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PHILIPPINE NYPA- AND VILLAGE-BASED BIOETHANOL INDUSTRY RESEARCH, DEVELOPMENT AND EXTENSION (RDE): GLOCAL CONVERGENCE AND INTEGRATION (GCI) MANAGEMENT FOR INCLUSIVE AND SUSTAINABLE DEVELOPMENT

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ABSTRACT – A pilot project was initiated in 2009 to test and demonstrate the potential of a nypa- and village-scale-based bioethanol industry in the Philippines. It is village-scale aimed to churn direct participatory engagement of the local village people in the processing and production of bioethanol from nypa, a popular Philippine palm as the source of feedstock. It is nypa-based for it taps a huge domestic renewable bio-resource. The whole module is founded on the twin principles of inclusivity and sustainability through a glocal convergence and integration management scheme involving a number of local, national and international agencies, government and non-government, including local government agencies (LGAs) and peoples' organizations (POs) with Mariano Marcos State University (MMSU) taking the lead. Over the years of its operations, the project has gained various recognitions and awards meriting its performance of its goals and objectives. This paper accounts as its shares to the public the highlights of its 10-year and continuing experience in managing (partnership) convergence and integration that underscore how and why such continuing performance and enlarging recognition remains. The experience details and explains the role of management on how performance-based convergence and integration are conceived, executed and sustained over time. Central to this paper is the documentation on the application of the concept of glocal convergence and integration (Global CI) management whereby various significant role players from different sectors at the local, regional, national, supra-regional and global (international) scene are functionally orchestrated and mobilized together for a common end. Distinct and of special interest in the documentation is the role and intricacies of managing research, development and extension (RDE) for a fast emerging cutting-edge technology (CTech) like renewable and bioenergy in general and bioethanol in particular. Implications and recommendations are offered in the purview of priming and mainstreaming GCI in RDE for CETech or conventional technologies for inclusive and sustainable development (ISDev).

Keywords: Convergence, partnership, integration, nypa, bioethanol, feedstock

INTRODUCTION

Breakthrough science (Rotham, 1980) and CTech (CHED, 2017) are society's prime and sustained modicum in coping with needs and demands throughout history (Grinin, Ilyin,

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Hermann, & Korotayev, 2017). This is most dramatic in fundamental drivers of existence and survival (Esteban & Esteban, 2014b) like energy which today, in a globalized world always streaking towards change, is bringing the greatest pressure ever brought about by the phenomenon of climate change (C-Change) punctuated by the growing challenges of geopolitics (Sobrevilla, 2016). As for energy, the world now subscribes to the redeeming potential of renewable energy (RE). For geopolitics, supra regions, i.e., Association of Southeast Asian Nations (ASEAN), European Union (EU), etc., national governments down to the smaller (regions, provinces, municipalities, barangays), and smallest units (sitios, households, individuals) of decision-making are making respective efforts and initiatives to respond (Esteban & Esteban, 2014). Such responses, taken as opportunities (Esteban, Malab, Esteban, & Gano, 2006) are anchored on local politics and locally available and/or adaptable and adoptable RE resources like biofuels. Global politics (Hall, 2014) and local politics are two distinct worlds while RE resources, though generally widely distributed, are or possible and feasible only in particular locations circumscribed by varying factors. The global-local divide and local possibilities and feasibilities, while workable, are no better when bridged and complemented for an inclusive and sustainable global world. The bridging and complementation could be done only by people through management (Esteban & Esteban, 2014). This is the case of a local Philippine experience with a global sense in breakthrough science (B-Science) and C-Tech in biofuels demonstrating global-local (glocal) convergence integration management or GCI-Management initiative in RDE that worked and was potentially replicable.

The Biofuels RDE Initiative

The brewing global issue on climate change and the drive for RE dawned upon curious technical people at Mariano Marcos State University (MMSU) in Batac City, Ilocos Norte, Philippines to indulge in biofuels RDE. The work formally started in 2009 (Agrupis, et al., 2017). This is incidentally a collateral and parallel work in the long-running renewable energy RDE in the university through its Department of Energy-funded Affiliated Renewable Energy Center (AREC). The biofuels initiative which formally became a project brought in a new and distinct dimension in the RE RDE of the university.

For five years (2009-2013) the project worked on sugarcane and sweet sorghum as the basic feedstocks. The economic limitations of these two feedstocks prompted the project to search for an alternative resource – the nypa palm. The project veered to nypa feedstock in 2014.

Figure 1. MMSU Bioethanol Project Through the Years, depicts the significant timelines and milestones in the engagement of the project (Agrupis, et al., 2017).

The project was carried out through the years not by MMSU alone but by partnership with various stakeholders across all significant sectors at the local, regional, national and international fronts. Convergence and integration mechanisms worked well together to bring relevance and functionality in partnership. In all, the partnership convergence and integration initiative involved 18 entities representing six sectors across regions and overseas: LGUs, academe, government service agencies, industry, people's organizations (cooperatives), and an international aid agency. Below is the list of the established partners of the project.

1. **Municipal Local Government Units (MLGU):**
    - Bugallon, Pangasinan
    - Pamplona, Cagayan
    - Currimao, Ilocos Norte
2. **Academe/Higher Education Institutions (HEIs): Philippine State Universities and Colleges (SUC):**
    - Aklan State University (ASU)
    - Cagayan State University (CSU)
    - Central Luzon State University (CLSU)
    - Marinduque State Colleges (MSC)
    - Pangasinan State University (PSU)
    - Western Philippines University (WPU)
    - University of Antique (UA)
3. **International Agency:** USAID-STRIDE
4. **Other Government Agencies**
    - Department of Energy (DOE)
    - Department of Agriculture-Sugar Regulatory Administration (DA-SRA)
5. **Industry**
    - Ethanol Producers Association of the Philippines (EPAP)
    - Far East Alcohol Corporation (FEAC)
6. **People's Organization (Cooperatives)**
    - Cabagan Women's Organization
    - Kapianan Nipa Wine
    - Sta. Cruz Multi-Purpose Cooperative

Objectives

The general objective of this paper was to present and share an experience-based scheme of managing convergent and integrative RDE in the RE sector.
The specific objectives were the following:

1. Establish the pattern of convergence and integration in the management of RDE in the RE sector particularly the bioethanol industry; and
2. Present a logical system of performance outcomes and measures of convergence and integration management as may be applied in B-Science and C-Tech initiatives.

Theoretical and Conceptual Framework

Systems theory (Turner, Beeghley & Powers, 2007) backed by the fundamental binary framework of the management functions (Stoner & Freeman, 1989) served as the theory and conceptual base for this paper (Figure 2).

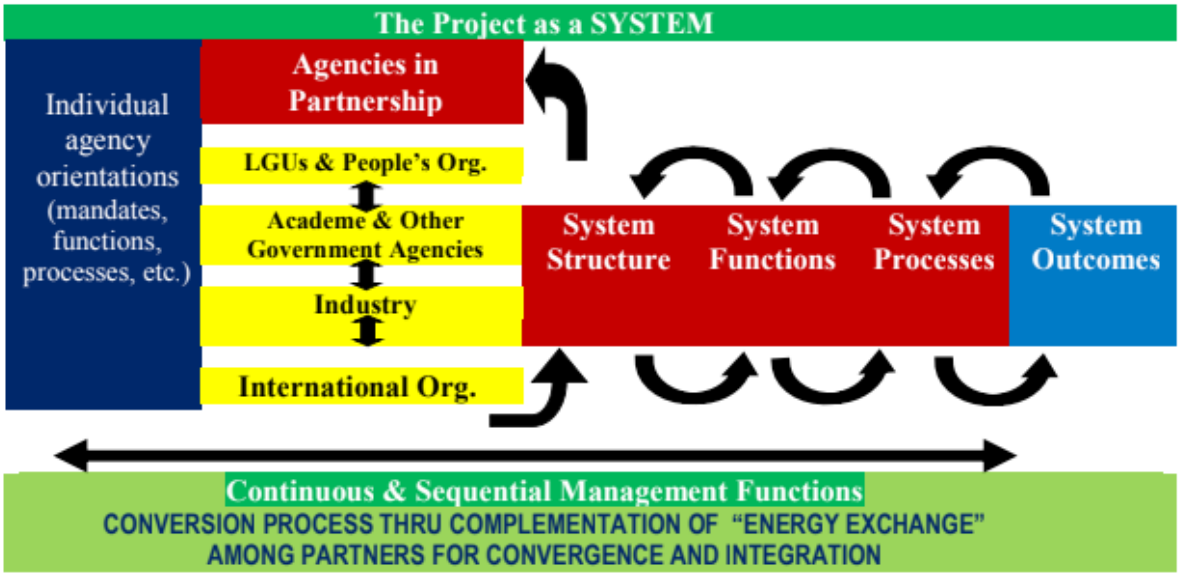

Figure 2. Diagram of the systems-based theoretical and conceptual framework in depicting/ documenting the convergence and integration mechanisms and outcomes in managing bioethanol industry RDE.

Esteban and Esteban (2016) explains the systems theory as a paradigmatic tool for analysis, thus:

> *"Systems theory points to the 'systemic' nature and interdependence of all events and phenomena. As systems, events and phenomena are composed of interdependent parts or aggregates (subsystems) which composes an integral whole (system). The existence and survival of one part is dependent from the other parts which in turn determines the life of the whole. Interdependence operates through 'energy exchange' in a condition of open environment. The integrity of every part and eventually the whole is a function of the quantity and quality of energy exchange. Such exchange is explained through time and space, the supra system."*

In this study, the bioethanol project is the system; the partners in convergence and integration as the subsystems; the pattern of convergence and integration contained in the system's structure, functions, process and outcomes; and the environment outside of the project makes up the supra system.

The basic binary management functions specification (MFS) framework that reinforces the systems theory base defines management as set of functions grouped into two according to when and how they happen along the program or project cycle. They are sequential and continuous (Stoner & Freeman, 1989). The basic sequential functions which are presumed to be done in the order of their specification or in chronological order are: planning, organizing, staffing, directing and controlling. On the other hand, the continuous functions are deemed to be done all throughout and across the life-stages of the project, which are: problem-solving and decision-making, communication, coordination, and monitoring and evaluation. Indispensable adjunct to the binary management functions is financing which is included as part of the study framework.

Methodology

Locale

The base local of the study is at MMSU, City of Batac, Ilocos Norte, Philippines. The MMSU is a member of the family of State Universities and Colleges (SUCs) and of HEIs in the country. Ilocos Norte is one of the four component provinces of Region 1 located in the northern tip of Luzon, the biggest of the three main island groupings of the Philippine archipelago. Ilocos Norte is around 500 kilometers north of Manila, the Philippine capital. The other settings of the project were in the geographic confines of the "project implementing" partners as indicated in the list of partners. The cross geographic confines of the documentation were in five regions (Luzon-3, Visayas-2) where the project implementing partners operate composed of seven (7) SUCs, three (3) LGUs, three (3) people's organizations or cooperatives, and two (2) industry players. These geographic locations are generally where the production and processing modules of bioethanol are undertaken.

Design and Unit of Analysis

This study made use of a cross-sectional post-hoc process documentation and analysis (Scriven, 1993) of the patterns of convergence and integration in the management of RDE of the bioethanol industry as per subject project disclosed in this paper.

Collection of Data

Data for this documentation were sourced primarily from the files of the project. The files included plans, reports, logs, and all other documents pertinent to the project.

Analysis of Data

Data analysis was done according to the principles of document analysis in the order of qualitative data assessment. Pursuant to the study framework, data representing the concepts were first freely "plucked" from each of the documents. These were later "openly coded", organized and "cleaned" according to the key concepts drawn in the framework and finally axially coded and interpreted pursuant to how the variables relate and merge together to form the patterns sought for.

Operational Definition of Terms

The key terms in this documentation are defined according to how they are used as follows:

Bioethanol refers to ethanol compounds derived from living organisms and in this case from the nypa palm.

Convergence refers to a sense of complementation of acts, activities and contributions between and among the partners in the project to effect partnership.

Development refers to the act of and/or progressive state of a result of such act of the project in harnessing the technology in the production and processing of bioethanol.

Extension refers to the non-formal education activities of and carried out by the project to various stakeholders in order to promote the bioethanol industry.

Glocal refers to a phenomenon that manifests the twin character of being global or international and local, e.g., nypa as a local plant but with global significance/use/importance, local-village-based processing of bioethanol in a barangay or sitio in the Philippines but the process can be adopted in other similarly confined geographic locations anywhere around the globe.

Integration refers to the long-term unifying act and/or unified state of different agencies and/or sectors along the functions of management in a complementary arrangement towards a common goal; it defines the character and depth of convergence.

Management refers to the act of the project to get things done through the functions of planning, organizing, staffing, directing, controlling, (sequential functions) problem-solving and decision making, communication, coordination, monitoring and evaluation (continuing functions), and financing.

Nypa refers to the plant, Nypa fruticans, a palm which is the subject of RDE of the project. Partnership refers to the state of formal or informal "coming together", understanding and collective action-engagement of different agencies, groups and/or institutions for a common purpose.

Research refers to the act or acts in the project to inquire or to investigate following an established method or methodology.

Village refers to a geographic confine made up of cluster or cluster of dwellings and population where the feedstock is found or sourced and/or processed; a sitio or a barangay or a cluster thereof.

RESULTS

The Management System for Convergence and Integration

The Sequential Management Functions

Planning. Convergence and integration are deliberate and purposive mechanisms that cements partnering initiatives in the project. The elements of deliberateness and purposiveness in the project through planning clarifies intentions and strengthens the motivations of each partner agency towards convergence and integration. To begin with, the project conceived the project concept or framework (Figure 3) in the conventional and classic mold of the Input-Process-Output (IPO) model (EU, ud.; Scriven, 1994) which served as the fundamental planning tool.

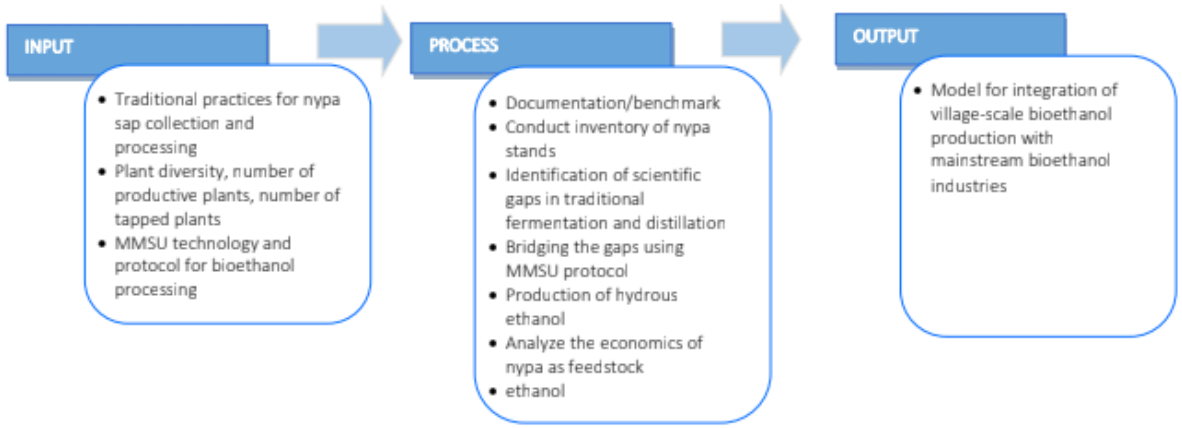

Figure 3. The IPO project concept used as the fundamental planning tool depicting the framework for which the project operates and is expected to accomplish.

Organizing. This management function operationalizes the project concept in terms of what "offices" are needed to perform and accomplish the required tasks and objectives. Given the clarity of the project concept, a simple one-level flat and four-narrow organizational structure was conceived (Figure 4). This conception of the project's organization placed prime consideration on simplifying the interaction of the "offices" for greater overall operational effectiveness and efficiency. That interaction pertains to the structure of the organization and which carries as it executes the functions of the project. Overall leadership, administration and secretariat (LAS) functions steer the subordinate sections or "offices" which are: socio-economics, feedstock and biometry, fermentation and distillation, and design, fabrication and deployment. Between the LAS and the four subordinate "offices" is a direct interaction (solid line) protocol while among these subordinate "offices", direct coordination is also established (broken line).

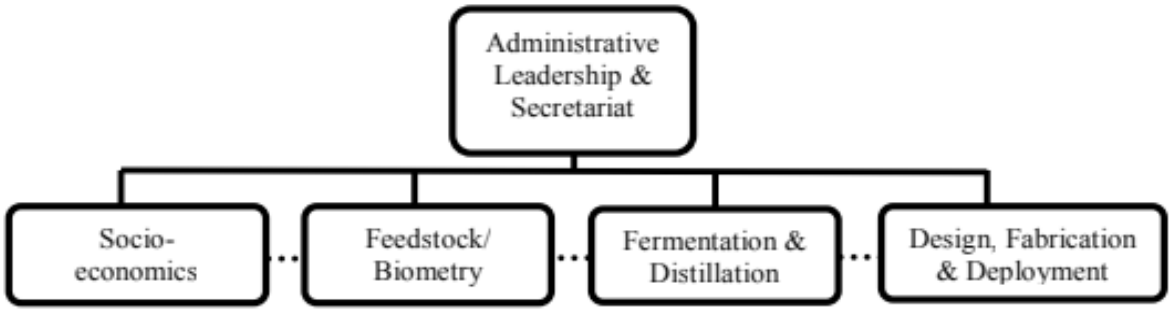

Figure 4. The organizational structure of the bioethanol project.

Staffing. As a convergence and integration mechanism, the project adopted the matrix type (Cuyno & Saludadez, Ud) of organizational staffing. A matrix type organization is composed of regular staff of MMSU and of other partner agencies as were needed who, in addition to their prescribed official mother-agency functions, are designated to positions in the structure. These are generally on part-time status (affiliates) in the project. However, they are backed by full-time staff composed of casual or temporary workers enlisted as required and according to the task-timelines of the project. The full-time staff are hired according to the demands of each of the operating sections or "offices" as prescribed in the organizational structure. Accordingly, there are two general staff-types in the project – the full-time contractual (FTC) and the part-time tenured (PTT) MMSU personnel. Normally, the project is granted the liberty to compose its own staff according to its needs. Nonetheless, all staff recruitment and enlistment are done in accordance with applicable government policies and guidelines particularly that of MMSU. Overall, the staffing composition of the project is multi-disciplinary.

Directing. The pathways normally treated by the project are both simple and complex management challenges. It is simple because it puts into one semi-autonomous office the responsibility to plan, decide, and execute for activities it is assigned to perform, to accomplish targets and satisfy set deliverables. On the other hand, it is complex because it is inherent to the multiplicity of its pathways, to the "novelty" of its organizational structure and staffing pattern and to the exacting deliverables bound by sharp timetables. Personal and informal participatory modes dominate the project's mantra of directing intra-agency convergence and integration. The opposite happens in an inter-agency environment which is given as part of standard operating procedures (SOPs) especially in and with government agencies. Directing, like staffing and organizing, is greatly a function of the project concept, organizational structure and staffing pattern.

Controlling. Two control mechanisms operate in the project's convergence and integration mechanisms. One is the established SOPs within each of the partner agencies or entities. These are strong control mechanisms which exerts significant influence in the process of convergence and integration. The other are the SOPs especially designed and promulgated

by and for the project. The project designed its internal rules and procedures special to its operations though are derivatives from and responsive to the fundamental policies, rules and guidelines governing the individual (MMSU, STRIDE, etc.) and collective (government or non-government) agencies or entities. This includes the prescriptions in the particular or severally inked agreements or understanding between the partner agencies. The effectiveness of control in the process of convergence and integration is determined heavily by the concordance of the two sets of control mechanisms. Concordance in the context of the analysis pertains to two senses – documentary and personal. Documentary concordance is manifested in the complementarity of the substance and intentions of the documents. Personal concordance relates to the interpersonal accord established between the staff and other individual role-players in the interpretation and application of the SOPs. Again controlling for convergence and integration heavily relies on the clarity of specifications in the project concept as the basic planning template.

The Continuing Management Functions

Problem-solving and decision-making (PSDM). The extremes of simplicity and complexity in managing the project described above as tools and mechanisms for convergence and integration is a challenging menu being addressed. This is manifested in the series of process-mechanism loops (PML) depicted in the theoretical and conceptual framework. A fall-out of PSDM at any point may cut or disturb and derail the directional continuity of the PML and of the entire integrity of the project. The cut or disturbance may be temporary, long-term or even permanent until the end of the project depending on the gravity of the problem and how soon an effective solution is drawn and applied. General potential problem analysis (PPA) is done during planning but overall, there always were problems that were left unknown at that time. The key to the survival and sustainability of the project at any point in time was the monitoring and evaluation scheme built-in in the plan throughout the timeline of the project. Made deliberate part of the project's plan are decision-points along the critical stages in operations. Significant mechanisms along this are the continuing staff and inter-agency on-site assessments, meetings and consultations, re-planning workshops, and series of formative evaluations guided by the project concept and auxiliary established referents.

Coordination and communication. The distinct nature of the project presents a problematic situation for convergence and integration especially at a level beyond the project staff which is to the body of personnel at-large, colleges, units and offices. To contain this situation, coordination is built-in in the organizational structure and staffing pattern where the head of the lead-agency (MMSU) is normally the ex-officio executive officer of the project. All official "macro" or general directives and memos are thus emanated from his or her office. The project with respect to its component partner agencies is construed as an open system such that "energy exchange" is optimized within and outside of their environments. Thus, communication and coordination are managed as free-flow in both vertical and horizontal regimes and formal and informal modes.

Monitoring and evaluation. Monitoring and evaluation are built-in mechanisms in the project through the project concept as operationalized into methodological specifics. As shown in Figure 3, the diagram of the project concept, the critical path flows (CPF) constitute the roadmap-in-real-time of the progress of the various tasks and corresponding measured deliverables. The real-time orientation of the operationalized project concept and CPF enables management to employ and deploy remedial or check actions on any deviation as they may happen. The project concept with specified CPF serving as conversion mechanism for convergence and integration meter comprehend and covers the whole scope of the project from planning (ex-ante/before project) to implementation (on-going/formative) until the

determination of achievement of outputs, outcomes – the deliverables and impacts.

Modalities of monitoring and evaluation are deliberately diverse. According to where the monitors and evaluators come from, it is a mix of internal, external, and combined internal and external. Day-to-day and continuous monitoring is done by the project staff. Funding agencies, by self- prescription, serve as external monitors. At particular critical stages in the operation of the project, the internal and external monitors and evaluators are together as one-whole-team. Explicitly, participatory monitoring and evaluation are standard practices.

Financing. Financing taken as a special management function for convergence and integration is a crucial part of the process. This is especially true at points of interface between the regular functions of each of the partner agencies and what the project has to offer, at least in a special unique way. In this case, counterpart funding has to be worked out beginning from the Financing Agreement (FA) or Memorandum of Agreement (MOA) or Memorandum of Understanding (MOU) which serve as the official and binding document to justify counterpart budgets and disbursements. The counterparts vary which is a function of negotiation between the implementing agencies and the funding agencies justified by the nature, quantity and quality of deliverables. At most, counterparts of host HEIs are "indirect" costs which normally consists of outlays which are already part of normal operations like space/office, water and electricity, janitorial services, and others.

Project Outputs/Outcomes and Impacts

Pursuant to the second objective of this paper, the MMSU bioethanol project through the years (Figure 1) concisely manifests the key milestones, results and outputs, the project has accomplished especially of the measured technical and material deliverables. Underneath which carried and translated them are the management mechanisms tailored for performance in real time. Management provided the indispensable conversion dynamics for the static outcomes to be produced in terms of the deliverables. A manifest of distinction beyond the manifestations in Figure 1, something special over the ordinary and conventional, are the numerous awards the project and/or its staff have been accorded with over the years – 14 in the nine year-life of the project (Table 1).

Table 1. List of awards given to the project and/or project staff in recognition of its or their performance.

Level	Date	Title of Award	Granting Agency
International	Oct. 17-18, 2016	2016 First Best Paper	International Society for Southeast Asian Agricultural Science (ISSAAS)
National	Oct. 26, 2016	2016 AFMA Gold R&D	Department of Agriculture-Bureau of Agricultural Research (DA-BAR)
		Paper Award	National Academy of Science and Technology (NAST)
	July 8-9, 2015	2015 Best Scientific Poster	Ilocos Agriculture and Resources Research and Development Consortium (ILARRDEC)
		2014 1st Place R&D Paper	DA-BAR
	Oct. 7-8, 2014	2014 AFMA Paper Award	NAST

Table 1 continued...

Level	Date	Title of Award	Granting Agency
Regional	Nov. 19-20, 2015	2015 1st Place Poster Paper, Development Category	ILARRDEC
		2015 1st Place Poster Paper, Development Category	ILARRDEC
Local/ Institutional	Jan. 6, 2016	PRAISE 2016 Outstanding Researcher Award	PRAISE

Still a step beyond the project itself, the awards, the years ahead, and the society which paid for the project are expectations that should benefit solutions to concerns, issues and problems which in the very first place were the project's justifications and raison d'etre of becoming a special project. Following the thought of Bastow, Dunleavy, & Tinkler, 2014, it may not yet ripe to make reasonable account of what the project may benefit society at large in terms of its "promises" of impacts on the issues of climate change, of clean energy, of clean air, of sustained quality biofuel supply, etc. but the future, near and far, shall exact the project a fuller and more meaningful account of its beyond-the-project benefits and impacts.

CONCLUSION

The paper wishes to conclude, derive implications and recommendations by way of offering bodies of management principles and propositions for convergence and integration as contributions to advancing knowledge in the field of RDE. These are strictly in accordance with documented experienced realities in the nine-long-years of the bioethanol industry project presented.

1. Functional convergence and integration in RDE with glocal orientation is a direct function of the presence of willing and capable partners from across geographic settings and sectoral orientations with the substantive capacity and resource but which find complementation therein and agree to address common interests and ends.
2. Efficient convergence and integration in RDE with glocal orientation operates under the principle of unity in diversity. It is diversity-in-commonalities and similarities among different entities or agencies and institutions that significantly drives convergence and integration. Common interests but with diverse means and resources mends and molds convergence and integration for results.
3. Effective convergence and integration in RDE with glocal orientation recognizes parity and equity among partners. Parties in convergence and integration, while common interests and accomplishments are underscored, recognizes, acknowledges and respects individuality, contributions and efforts of each. The sense of equality among partners invigorates convergence and integration.
4. Management principles, no matter how excellent they may be, are simply static thoughts and have to be translated into action by responsible, capable and principled "managers".
5. Management experiences like what espoused by this paper are bound by time, space, the human factor, and other circumstantial elements. Considerations for adoption of established experiences must conscientiously look into fitness to specific situations and conditions. RDE are highly dynamic phenomena and so should management systems be applied. Dynamic management systems are a function of diligent and intelligent accumulation and sorting-out of experiences over time and

space

6. Multicultural complexity comes with convergence and integration. The challenge to management is to build bridges where such complexity works for the effective achievement of expected diverse results and outcomes.

7. Multidisciplinarity like multicultural complexity is inevitable in convergence and integration. The challenge to management is to translate such into sensible interdisciplinary attitude towards transdisciplinary culture in all role players and among concerned parties. That translation augurs well if not the best in the interest of sustainable and meaningful convergence and integration.

8. Results, outcomes and impacts of management are not as hard nor as easily comprehended or comes in strictly pre-ordained time like the material or physical like the volume and quality of bioethanol processed. This should not be a reason to discount nor diminish the value of management for it is the carrier and driver of such material outcomes. In the same vein, impacts do not come easily and fast and more so in a state or condition so rigid as may be expected. Measures, methods and timelines to account for these should be thoroughly studied and made a dynamic part of every plan.

9. Participatory principles should be taken seriously and not simply as a linguistic ploy to project color to convergence and integration. Projects or programs should attempt to define how participatory is participatory in order to establish benchmarks and landmarks for justifiable participatory convergence and integration.

10. Convergence and integration happens at different levels and segments – individual, group, discipline, sector, geographic confine, agency, institution, function, resources, etc. Efforts to converge and integrate should exquisitely define these and the parties involved to agree.

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