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Operation and Best Practices of the Department of Science and Technology Food Innovation Centers in the Philippines: Basis for Policy Enhancement

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Abstract

This study aimed to determine the status of the Department of Science and Technology Food Innovation Centers in the Philippines vis-a-vis the implementation of the program and services. Moreover, this shall be a basis for operational procedure enhancement. The respondents involved 13 functional food innovation centers and 55 staff from the different centers all over the Philippines.

The study employed descriptive research design with the survey questionnaires as the main instrument in gathering the data. To determine the profile of the respondents, the frequency count and percentage were used. For variables that generated interval data such as those responses using the Likert Scale mean and standard deviation were used. To answer the research problem and testing the hypothesis, the multiple regressive analysis was used. The following findings were obtained according to the problems presented. Majority of the respondents are within the ages 21 to 25 years old (20%), female (64%), with designation of Senior Science Research Specialist (SSRS) (27%), and Operation/Maintenance (27%), with Food Technology related courses (64%), no eligibility (47%), bachelor's degree holders (49%), contractual status of employment (53%), 3-4 years in the service (53%), most of them attended 1-10 local seminars (73%), and 1-10 international seminars (92%).

The level of awareness of the DOST-FIC staff on their VMGO obtained an overall mean of 4.60. The level of acceptability obtained an overall mean of 4.44. The degree of relevance obtained an overall mean of 4.60 which means that the respondents are very much aware of the VMGO. They much accepted the VMGO, and they perceived that the DOST-FIC VMGO is very much relevant.

The DOST-FICs have adequate supply for the other support services such as tools/utensils/materials, equipment, other facilities, building and staff, which obtained an overall mean of 3.64 interpreted as moderately adequate that would support on the performance of the services offered by DOST-FICs in the different functional centers in the Philippines. The mean perception of the respondents on the Operational Procedures of DOST – FIC obtained an overall mean of 4.04 interpreted that the staff respondents moderately agree that the DOST-FIC oftentimes perform the operational procedures. In

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the light of the findings, it is concluded that DOST-FIC was rated higher in performance by the respondents which are younger; respondents with Food Technology courses, and Food Technology related courses; non-eligible respondents; respondents with higher educational attainment; and respondents with lesser number of years in service with the Center. Furthermore it is concluded that the strong significant predictors of the performance of DOST-FIC are the proper and always execution of the operational procedures; length of service of the staff, and related trainings. The hypothesis posited in the study that the respondents' demographic profile; DOST-FIC's profile, and the operational procedures and best practices, singly or in combination predict significantly its (DOST-FIC) performance is partially sustained.

Keywords: *Food Innovation Centers, DOST Philippines, operational procedures, MSMEs support, food technology services*

INTRODUCTION

The Department of Science and Technology (DOST) has always designed and implemented projects and programs that are meant to enhance productivity for the country thereby improving the quality of life of the people it serves. This has been a consistent move of the department since it is covered as one of its mandates.

One of the many initiatives of DOST is the implementation of the National Innovation strategy called "Filipinovation" which seeks to nurture competitiveness and innovation among Filipino firms, products and services through increased research and development. It should be stressed though that the generation of significant research results and technological progress will not create competitive advantage without practical application of the vital step that transforms research breakthroughs into innovation products and services.Based on this premise, the establishment of a Food Innovation Center (FIC) in every region in a chosen academe or LGU as the host institution intends to enhance the innovation capacities of MSME's in the food industry to improve the quality of their existing products and/or develop new ones; thereby increasing their competitiveness in local and expert markets.

The Food Innovation Center is a facility being established to assist food producers, processors, marketers, and entrepreneurs as they develop, improve and promote their products. Food and beverage (F& B) processing is a booming industry in the Philippines. It is comprised of the following major sectors: beverages, coffee and cacao, condiments and seasonings, dairy products, fats and oils, flour and bakery products, fruits and vegetables, meat and poultry products, seafood products, snacks foods and sugar and confectionery. Quadrupling to $27.1 billion in five years (2009 – 2013), the food processing industry contributes 50% to the country's total manufacturing output. While most of the roughly 500 f & b processors registered under the Philippines Food and Drug Administration are Micro or Medium- sized business.

The Food Processing Firms (FPFs) are recognized to be the prime movers of the country's economic growth. FPFs provide a reliable and equitable basis for economic development as experienced by most successful and newly industrialized countries in the world. However, technology-based food based food processors in the country are confronted with barriers regarding access to information, capital and high cost of equipment. Acquisition of state of the art equipment deprived local manufacturers of the opportunity to expand their product lines in order to meet diverse range of customer requirements. The competitiveness of the manufacturing sector specifically, food processors continue to lag our ASEAN neighbors Thailand, Malaysia, Indonesia, and now Vietnam. Processed products particularly food

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manufactured by said neighbors are more competitive (price and quality wise) continue to be sold and patronized by the local market. (DOST, ITDI)

In year 2011, the project entitled "Design and Development of Process Equipment for Food Processing Firms" aimed to develop locally fabricated process equipment for the food processing industry sector was approved and funded under the DOST GIA Program. The project was implemented by the ITDI in cooperation with the MIRDC and the Project Management Engineering Design Services Office (PMEDSO) of DOST. The activities undertaken include design development fabrication and performance testing of five prototype equipment which was identified as primary needs of food processing industry that requires importation. These are the Spray Dryer, Vacuum Fryer, Water Retort, Freeze Dryer and Vacuum Packaging Machine. Functional and performance testing of the seven-equipment prototype were already completed. Field testing of equipment is ongoing in cooperation with targets cooperators to monitor the actual operating performance of equipment prototypes. The project is on its final stage particularly, gathering of data/feedback from project cooperation on the use of equipment and identifying possible areas to further enhance the efficiency of the equipment. Plan to facilitate its transfer to potential users is underway.

Along this line, a project entitled: Roll-Out of Five Food Processing Equipment Prototypes in the Regions has been proposed which intends to promote and demonstrate the functionality of the locally fabricated food processing equipment developed under the DOST HITS Program. This approach is vital for these food processing equipment prototypes to proceed to commercialization stage. Hence, this will enable the designers / engineers involved in the prototyping to validate performance acceptability and carry on innovation to further improve their capacities in support of start –ups/micro food processors.

The Department of Science and Technology Food Innovation Centers envisions to become a fully equipped service center fostering innovation and bringing new products to the market, an industry shared world class facility for food product development and processing, and a leading network of innovation hubs providing critical support to the food industry in the Philippines. (DOST, ITDI). Moreover, its mission includes: to serve as hubs for innovations, R&D, and support services for the development of processed foods; to provide innovative technologies and relevant technical support services to contribute to inclusive and sustainable development of the food industry in the Philippines; and to enable product innovation and diversification in order to maximize value addition to diverse agricultural and fishery resources.

It is noteworthy to note that the Department of Science and Technology (DOST) is targeting to set up and launch Food Innovation Centers (FICs) this CY 2017 in seven of the country's 17 regions. Dr. Carol Yorobe, DOST undersecretary for regional operations, said the department has a P66-million budget this year for the construction and provision of equipment for the seven FICs. Yorobe said the establishment of FICs is one of their projects under the DOST's High Impact Technology Solutions (HITS) program. The DOST requires the FICs to be situated in state universities and colleges or in private higher educational institutions to give the college students access to a facility with modern equipment and where they can study and pursue research and development (R&D) on food processing. The FIC will also allow food processing firms to use the modern equipment and facilities to process their food products and also undertake food processing R&D.

Indeed, the establishment of FICs harmonizes activities and rationalizes resources for industry development through better interface among R&D agenda technology generation, S&T programs and food industry needs. The existence of Food Innovation Centers in the Philippines and how these centers are managed will be magnified in this paper. How the FICs operate under the department may serve as a basis for possible revision or enhancement of existing policies that will eventually lead to the attainment of the very mandate of the Department of Science and Technology.

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This paper assessed the operation of the Food Innovation Centers in the Philippines and highlighted the strengths of each center at the same time noted their weaknesses or problems encountered which may serve as basis for improving and enhancing the already existing policies of the centers or may serve as basis for the creation of some other policies that will be beneficial to the operation of the centers.

In Region 02, the DOST FIC is located at Cagayan State University, Carig Campus and the researcher is a faculty of the College of Industrial Technology, , teaching food technology subjects, expert on food product development, author of several food technology books and seven (7) patents on utility models and was designated as project leader of Package for the improvement of Nutrition of Young (PINOY) Filipino Children Program of the DOST – CSU FIC, it is for that reason why the researcher was encouraged to conduct this study.

Objectives of the Study

The study aims to assess the operation of the Department of Science and Technology Food Innovation Centers in the Philippines vis-a-vis the implementation of the program and services. Specially, it sought to answer the following questions:

1. How can the profile of the administrators, and staff of DOST- FIC be described in terms of?

    a. Age
    b. Sex
    c. Designation
    d. Course / Major
    e. Eligibility
    f. Highest Educational Attainment
    g. Status of Employment
    h. No. of years in service
    i. Related local seminars / Trainings attended
    j. Related international seminars / Trainings attended

2. How can the profile of DOST- FIC be described in terms of:

    a. Vision
    b. Mission
    c. Goals
    d. Objectives

3. How can the other support services be described in terms of:

    a. Tools/Utensils/Materials
    b. Equipment
    c. Other Facilities
    d. Building
    e. FIC Staff

4. How can the following operational procedures / best practices of DOST – FIC be described?

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a. Eligibility of firms/ MSMEs
b. Provision of services and use of facilities
c. Intellectual property (IP) management
d. Marketing/promotional strategies
e. Monitoring and evaluation
f. Sustainability mechanism
g. Procedures for customers transactions
h. Schedule of fees
i. Schedule for operation

5. What is the level of DOST- FIC performance in terms of the following services?

a. Technology Hubs for food processing for short-run production
b. Food Research and Laboratory Testing for:

1. Process and product development
2. Shelf-life testing
3. Nutritional labeling
4. Sensory evaluation
5. Food Quality and Safety Test

c. Technology Information
d. Technology Trainings
e. Technical Consultancy and Advisory
f. Packaging and labeling Services
g. Rental of Equipment

6. Do the following factors predict the performance of DOST-FIC?

a) Profile of the administrators and staff of DOST- FIC in terms of age, sex, designation, course / major, eligibility, highest educational attainment, seminars / trainings attended, no. of years of related experience;
b) Profile of DOST- FIC in terms of vision, mission, goals, objectives;
c) Other support services such as tools/utensils/ equipment, other facilities, building, FIC staff?
d) Operational Procedures / Best Practices: Eligibility of firms/ MSMEs,
e) Provision of services and use of facilities, Intellectual property (IP) management, Marketing/promotional strategies, Monitoring and evaluation, Sustainability mechanism Procedures for customer's transactions, Schedule of fees, and schedule of operation?

METHOD

Research Design

This study used a descriptive and predictive research utilizing correlation technique in determining the relationship of operation of DOST FIC to the performance of its services. This descriptive research describes the nature of the situation as it exists at the time of the conduct of the study

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Population and Sample

The respondents of the study were the administrators, and staff of the different DOST - FIC's in the Philippines. The table below presents the frequency distribution of the respondents coming from the different FICs in the Philippines.

Table 1. Frequency Distribution of Respondents

DOST – FICs	Number of Respondents
ITDI - DOST Central Office, Bicutan, Taguig City	3
NCR – University of the Philippines, Diliman, Department of Science and Nutrition, Alonzo Hall, College of Home Economics, UP Diliman, Quezon City	2
RO1 – Pangasinan State University, Zone IV Poblacion, Bayambang, Pangasinan	6
RO2 – Cagayan State University (Carig Campus), Carig Sur, Tuguegarao City, Cagayan	8
RO4A – University of the Philippines Los Banos, Food Science Cluster Pilot Plant, amboree Rd., Los Banos, Laguna	___
RO4B – Mindoro State College of Agriculture and Technology, Masipit, Calapan City, Oriental Mindoro	5
RO6 – Guimaras State College (Mosqueda Campus), Alaguisoc, Jordan, Guimaras	5
RO7 – Cebu Institute of Technology, N. Bacalso Ave., Cebu City	3
RO8 – Eastern Visayas University, Salazar St., Quarry District, Tacloban City, Leyte	7
RO9 – Zamboanga State College of Marine Science and Technology – Rio Hondo, Zamboanga City	6
RO10 – Mindanao University of Science and Technology, Claro M. Recto Ave., Lapasan, Cagayan de Oro City	4
RO11 – Philippine Women's College, Juna Subd., Matina, Davao City	6
RO13 – Caraga State University (CSU Campus), Ampayon, Butuan City	____
Total	**55**

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Research Instruments

The questionnaire was designed to gather the profile of the respondents' in terms of age, sex, designation, course / major, eligibility, highest educational attainment, seminars and trainings attended, number of years in service; the profile of DOST – FIC in terms of the vision, mission, goals and objectives; the services offered by the FIC in terms of technology hubs for food processing for short-run production; food research and testing laboratories; packaging and labeling services; technology information; technology trainings; technical consultancy and advisory and other support services in terms of equipment, buildings, and budget; and the status of the operation of DOST –FICs.

Statistical Treatment of Data

The responses to the questionnaire were collated, tallied, coded and entered into the data matrix for statistical treatment using the SPSS computer package software.For descriptive presentation of data, the following statistical tools were applied: (1) Frequency and percentage were used for variables that generate nominal or categorical data; (2) Mean and standard deviation were used for variables that generated interval data such as those responses using the Likert Scale; (3) problem and testing the hypothesis, the multiple regression analysis was used.

To analyze the data gathered the following mean range and interpretation was adopted: 4.51 - 5.00- Very Much Aware; 3.51 - 4.50- Much Aware; 2.51 - 3.50 - Moderately Aware; 1.51 - 2.50- Slightly Aware; 1.00 – 1.50 -Not Aware.

RESULTS AND DISCUSSION

Demographic Profile of the Respondents

The modal profile of the respondents is 21-25 years old (20%), female (64%), Senior Science Research Specialist (SSRS) (27%), and Operation/Maintenance (27%), Food Technology related courses (64%), No Eligibility (47%), bachelor's degree holders (49%), Contractual status (53%), 3-4 years in the service (53%). Most of the respondents attended 1-10 local seminars (73%), and 1-10 international seminars (92%)

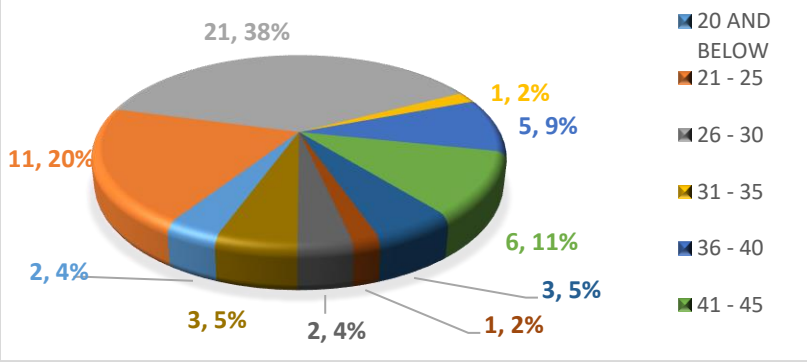

Figure 1. Frequency and Percentage Distribution of the Respondents' Age

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Sex

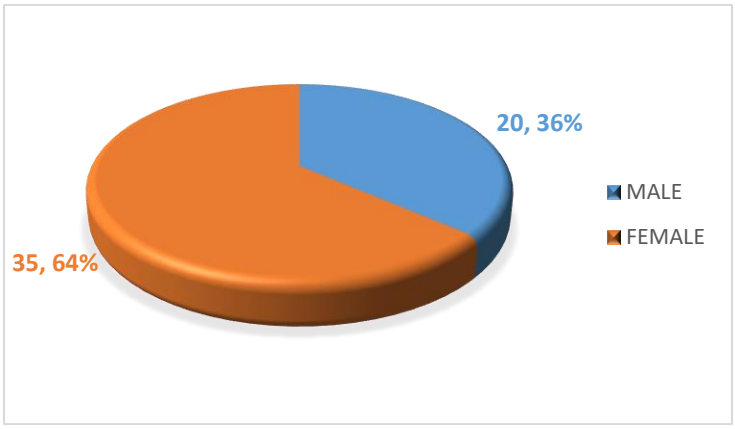

Figure 2. Frequency and Percentage Distribution of the Respondents' Sex

Designation

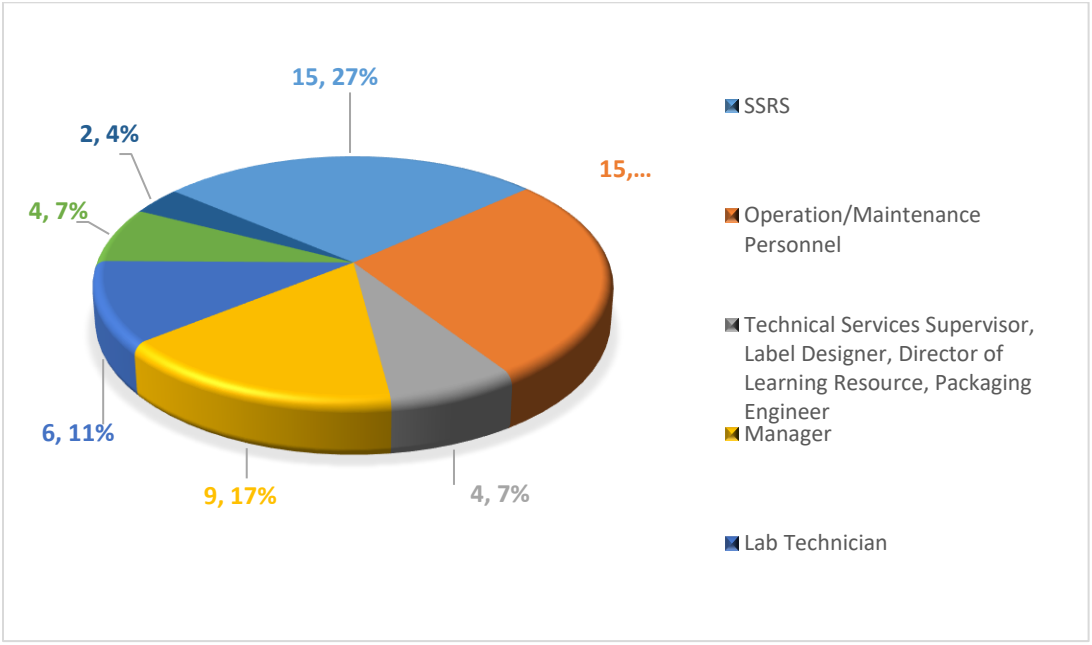

Figure 3. Frequency and Percentage Distribution of the Respondents' Designation

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Course / Major

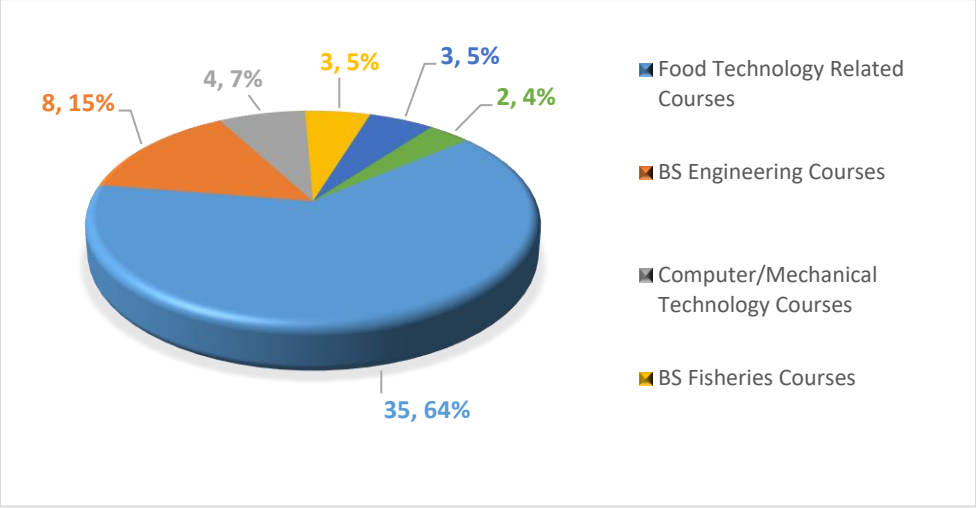

Figure 3. Frequency and Percentage Distribution of the Respondents' Course/Major

Eligibility

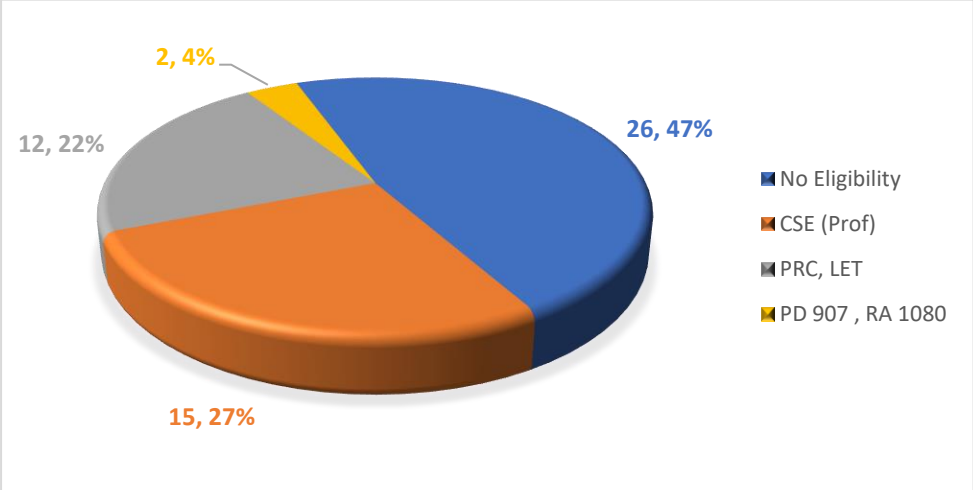

Figure 5. Frequency and Percentage Distribution of the Respondents' Eligibility in the Government Service

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Educational Attainment

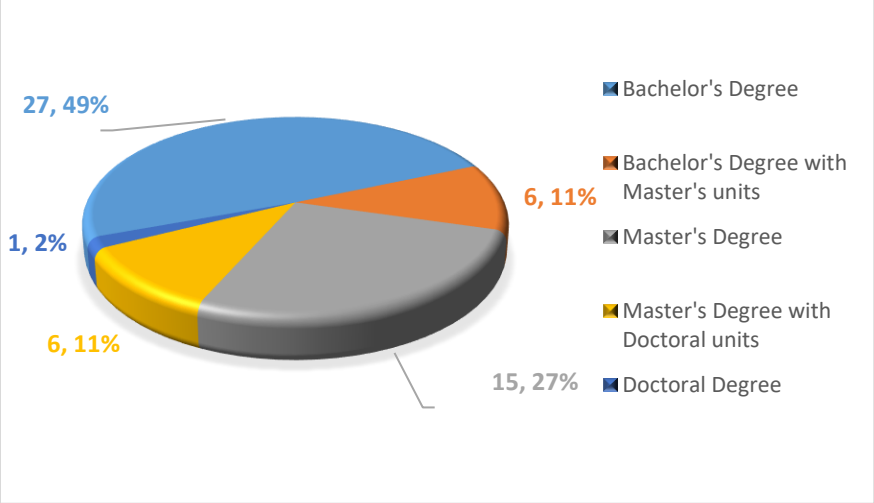

Figure 6. Frequency and Percentage Distribution of the Respondents' Highest Educational Attainment

Status of Employment

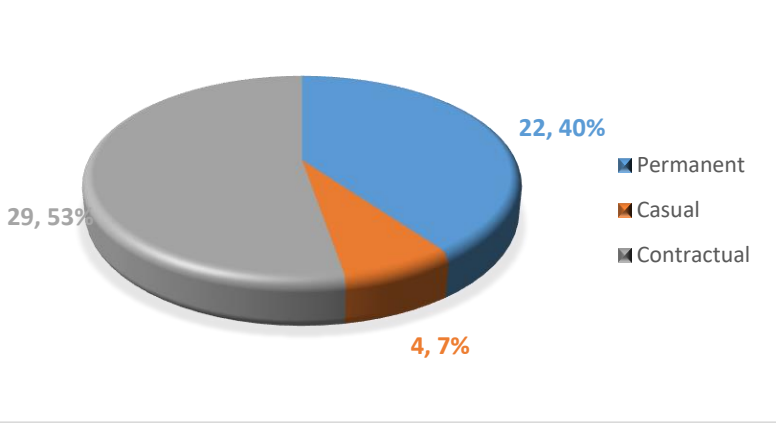

Figure 7. Frequency and Percentage Distribution of the Respondents' Status of Employment

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Years in Service

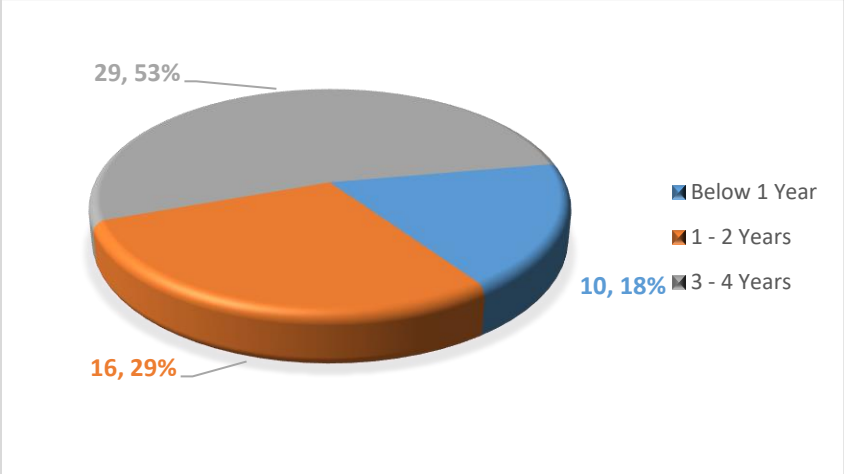

Figure 8. Frequency and Percentage Distribution of the Respondents' Stay or Years in Service at the DOST- FIC

Local Seminars and Trainings Attended

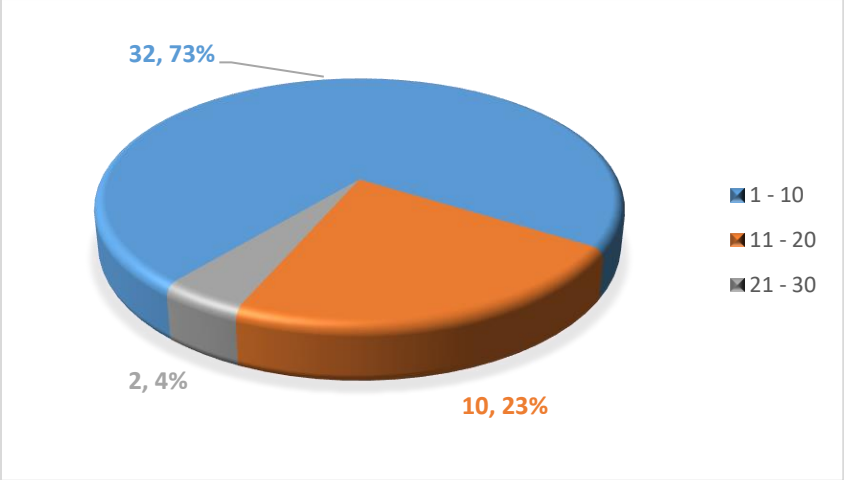

Figure 9. Frequency and Percentage Distribution of the Respondents' Local Seminars and Trainings Attended

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International Trainings Attended

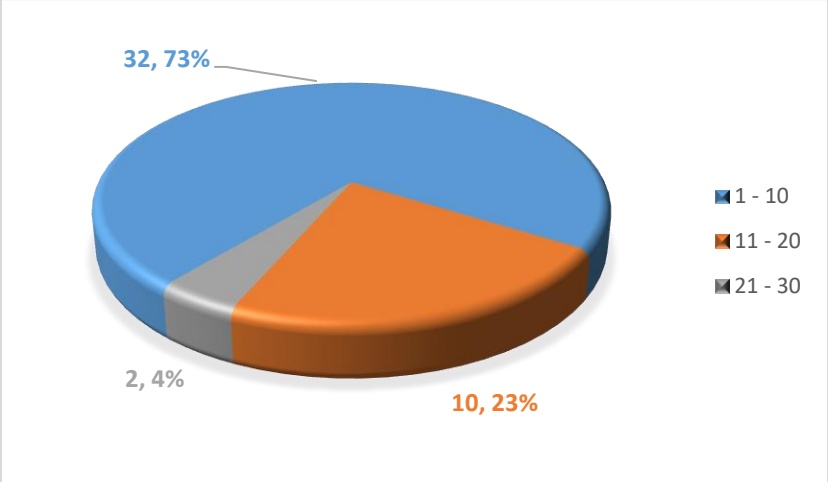

Figure 10. Frequency and Percentage Distribution of the Respondents' International Trainings Attended

Level of Awareness, Acceptability and Degree of Relevance of FICs VMGO As Perceived by the Its Administrators and Staff

The level of awareness of the DOST-FIC staff with its VMGO obtained an overall mean of 4.60. The level of acceptability obtained an overall mean of 4.44. The degree of relevance obtained an overall mean of 4.60 which means that the respondents are very much aware of the VMGO, they much accepted the VMGO, and they perceived that the DOST-FIC VMGO is very much relevant.

Level of Awareness of the DOST – FIC VMGO

Table 2 presents the mean perception of the Respondents' on the Level of Awareness on the Vison, and Mission of the DOST – FIC. As reflected in Table 2 below, the respondents are *very much aware* of the vision of the FIC ($\bar{x}$ = 4.58). They are *very much aware* that the center is fully equipped, fostering innovation and bringging new products to the market ($\bar{x}$ = 4.69); the respondents are *much aware* that it shared world class facility for food product development and processing ($\bar{x}$ = 4.45) and they are *very much aware* that the center is a leading network of innovation hubs providing critical support to the food industry in the Philippines ($\bar{x}$ = 4.60).

Table 2. Mean Distribution of Level of Awareness on the Vision, Mission of the DOST– FIC

Extent of Awareness on			
Vision	**$\bar{x}$**	**SD**	**Interpretation**
1.A fully equipped service center fostering innovation and bringing new products to the market;	4.69	0.50	Very Much Aware
2. An industry shared world class facility for food product development and processing	4.45	0.69	Much Aware

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3. A leading network of innovation hubs providing critical support to the food industry in the Philippines.	4.60	0.60	Very Much Aware
Average	**4.58**	**0.60**	**Very Much Aware**
Mission			
1. To serve as hubs for innovations, R&D, and support services for the development of processed foods;	4.78	0.42	Very Much Aware
2. To provide innovative technologies and relevant technical support services to contribute to inclusive and sustainable development of the food industry in the Philippines;	4.73	0.49	Very Much Aware
3. To enable product innovation and diversification in order to maximize value addition to diverse agricultural and fishery resources.	4.69	0.50	Very Much Aware
Average	**4.73**	**0.49**	**Very Much Aware**

Looking at the respondents awareness on the mission of the FIC, the same Table shows that they have high level of awareness of the mission of the center ($\bar{x}$ = 4.73). They are *very much aware* that the center aims to serve as hubs for innovations, R and D, and support services for development of processed foods; similarly the FIC administrators and staff are *very much aware* on the mission to provide innovative technologies and relevant, and technical support services (X= 4.73); and so with the mission to enable enable product innovation and diversification in agriculture and fishery (X=4.69). The small average SDs of 0.60 and 0.49 respectively denote homogeneous responses from the respondents.

Degree of Acceptability of the DOST - FIC VMGO

Table 3 presents the mean average of the acceptability of the DOST-FIC VMGO as perceived by the respondents. The respondents *much accepted* the vision, with average mean ($\bar{x}$ = 4.36). Likewise they *much accepted* all the sub-scale indicators: fully equipped service center fostering innovation and bringing new products to the market ($\bar{x}$ =4.22), an industry shared world class facility for food product development and processing ($\bar{x}$ = 4.38) and, leads network of innovation hubs providing critical support to the food industry in the Philippines ($\bar{x}$ = 4.49).

Table 3. Mean Distribution of Degree of Acceptability of Vision and Mission Of the DOST – FIC

Vision	**$\bar{x}$**	**SD**	**Interpretation**
1.A fully equipped service center fostering innovation and bringing new products to the market;	4.22	0.90	Much Accepted
2.An industry shared world class facility for food product development and processing	4.38	0.73	Much Accepted
3. A leading network of innovation hubs providing critical support to the food industry in the Philippines.	4.49	0.77	Much Accepted

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Average	**4.36**	**0.80**	**Much Accepted**
Mission			
1.To serve as hubs for innovations, R&D, and support services for the development of processed foods;	4.64	0.68	Very Much Accepted
2.To provide innovative technologies and relevant technical support services to contribute to inclusive and sustainable development of the food industry in the Philippines;	4.51	0.74	Much Accepted
3. To enable product innovation and diversification in order to maximize value addition to diverse agricultural and fishery resources.	4.64	0.62	Very Much Accepted
Average	**4.59**	**0.68**	**Very Much Accepted**

The findings also indicate that the respondents *very much accepted* the mission of the DOST-FIC, with an average mean ($\overline{x}$ = 4.59). Similarly, *very much accepted* to serve as hubs for innovations, R&D and support services for the development of processed foods ($\overline{x}$ = 4.64) and to enable product innovation and diversification in order to maximze value addition to diverse agricultural and fishery resources ($\overline{x}$ = 4.64); however the respondents *much accepted* on the mission to provide innovative technologies and relevant tchnical support services to contribute to inclusive and sustainable development of the food industry in the Philippines ($\overline{x}$ = 4.51). The small values of SDs denote homogeneous responses.

Degree of Relevance of the DOST – FIC VMGO.

Table 4 presents the mean average perception of the respondents on the degree of relevance of the vision and mission of DOST – FIC.The findings on Table 4 below shows that the respondents perceived the vision as *very much relevant* ($\overline{x}$ = 4.60), They also believed the *very much relevance* of fully equipped service center fostering innovation and bringging new products to the market ($\overline{x}$ = 4.65); an industry shared world class facility for food product development and processing ($\overline{x}$ = 4.58); A leading network of innovation hubs providing critical support to the food industry in the Philippines as very much relevant ($\overline{x}$ = 4. 56).

Table 4. Mean Distribution of Degree of Relevance of the DOST – FIC Vision, Mission, Goals, and Objectives

Vision	X	SD	Interpretation
1.A fully equipped service center fostering innovation and bringing new products to the market;	4.65	0.58	Very Much Relevant
2.An industry shared world class facility for food product development and processing	4.58	0.60	Very Much Relevant
3.A leading network of innovation hubs providing critical support to the food industry in the Philippines.	4.56	0.60	Very Much Relevant

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Mean Average	**4.60**	**0.59**	**Very Much Relevant**
Mission			
1.To serve as hubs for innovations, R&D, and support services for the development of processed foods;	4.69	0.50	Very Much Relevant
2.To provide innovative technologies and relevant technical support services to contribute to inclusive and sustainable development of the food industry in the Philippines;	4.56	0.54	Very Much Relevant
3.To enable product innovation and diversification in order to maximize value addition to diverse agricultural and fishery resources.	4.69	0.57	Very Much Relevant
Average	**4.65**	**0.54**	**Very Much Relevant**

Likewise, the mission of the DOST-FIC percieved by the respondents as very *much relevant* ($\bar{x}$ = 4.65). The following indicators have similar mean perceived interpretations as *very much relevant*: to serve as hubs for innovations, R&D , and support services for the development of processed foods ($\bar{x}$ = 4.69); to provide innovative technologies and relevant technical support services to continue to inclusive and sustainable development of the food industry in the Philippines ($\bar{x}$ = 4.56); and to enable product innovation and diversification in order to maximize value addition to diverse agricultural and fishery resources ($\bar{x}$ = 4.69).

Status or Adequacy of DOST-FIC's Other Support Services. (Tools/Utensils/Materials, Equipment, Other Facilities, Building, and FIC Staff)

Part of the input variables of this study using the independent and dependent variable model is the other support services which includes the tools/utensils/materials, equipment, other facilities, building and FIC staff. Table 5 shows the mean average of the respondents' perception on the support services in terms of tools/utensils/materials of the DOST- FIC.

Table 5. Mean Distribution of DOST-FICs Support Services in terms of Tools/Utensils/Materials

1.Tools / Utensils / Materials	$\bar{x}$	**SD**	**Description**
1.1. Set of measuring spoons	4.27	0.89	Very Adequate
1.2. Set of measuring cups	4.25	0.93	Very Adequate
1.3. Measuring Glass	3.75	1.22	Very Adequate
1.4. Weighing scales	4.33	0.88	Very Adequate
1.5. Refractometer	4.16	0.92	Very Adequate
1.6. Salinometer	2.49	1.72	Slightly Adequate
1.7. Knives	4.25	1.06	Very Adequate
1.8. Tongs	4.22	0.99	Very Adequate
1.9. Spatula	4.35	0.84	Very Adequate
1.10. Wire whisk	4.00	1.28	Very Adequate
1.11. Strainer	4.05	1.21	Very Adequate

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1.12. Ladles	4.09	1.25	Very Adequate
1.13. Chopping board	4.22	1.08	Very Adequate
1.14. Utility trays	4.20	1.08	Very Adequate
1.15. Colander	4.13	1.06	Very Adequate
1.16. Mixing bowls	4.13	1.11	Very Adequate
1.17. Steamer	3.60	1.36	Very Adequate
1.18. Casserole	3.67	1.23	Very Adequate
1.19. Pails	3.76	1.23	Very Adequate
1.20. Crates	3.76	1.35	Very Adequate
1.21. Burner	3.93	1.20	Very Adequate
1.22. Gas range	3.69	1.53	Very Adequate
1.23. Gas tanks	4.53	0.69	Very Much Adequate
Average	**3.99**	**1.13**	**Very Adequate**

It is shown in Table 5 that the tools /utensils/materials except for the gas tank which is rated (X=4.53) *very much adequate* are *very adequate.* Set of measuring spoons ($\bar{x}$ = 4.27); set of measuring cups (X=4.25); measuring glass (X=3.75); weighing scales (X=4.33); refractometer (X=4.16); knives (4.25); tongs (X=4.22); spatula (X= 4.25); wire wisk (X=4.00); strainer (X=4.05); ladles (X=4.09); chopping board (X=4.09); utility trays (X=4.20); colander (X=4.13); mixing bowls (X=4.13); steamer (X=3.60); casserole (X=3.67); crates (X=3.76); pails (X=3.76); burners (X=3.93); and gas range (X=3.69), while the salinometer obtained a mean ($\bar{x}$ =2.49) which is interpreted as *slightly adequate*. The mean average for tools/utensils and materials is ($\bar{x}$ =3.99) interpreted as *very adequate.* The SD values denote homogeneous responses.

All the other materials, utensils and tools are adequate: set of measuring spoons (4.27); The result pinpoints that , there is an adequacy of supply of tools/utensils/materials in all functional DOST-FICs in the Philippines.

Operational Procedures of DOST – FIC

One of the independent variables of this study using the IV and DV model is the operational procedures of DOST-FIC as measured by the indicators: eligibility of firm / MSMEs, Provisions of Services and use of Facilities, Intellectual Property (IP) Management, Marketing / Promotional Strategies, Monitoring and Evaluation, Sustainability Mechanism, Procedure for Customer Transactions, Schedule for Fees, Equipment Rental Rates, and Schedule for Operation.

Table 6 presents the mean average of the respondents' perception on the operational procedures in terms of eligibility of firm / MSMEs and provisions of services and use of facilities of DOST – FIC.

Table 6 below shows the mean average of the respondents' perception in terms of eligibility of firm / MSMEs and provisions of services and use of facilities of DOST – FIC. It obtained a mean average of 4.03, with the interpretation that the respondents *moderately agree* that DOST – FIC follows its standard procedures especially on eligibility of firms / MSMEs with ($\bar{x}$=4.32), provisions of services and use of facilities with a ($\bar{x}$=4.15). All the small SD values are close with each that denote homogeneity of responses. The findings reveal that this operational procedure particularly on eligibility of firm/MSMEs and provisions of services and use of facilities are oftentimes used by the DOST-FIC in performing their services to their clients.

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Table 6. Mean Distribution of Operational Procedures of DOST-FICs in terms of Eligibility of Firm / MSMEs, and Provisions of Services and Use of Facilities

1. Eligibility of Firm/MSMEs	$\bar{x}$	SD	Interpretation
a. The company or individual firm is based in the Philippines and is wholly owned by Filipino citizens.	4.45	0.79	Moderately Agree
b. The micro, small, or medium scale business firm is willing to apply technological innovations to the existing operations; or adopt the technology, case of start-ups.	4.18	0.86	Moderately Agree
c. The interested individuals, organizations an institutions is engaging in food research and development.	4.31	0.72	Moderately Agree
Average	**4.32**	**0.79**	**Oftentimes**
2. Provisions of Services and use of Facilities			
a. The center provides a GMP compliant food processing facilities and acquires License to Operate from Food and Drug Administration; The use of the centre's LTO by customer is included in Terms of Reference; Compliance to Occupational Safety and Health requirements shall also be observed.	3.55	1.63	Moderately Agree
b. Customers that initially avail of the FPIC services are given prior orientation on GMP and OSH.	4.13	0.98	Moderately Agree
c. All engagements with stakeholders (firms, public and private entities) is covered by Terms of reference (TOR). A specific and customized TOR is prepared by the Center based on a generic template.	4.40	0.85	Moderately Agree
d. Each center formulates appropriate guidelines, vis vis, terms and conditions on the use of each equipment to include among others the prioritization, length of use, and responsibilities of stakeholders.	4.55	0.69	Highly Agree
Average	**4.15**	**1.04**	**Oftentimes**

Services Offered by the DOST- FIC

One of the cluster dependent variables of this study using the IV and DV model is the services offered by the DOST-FIC such as techno hubs for food processing for short-run production, food research and testing laboratories, packaging and labelling services, technology information, technology trainings, technical consultancy and advisory and rental of equipment.

Table 7 presents the mean average of the respondents' perception of DOST-FIC services in terms technology hub. As shown, it got an average mean of ($\bar{x}$ = 3.85). The indicators; shared use as a common service facility ($\bar{x}$ = 3.82), food technology faculty and students ($\bar{x}$ = 4.33), MSME food processors and other food establishments use equipment alternately or jointly for a specified schedule ($\bar{x}$ = 4.22); and toll processing/packaging as to the use of the facility or equipment is on required basis/need basis ($\bar{x}$ = 3.87). All were perceived *often* done services by the DOST-FIC, and *sometimes* done with regards to the service, specific production run(s) of the firm (s) and limited to a specific period with ($\bar{x}$ = 3.27). It implies that

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the services offered by DOST-FIC particularly on Technology Hub is not yet fully utilized by the expected stakeholders such as Food Technology and other related courses; faculty and students; and MSMEs food processors. All the values of SD denote homogenuity of respondents' perceived responses.

Table 7. Mean Distribution of Services Offered by the DOST-FIC in terms of Technology Hub

I. Technology Hub	**$\bar{x}$**	**SD**	**Description**
1.Shared - Use			
a. As a common service facility	3.82	1.11	Often
b. Food Technology faculty and students	4.33	0.67	Often
c. MSME food processors and other food establishment use equipment alternately or jointly for a specified schedule	4.22	0.90	Often
2.Toll Processing/Packing			
a. Use of the facility or equipment is on required basis/need basis	3.87	0.98	Often
b. Specific production run(s) of the firm(s) and limited to a specific period	3.27	1.38	Sometimes
Others:			
Average	**3.85**	**1.04**	**Often**

Predictors of DOST-FIC Performance

The result of the stepwise multiple regression analysis shows that input and process variables significantly predict the FIC performance as technology hub for food processing service as shown in Table 8.

Table 8. Predictors of DOST- FIC Performance in Technology Hub For Food Processing Service

Predictors	Beta	t-value	Sig,
Operational Procedures	0.985	11.107	0.000
Eligibility	-0.078	2.682	0.010
Educational Attainment	0.168	2.163	0.035
Local Trainings Attended	0.168	8.346	0.000
International Trainings Attended	0.090	3.665	0.001

Adjusted R Square = 0.983

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F = 630.681

Sig. = 0.000

As gleaned from the Table 8, the operational procedures as process variables are strong predictors of the performance of the FIC as Technology hub for food processing. The beta coefficient of 0.985 with a t-value of 11.107 is highly significant (p = 0.000). This simply means that the operational procedures and policies adopted by the centers have positive effect on its service performance particularly on its function as technology hub for food processing. Statistically, for every standard deviation unit-increase in adherence to standard policies and procedures in the operation of the center, there is 0.985 standard deviation unit increase in its service performance as a center for technology hub processing for short-run production.

Surprisingly, the eligibility of the respondents has negative effect on the performance of the center as a technology hub for food processing for short-run production. The negative beta coefficient (-0.078) with -2.682 t-value is significant at the 0.01 level. The negative effect of eligibility can be explained by the fact that the center accepts non-eligible applicants who meet the minimum educational qualification as long as they are trainable and have positive work attitude. As indicated in table 8, educational attainment with 0.168 beta coefficient and a t-value of 2.163 is significant with 0.036 exact probability value. This means that the educational attainment of its employees spells out also the quality of performance of the center. As further indicated in the table, trainings of the employees both local (Beta = 0.168) and international (Beta = 0.090) are significant predictors of service performance in technology and food processing service. Statistically, this means that the more local and international trainings participated in by the employees of the center, the higher also is the center performance as Technology hub for food processing for short run production.

The adjusted R Square implies that 98.3% of the variance in performance of the center as technology hub for food processing for short-run production is explained by the operational procedures, the respondent's eligibility educational attainment, local and international trainings attended.

Predictors of DOST-FIC Performance in Food Research and Laboratory Testing Service

Table 9. Regression of Food Research and Laboratory Testing Service Performance on Independent Variables

Predictors	Beta	t-value	Sig,
Operational Procedures	0.847	5.424	0.000
Years in Service	-0.239	2.711	0.009
Local Training Attended	-0.093	2.221	0.031
International Training Attended	0.127	2.621	0.012

Adjusted R Square = 0.945

F = 185.037

Sig. = 0.000

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Table 9 shows that the operational procedures, years in service, local and international trainings predict significantly the DOST-FIC Food Research and Laboratory Testing Center.

In this study, it is found that the operational procedures significantly predict the performance of the support services. The Beta coefficient (0.847) with 5.424 t-value and is highly significant at the 0.000. It implies that in this study, the more the DOST-FIC staff follow the set standards for operational procedures, the better the performance and the results produced by the DOST- FIC Food Research and Laboratory Testing Center.

Years in service significantly predicts the Support Services of DOST-FIC Food Research and Testing Laboratories. The negative beta coefficient of -0.239 with 2.711 t-value is significant at the 0.009 level. It reveals that in this study, the younger respondents rated this service higher than their older counter parts. This can be explained by the fact that the younger employees who usually attend trainings become more competent with their updated knowledge and skills to improve the performance of the Center. As supported statistically both local (Beta = -0.093) and international (Beta = 0.127) trainings attended by the respondents significantly predict the services of DOST-FIC in terms of food research and laboratory testing service. The more local and international trainings they receive, the better they perform in food research and laboratory testing service. This is so because the international standards are being taught during this training and being adopted in the DOST-FIC.

The adjusted R square indicates that 94.5% of the variance in the performance of DOST-FIC in Food Research and Laboratory Testing Service is explained by the operational procedures, the respondents' years in service, local and international trainings attended.

Predictors of DOST - FIC Performance in Packaging and Labeling Service

The result of the stepwise multiple regression analysis shows that the operation procedures, age, eligibility, course/major, local training attended predict significantly the services of DOST-FIC on packaging and labeling services.

Table 10
Regression of Services of DOST - FIC (Packaging and Labeling Services)

On Independent Variables

Predictors	Beta	t-value	Sig,
Operational Procedures	1.306	18.306	0.000
Age	0.232	2.815	0.007
Eligibility	-0.072	2.291	0.026
Course / Major	0.203	3.160	0.003
Local Training Attended	0.053	2.239	0.030

Adjusted R Square = 0.983

F = 638.215

Sig. = 0.000

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As statistically indicated the operational procedures significantly predict the performance of the DOST – FIC. The Beta coefficient (1.306) with 18.306 t-value and is highly significant at the 0.000 level. It implies that in this study, the more the staff respondents follow the set standards for operational procedures, the better the performance of DOST-FIC in terms of packaging and labeling services.

Age likewise (Beta = 0.232) is also a significant predictor of FIC in terms of packaging and labeling service. The t-value of 2.815 and is significant at the 0.007 level. This means that the older staff respondents the better is their assessment of the performance of the DOST- FIC on packaging and labelling service.

In this study, the eligibility significantly predicts negatively the performance of the support services. The negative beta coefficient (-0.072) with 2.291 t-value and is highly significant at the 0.026 level. It implies that respondents with no eligibility are found to perform better particularly in the Packaging and Labeling Services.

The respondents' course/major significantly predicts also the performance of DOST-FIC - Packaging and Labelling Services with the beta coefficient of 0.203 and t- value of 3.160 and which significant at the 0.003 level. This implies that the more relevant the course/major the respondent have, the better they perform particularly in the packaging and labelling services.

The (Beta = -0.093) of local training attended by the respondents significantly predicts the performance of DOST-FIC particularly Packaging and Labeling Services. The more local training they receive, the higher is the FIC performance in this particular function of the Center.

The adjusted R Square indicates that 98.3% of the variance in the performance of the Center in packaging and labeling services is explain by the operational procedure in combination with the respondents' profile variables such as age, eligibility courses/major, field of specialization, and local training attended.

Predictors of DOST - FIC Performance in Technology Information Service

The result of the stepwise Multiple Regression Analysis shows that the operational procedures and course/major predict significantly the performance of FIC in Technology Information service as shown in Table 11.

Table 11. Regression of FIC Technology Information Service Performance on Independent Variables

Predictors	Beta	t-value	Sig,
Operational Procedures	1.413	22.040	0.000
Course / Major	0.539	8.412	0.000

Adjusted R Square = 0.949

F = 502.280

Sig. = 0.000

Table 11 shows that the operational procedures significantly predict the performance of the support services. The Beta coefficient (1.413) with 22.040 t-value and is highly significant at the 0.000. It implies that in this study, the more the staff respondents follow the set standards for operational procedures, the better the performance of the FIC in providing technology information to its clients or service community.

The respondents' course/major is also a significant predictor of performance of DOST- FIC on technology information services. The beta coefficient of 0.539 with t- value of 8.412 is significant at the

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0.000 level. This implies that the more relevant the course/major the respondent have, the better is the performance of DOST- FIC in the technology information service. It is understood that employees who have the appropriate educational preparation for the job are more competent to do the assigned tasks and functions and know the standard quality of service that can satisfy its clients.

The adjusted R Square indicates that the operational procedures in combination with the course or major field of specialization of the respondents account for 94.9% of the variance in performance of the FIC in Technology information service.

Predictors of DOST- FIC Performance in Technology Training Service.

As shown in Table 12, the respondents' age, sex, educational attainment, years in service and international training attended predict significantly the technology training service performance of the Center.

Table 12. Regression of DOST- FIC Technology Training Service Performance

On Independent Variables

Predictors	Beta	t-value	Sig,
Age	-0.309	3.966	0.000
Sex	-0.458	7.592	0.000
Educational Attainment	0.291	3.073	0.003
Years in Service	-0.463	6.125	0.000
International Training Attended	0.128	2.361	0.022

Adjusted R Square = 0.946

F = 190.504

Sig. = 0.000

As gleaned from the table, age significant predicts the performance of the DOST-FIC. The negative beta coefficient (-0.309) with 3.966 t-value is highly significant at the 0.000. It implies that in this study, the younger the respondents the higher is the rating to the performance of the Center in its delivery of technology training services to its clients.

Sex is also found to be a significant predictor of the performance in technology training services. The negative beta coefficient (-0.458) with 7.592 t-value and is highly significant at the 0.000 level. It means that male respondents rated the performance of the Center in technology training lower than the rating given by the female respondents.

The female until now dominates the food service. Being involved in the food service particularly in technology training, they are in a better position to assess the performance of the FIC more accurately.

The next predictor is educational attainment. The beta coefficient of 0.291 with 3.073 t-value is significant with 0.003 exact probability value. This simply means that employee respondents with more appropriate educational background related the performance of the Center in technology training service higher than those respondents with less appropriate educational attainment. Logically, more credence can be given to those who are more knowledgeable and skillful in doing the job. Higher rating given to the Center would simply means that the Center is performing well in providing technology training service.

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The number of years of service projects a negative beta coefficient (Beta = -0.463) with 3.073 t-value but significant (p = 0.000). This statistically means that respondents with lesser number of years in the service rate the FIC performance in technology training higher than those with greater number of years in the service. This finding can be explained by the effect of advancement of science and technology which favor the younger ones than the old employees of the system. New food processes and technologies are imbibed in the new curriculum and training program specially if the Center sends younger employees to international training offered by more advanced countries. As shown on table 12, international training attended by the respondents predicts the performance of the Center as assessed by them particularly in technology training service. Those who underwent offshore training understand that the Centers deliver relevant trainings which would approximate regional standards. Respondents who were not exposed to latest food technology processing and standards may not be able to assess fairly the quality of FIC services given to clients.

The Adjusted R Square indicates that age of the staff respondents in combination with sex, educational attainment years in service and international training attended accounts for 94.6% of the variance in the performance of DOST- FIC in Technology Training Service.

Predictors of DOST - FIC Performance in Technical Consultancy and Advisory Services

The regression Table below shows that the operational procedures and the respondents' sex, years in service, course/major and international training attended predict significantly the DOST- FIC performance in technical consultancy and advisory services. See Table 13.

Table 13. Regression of FIC Technical Consultancy and Advisory Services On Independent Variables

Predictors	Beta	t-value	Sig,
Operational Procedures	0.564	7.264	0.000
Sex	-0.232	7.457	0.000
Years in Service	-0.311	7.989	0.000
Course / Major	0.120	2.375	0.021
International Training Attended	0.059	2.718	0.009

Adjusted R Square = 0.946

F = 190.504

Sig. = 0.000

The table shows that the operational procedures as process variables has a beta coefficient of 0.564 with a t-value of 7.264 which is highly significant (p = 0.000). This simply means that for every standard deviation unit increase in strict adherence to operational procedures and policies, there is 0.564 standard deviation unit increase in performance of the DOST-FIC in technical consultancy and advisory services. Adherence to standard procedures and policies would make the operation of the Center smooth and easy for both the employees, supervisors, and clients. It will spell out higher efficiency and greater effectiveness and productivity.

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Sex similarly is a significant predictor. The negative beta coefficient (Beta = -0232) with – 7.453 t-value which is significant at 0.000 level favors the female respondents which bear a lower numerical code of zero (0) than the male respondents coded 1. This simply means that female respondents rated the FIC performance in this service higher than the male respondents. Years in service is also a negative predictor (Beta = -0.311) with -7.989 t-value, significant with 0.000 exact probability. This means that the younger respondents rated the performance of FIC in consultancy and advisory service higher than those respondents with more years of service in the Center. The respondents' course or major field of specialization with 0.120 beta coefficient and a t-value of 2.375 is highly significant with 0.000 exact probability. This means that respondents with more appropriate degree and field of specialization rated the performance of the center higher than those with less relevant degree or major field of specialization. Considering the reliability of rating given by more knowledgeable employees or respondents of the study it implies that the Center is doing well in its service functions. Appropriate degree and field of specialization somehow contribute to the performance of the DOST-FIC in Technical consultancy and advisory services for the clients.

In like manner related to the course and major, field of specialization is the international training attended by the respondents which is a significant predictor of FIC performance in the consultancy and advisory services. The beta coefficient of 0.059 with 2.718 t-value is significant with 0.009 exact probability value. This means that international training attended contributes to the performance rating given by the respondent's performance rating is higher when exposure to international training is greater.

The adjusted R Square indicates that 94.6 percent of the variance in the FIC performance in Technical consultancy and advisory is explained by the operational procedures and respondents' sex, years in service and international training attended.

Predictors of DOST - FIC Performance in Rental of Equipment Service

Table 14 reveals that the operational procedures as process variable and the respondents profile as input variables predict significantly the performance of the FIC in its rental equipment service. See Table 14.

As gleaned from the Table, the operational procedures with 0.544 beta coefficient and 3.594 t-value is highly significant predictor of FIC performance in rental equipment service (p = .001).

This means that strict adherence to rental policies and procedures contribute to the productivity or performance in this particular service offered by the Center. Following the standard procedures and policies would not only protect the equipment from being broken but would lengthen the service life by proper care and maintenance and greater productivity or generation of additional income on top of providing service for the satisfaction of the clients.

Table 14. Regression of FIC Rental of Equipment Services on Independent Variables

Predictors	Beta	t-value	Sig,
Operational Procedures	0.544	3.594	0.001
Age	-0.347	4.273	0.000

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Sex	-0.426	3.814	0.000
Years in Service	-0.302	6.063	0.000
Educational Attainment	0.363	4.331	0.000
International Training Attended	0.079	2.339	0.024

Adjusted R Square = 0.983

F = 190.504

Sig. = 0.000

Age with a negative beta coefficient (Beta = -0.347) and a t-value of -4.273 is highly significant (p = 0.001). This means that younger respondents rated this service performance of the center much higher than the older respondents. this implies that the FIC performance in rental of equipment service is higher in the evaluation of the younger respondents if it can be basically assured that younger respondents have more knowledge in handling modern facilities and equipment based on their exposure to international training in advanced countries with state of the art facilities and equipment in food technology processing and services. As gleaned further from the table, attendance in international training predicts the performance of center in rental of equipment service as rated by the respondents. The beta coefficient of 0.079 with 2.339 t-value is significant (p = 0.024) respondents with more international trainings attended rated the FIC performance in rental of equipment service much higher than those respondents with lesser exposure to international training.

Sex, likewise, is a significant predictor. The negative beta coefficient is in favor of the female respondents than the male (Beta = -0.426). The t-value of -3.814 is highly significant (p=0.000). This means that the female respondents rated this service performance of the center much higher than the male counterpart.

The negative influence of years of service (Beta = -0.302) point out that respondents with lesser number of years in the service tend to rate the FIC performance in rental service higher than those with greater number of years in the service. This is so because of the general practice of assigning new jobs requiring higher level of technology. The use of modern equipment is always welcomed by the younger ones who are more excited to learn and use it with greater ease and interest. The older ones are usually hesitant to handle new and high-tech machines or equipment. As generally observed, more senior employees refuse to learn how to operate machines that are highly computerized for fear of committing mistakes when memory begins to fail, and confidence begins to decline.

Educational Attainment is a positive predictor of FIC performance in rental of equipment service. The beta coefficient of 0.363 with 4.331 t-value is highly significant (p=0.000). This means that respondents with more appropriate educational background tend to rate this service of the center much higher than those with less appropriate educational background. Logically those who have knowledge of food technology machines and equipment used in product development can assess better the service performance of the FIC. Likewise, those with units in management is in a better position to assess the performance of this FIC service which may bring on proper management covering maintenance and implementation of policies and standard procedures.

As gleaned further, the adjusted R Square indicates that 98.3 percent of the variance in the FIC performance in rental of equipment service can be attributed to the strict compliance of operational policies

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and standard procedures in combination with other profile variables such as age, sex, and years in service, educational attainment and international training attended by the respondents.

Conclusion

Based on the summary of the findings the following conclusions are arrived at:

1. The strict adherence to operational procedures; Female respondents rated the performance of FIC services much higher than the male respondents; The younger the respondents, the higher is their performance of the FIC; The respondents with Food Technology related courses have a better performance of the FIC; Non-eligible respondents rated higher the performance of the FIC; The higher the educational attainment of the respondents the higher is the performance rating given to the FIC; The more number of local training attended by the respondents, the higher is the performance rating given to the FIC ; Respondents with lesser number of years in service tend to rate high on the performance of the FIC than the respondents with more number of years in the service; Respondents who underwent for offshore training contributes proper assessment on the quality performance of FIC.
2. The performance of DOST-FIC is strongly predicted by the execution of operational procedures, length of service of the staff, and related trainings.
3. The research hypothesis stating that the following factors predict significantly the performance of DOST-FIC: The Profile of the administrators and staff of DOST- FIC in terms of age, sex, course / major, eligibility, educational attainment, seminars / trainings attended (local and international), no. of years in service; and the operational procedures / best practices of the FICs is partially sustained

Recommendations

In the light of the findings, and conclusions of the study, the following recommendations are hereby offered: (1) Considering that the operational procedure predicts the performance of the FIC in the different service functions, it is recommended that, the management of the center should strictly adhere to policies and standards procedures in the operation of the FIC; (2) Hiring additional manpower for the Center may be considered with preference to the younger ones with appropriate field of specialization and preferably higher educational attainment; (3) Sending some of the staff to advanced study may be considered to elevate the profile of the staff and thereby improve the DOST-FIC services; and (4) Intensify sending more employees to local and international training may be considered as it predicts significantly the FIC performance. Encourage the management to allocate funds for local or international training, and intensify institutional linkages for possible local/international training

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