted a discussion of the Strategic Plan prepared by the SAGARPA and SEDEREC through the guidance of National Institute for Capacity Development (INCA Rural).

From this exercise, we selected and extracted the most relevant agro-productive and aquaculture chains from the CDMX, and they were considered within the support project of the Rural Extension of the SAGARPA.

Development of the innovation agendas and schedule of the extension staff at the individual level and by a chain. Using a pre-determined script and with the collaboration of the Autonomous University of Chapingo, series of participatory workshops with extension staff were conducted to define the actions that were considered to be on the agendas. The agendas served as a framework to technicians during the process of integration of individual schedules. The tasks related to the individual schedules were aligned to the innovation agenda of the chain.

Socialisation of the agendas of innovation. This activity was performed by developing workshops in partnership with the INIFAP, UACh and INCA Rural. For each of the agricultural, livestock and aquaculture value chains selected, the leading producers, cooperating producers and producers were the main actors of these workshops. During the workshops, an explanation on how and what was the process for developing the agendas. In a second phase, the participants provide feedback and opinions. The information shared during the workshops was added to the agendas of innovation to validation, and above all, to the appropriation of the participants.

Implementation of the innovations. This step was carried out in situ under the direct supervision of each of the extension staff responsible. Besides, periodic visits to producers plantations were made with the aim of observing the evolution of innovations implemented.

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Supervision on the field. Monitoring visits were made by the three institutions responsible for this activity: Center for Rural Innovation and Extension of the Autonomous University of Chapingo, the INCA Rural and INIFAP, as well as to the accompaniment of officials of the State Delegation of the CDMX SAGARPA and the Government of the SEDEREC CDMX.

Evaluation of the component. To assess the program a questionnaire was designed to be answered primarily by the producers dedicated to the agricultural activity, with two groups of questions; one relating to questions qualitative and quantitative, respectively. In total, 16 questions were applied, 10 were qualitative and five quantitative-type. The sample size was determined according to the strata within the universe of producers. Were applied stratified random sampling with fixed proportional sample size proportional (Grégoire and Valentine 2008) following the formula:

$$N = \sum_{h=1}^{L} N_h \quad (1)$$

Where:

N = Population
L = Stratum
Nh = units of each one of the L stratum

Then, from before:

$$nh = n\left(\frac{N_h}{N}\right) = nW_h \quad (2)$$

Where:
nh = number of samples from the stratum
n = number of samples
N = population
nW_h = number of weighted samples per stratum
From the above, the implementation of the data is shown in Table No. 2 (Appendix 1)

The proportional allocation by value chain agricultural and aquaculture was as follows: amaranth = 3.84; ornamental = 4.09; corn = 3.20, vegetables = 8.57, nopal = 9.79, cattle = 1.92, apiculture = 4.03 rabbits = 5.89, sheep = 5.76, pigs = 3.84 and aquaculture = 3.07.

The values of the variables were average = 46.74; Beta = 9.61, permissible error = 0.20 and the permissible error in percentage = 1.09

Development and Results

Selection of agricultural extension staff. With the aim of improving the efficiency in the response to the demands of the agricultural producers in the CDMX, and based on the federal and state budget, several technicians were hired for a period of 11 months which included April of 2016 to February of 2017, according to Table 3

Chain	**No. Tech.**	**Chain**	**No. Tech.**
Amaranth	2	Apiculture	2
Vegetables	4	Rabbit	3
Corn	1	Sheep	3
Nopal	5	Swine	2
Ornamental	2	Aquaculture	2
Bovine	1	Rural development	1
Coordination	1	Total	**29**

Table 3 Technicians hired by each value chain in the CD**MX**
Source: Personal development

The allocation of extension staff to value chains of the CDMX pursued a balance between the agricultural and livestock sub-sectors; the first with 14 technical and the second with 11; in addition, 2 technicians were allocated to aquaculture, and in the cross-sectional chain of rural development 1 more technician was allocated. The percentage distribution is shown in Graph 1.

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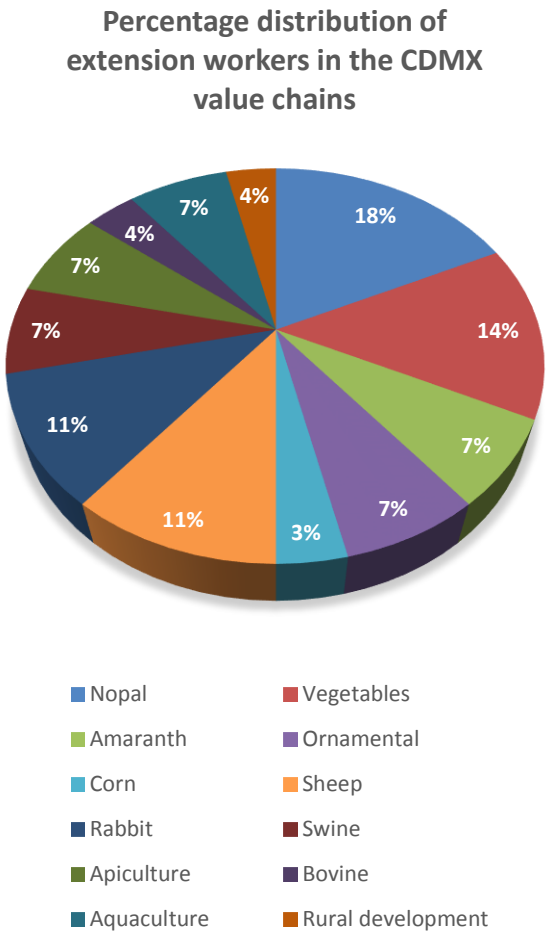
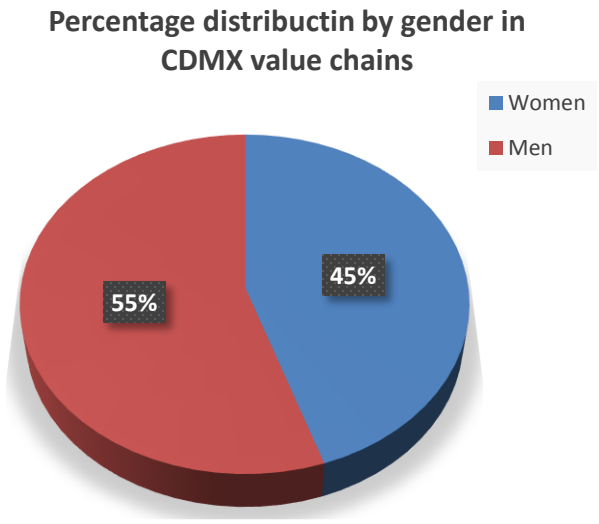


Graph 1 Number of extension staff and their percentage participation in attending chain values in the CDMX

The largest number of extension staff were allocated to the value chain of Nopal, followed by vegetables in order of importance of vegetables with 32% of the technicians. The chains of sheep and rabbit covered little bit more of 22% and the chains with lower coverage of extension staff were corn, cattle, and cross-sectional of rural development.

The performance of the women within the rural extension program in the CDMX is important for the contributions that they promote within the chains as you can see in graph 2.



Graph 2 Extension staff and their percentage participation by gender

The participation of gender is remarkable and almost equal within the CDMX rural extension program and even in four of the chains: corn, cattle, apiculture and swine, its coverage was 100%, which reaffirms its action within the improvement of value chains in the primary sector.

In relation to the number of producers that participated in the program, SAGARPA and SEDERC requested to extension staff the formation of a list of at least 30 producers who were classified within the levels II and I according to the rules of operation of the component extension. They would be considered for further attention. The number of producers attended is shown in Table 4.

Chain	Women	Men	Total
Amaranth	7	53	60
Vegetables	20	114	134
Corn	12	38	50
Nopal	89	64	153
Ornamental	14	50	64
Bovine	5	25	30
Apiculture	26	37	63
Rabbits	38	54	92
Sheep	21	69	90
Swine	15	45	60

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Aquaculture	12	36	48
Rural development	7	23	30
Total	**266**	**608**	**874**

Table 4 Register of producers by value chain and gender issues that were dealt with in the rural extension component of the CDMX in the year 2016.

Personal development

Among the producers, those who attended the chains of nopal and vegetables were highlighted within agricultural value chains, and the rabbits and sheep were highlighted within the livestock chain. The nopal and vegetable chains concentrated one-third of the producers registered (32.84%) and livestock chains of rabbits and sheep amounted to a little more than one-fifth part of the total (20.82%). These four value chains account for more than half (53.66%) of the producers that were registered in the program to support the rural extension of the CDMX. The cross-sectional chain was appointed, as rural development was the one that had the lowest number of producers (30), which represented 3.43% of the list of producers; however, only one technician was assigned to take care of this action.

It is worth noting that participation of woman was outstanding in the value chain nopal, because of the representativeness was 58.17%, meanwhile, in rabbits, 41.3% of the actors interviewed were women. Evaluation of the extension component. Based on all the surveys that producers responded, 45 in total, 35 were cooperating producers and 10 were leaders. The 95.56 % of the people had knowledge of the extension and innovation network model (REI, in Spanish), as was explained by the extension staff. On the other hand, 88.89% of the producers took part in an event of dissemination, transfer of technology or training and 95.56% of them participated in the implementation of some of the agricultural or aquaculture innovations proposed by the extension program.

Regards to the practice of sharing experiences with other producers within the area, 95.56% responded favourably. The number of agricultural producers who were exposed to the extension program in the CDMX was 631 and all of them were from productive chains mentioned lines above. All producers (100%) shown interest in the continuity of the extension program from SAGARPA and SEDEREC and remain to obtain the support of the technical assistance on agricultural and aquaculture activities.

In the quantitative questions, we used a scale of 1 to 10, in which 10 meant very good; nine and eight meant good; seven and six regular and five or less are catalogue as bad. Table 5 shows the scale used in this study.

Question	Max value	Min value	Mean	Mode
How do you qualify the REI?	10	7	9.04	9
How do you qualify the implemented innovations?	10	7	9.17	10
How do you qualify benefits coming from the implemented innovations?	10	8	9.36	10
How do you qualify the extension staff participation within the model REI?	10	7	9.23	9
How do you qualify the information provided regards to the extension process?	10	8	9.32	9

Table 5 Producer's assessment to the survey questions of the extension component of the CDMX.

Personal development according to survey data

From Table 5 , the most common qualifications and with the highest values were for the innovations implemented and the benefits they left.

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However, the lower evaluations (minimum) were also in innovations and the participation of the extension staff. The lowest value (minimum) assigned by the producers was 7, and it was on three questions: implementation of the innovations, participation of the extension staff and the Network model of extension and innovation. The main innovations implemented by the SAGARPA and the SEDEREC extension program, in the CDMX, under the supervision of the agricultural extension staff were the following: management of organic fertilizers, mineral, earthworm compost, improved seeds, inoculation, planting of conservation, mycorrhizae, filters to clean water, pest repellents, composting, biofertilization, new product development, business plan, design of corporate image, technical and economic journals, foliar fertilization, certification and cushioning.

In the livestock sector, the main innovations implemented were: animal transformation of raw materials into value-added products, leather tanning, earthworm compost, use of diaries and technical and economic records, preventive medicine, nutritional supplementation and diet, breeding periods, preparation of silos, good management practices, use of traps for propolis, weaning, rugs, wastewater treatment and improvement of water quality. Regards to the benefits detected by the agricultural producers are mentioned as follows: cost reduction and higher yields, higher income, obtaining knowledge, lower consumption of agrochemicals and chemical fertilizers, increased production in critical seasons, processing of products, markets, sales, less pollution of the environment, better management, linking with other companies, greater management capacity and cooperatives, better product quality, greater competitiveness, better animal health and welfare, improve the presentation of the products and a decrease in the "varroa" disease.

Conclusions

The extension program in the CDMX operated for the fourth time. This was the first year (2016) in which the INIFAP joined in the technology accompaniment. The number of chains that were selected to participate in the 2016 extension program was twelve, distributed in five agricultural: amaranth, Maize, Nopal, Vegetables and Ornamentals; five Livestock: Cattle, pigs, sheep, rabbits and bees; one in aquaculture and a cross-sectional study in rural development. All of them are representative of the agricultural sector and aquaculture of the CDMX.

The operation of the program focused on the four delegations located in the south-east of the CDMX: Milpa Alta, Tlahuac, Tlalpan and Xochimilco. The agro-productive chains that had the largest number of extension staff were Nopal and Vegetables, agricultural chains, and rabbits and sheep, in the livestock segment. Among these four chains, the 55.6% of the producers are located (31% in agricultural chains and 24.6% in the livestock, respectively).

The program allocated 29 technical staff distributed among chains and a coordinator of extension staff. The participation by gender was very relevant since 45% were women, and they provided relevant contributions in the implementation of the actions planned within the Rural Support project to the SAGARPA extension program. The number of agricultural producers incorporated in extension program was 874. From the total of participants, the gender was significant (30.4% were women), and it is inferred that the agro-productive activities in the CDMX begin to feminise.

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The structured survey with open questions (qualitative) and numerical assessments (quantitative), which was implemented, had a permissible error measured as a percentage of 9%, which is considered as acceptable in our survey. The Network Model of extension and innovation implemented had a broad knowledge among the producers interviewed. The 95.6% responded affirmatively about the existence of the extension program and the model and its agro-productive chains attended.

The 88.9% of the producers who gave their responses stated that they participated in at least one event, disclosure, dissemination of technological tour, demonstration of technology transfer, training or lectures with which the informative actions of the extension staff had high acceptance. The 95.6% of producers participating in the survey said they worked on the implementation of at least one technological innovation under the guidance and supervision of extension staff and they share experiences with other producers in their localities. This reached 631 primary producers in the CDMX.

The main benefits detected by the producers that implemented innovations were higher yields, lower costs, better quality, the transformation of their raw materials to give an added value, less pollution, better animal health and welfare, greater management capacity and awareness to associate themselves (cooperatives). Within the numerical assessments, the program identified three areas of improvement, as the variables that had the lowest ratings: to improve the participation of the extension staff, to improve the implementation of innovations and to make adjustments to the model.

Finally, the 100% of the agricultural and aquaculture producers surveyed expressed their interest in continuing with the operation of the extension component of the SAGARPA and SEDEREC.

Aknowledge

To SAGARPA through its Project Support to Rural Extension. No. SIGI: 1118933872

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Appendix

Cadena	♀	♂	Nh	Wh	nh	Wh	Mean of the stratum	Wh Mean	Variance of the stratum	Stratified variance
Amaranthus	7.00	53.00	60.00	0.07	3.20	0.07	18.76	1.33	1058.00	313.09
Ornamental	14.00	50.00	64.00	0.08	3.41	0.08	18.76	1.42	648.00	179.78
Corn	12.00	38.00	50.00	0.06	2.67	0.06	18.76	1.11	338.00	120.03
Vegetables	20.00	114.00	134.00	0.16	7.14	0.16	18.76	2.98	4418.00	585.40
Nopal	89.00	64.00	153.00	0.18	8.16	0.18	18.76	3.40	312.50	36.27
Bovine	5.00	25.00	30.00	0.04	1.60	0.04	18.76	0.67	200.00	118.37
Apiculture	26.00	37.00	63.00	0.07	3.36	0.07	18.76	1.40	60.50	17.05
Rabbits	38.00	54.00	92.00	0.11	4.91	0.11	18.76	2.04	128.00	24.70
Sheeps	21.00	69.00	90.00	0.11	4.80	0.11	18.76	2.00	1152.00	277.27
Swine	15.00	45.00	60.00	0.07	3.20	0.07	18.76	1.33	450.00	133.17
Aquaculture	12.00	36.00	48.00	0.06	2.56	0.06	18.76	1.07	288.00	106.53

Nh = Units of each of the L strata
Wh = Sample number weighted by stratum
nh = Sample number of the stratum

Table 2 Data distribution of the participating producers by value chain in the agricultural and aquaculture extension components of the CDMX

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