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Local Governance Policies and Advocacy Has High Impact on Waste Management Technology Transfer

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Abstract
Waste management has been a challenge for developing cities of 3rd world nations. An enduring national resolve is already in place in many Governments to ensure waste management infrastructure is place as population numbers rise for major cities. Developed nations have faced the obstacles and are ready from experiences learnt to venture un-chartered path of globalization, market liberalization and sustaining industry competitiveness. This is specific for the new group of developed nations the likes of Malaysia, India, Turkey and Taiwan. Having gained all the technological growth it would be prudent for these nations to now become technology exporters in the new era. An impact initiation to this can be set for the Waste Management sector. The application of this can be adopted by any developing nation moving on towards being an exporter of knowledge and technology transfer.

Keywords: Technology Transfer, Local Government Policy & Advocacy, Waste Management

1. Introduction

A wide variety of alternative programs and technologies are now available for the management of wastes. Because of the wide range of participants in the decision making process for the implementation of waste management systems, the selection of the proper mix of alternatives and technologies for the effective management of wastes has become a challenge. Developed nations have been successful in waste management strategies via proper research, teats and implement programs. Countries such as Malaysia, India, Turkey and Taiwan have now reached a level of experience sufficient to be exported to other countries via a technology transfer (TT) process. The technology export strategy for this paper is concentrated for waste management based on the high impact of local government policies and advocacy but the framework can work for other technology transfers of the same route or framework.

2. Implementation Process

Waste generation is predicted to double by 2025. The higher the income level and rate of urbanization, the greater the amount of waste produced in all forms. The countries aligned under the Organization of Economic Corporation and Development (OECD) produce 50% of the world's waste where else Africa and South Asia produce the least. Current global Municipal Solid Waste (MSW) generation levels are approximately 1.3 billion tonnes per year, and are expected to increase to approximately 2.2 billion tonnes per year by 2025. This represents a significant increase in per capita waste generation rates, from 1.2 to 1.42 kg per person per day in the next 10 years.

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Table 1. Waste Demand Projections until 2025

Region	Current Available Data		
	Total Urban Population (Millions)	Urban Waste Generation	
		Per Capita (kg/capita/day)	Total (tons/day)
Africa	260	0.65	169,119
EAP	777	0.95	738,958
ECA	227	1.1	254,389
LCR	399	1.1	437,545
MENA	162	1.1	173,545
OECD	729	2.2	1,566,286
SAR	426	0.45	192,410
Total	2980	1.2	3,532,252

Region	2025 Projections			
	Projected Population		Projected Urban Waste	
	Total Population (Millions)	Urban Population (Millions)	Per Capita (kg/capita/day)	Total (tons/day)
Africa	1,152	518	0.85	441,840
EAP	2,124	1,229	2	1,865,379
ECA	339	239	1.5	354,810
LCR	681	466	1.6	728,392
MENA	379	257	1.43	369,320
OECD	1,031	842	2.1	1,742,417
SAR	1,938	734	0.77	567,545
Total	7,644	4,285	1	6,069,703

The volume figures are alarming and there is a critical need to provide a solution to the waste management to disposal in the developing nations which are mostly defined as 3rd world countries. The solution to the concern is via technology transfer from new developed nations of which they can pass on the know-how and technology implementation to the current developing nations. Based on certain government policies and regulations in place, it is best to strategize the implementation of the technology or knowledge offering. The key factors for the effectiveness of waste management technology transfer out from a new developed nation can be built on a three phase implementation process.

2.1 Pre-Technology Transfer (Pre-TT)

The National Strategic Plan of any country serves as a guide in planning and allocating resources for efficient waste service provisions. As researched by MHLG, it would be efficient for a solution provider to setup a facility for waste management but post construction operations and maintenance of the facility could be a problem as it involves new technologies. This was tackled at implementation stage for a country like Malaysia and should be applied in the same manner for the receiving country. One of the key factors is technical resources, i.e educated, trained and skilled personnel to carry out O&M practices. The framework developed from the research and the routes created for

best technology transfer management is as shown in Fig 1 based on research conducted using Malaysia as a study base.

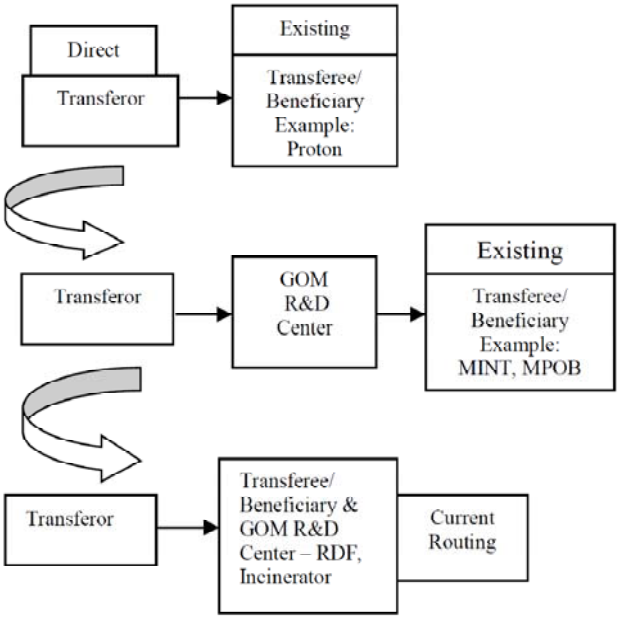

Fig 1. Model for Effective Waste Management Pre to During-TT

The strategy for waste management TT must be outlined between both parties. The offering party can base on the seven strategic aims, which are as shown below ultimately supporting the developing nation in its growth:

- To adopt an integrated approach to waste management which considers impacts of substances and activities on natural resources;
- To work for all sectors of society, to develop approaches which deliver waste management requirements and goals, without imposing excessive costs (relative to benefits gained) on the nation as a whole;
- To adopt clear objectives and effective targets;
- To focus on an overall strategy for long term, and an action plan for progressive implementation;
- To build on existing data to provide a system for monitoring and measuring on-going performance;
- To adopt policies that recognize the aims of sustainable development;

The aims have to be frozen in line with national interest in the Pre-TT phase. Additionally bilateral or multilateral regulatory or policy development assistance can be very useful to countries seeking to develop an appropriate framework for waste management. Given the importance of the regulatory/policy framework for international private sector investment, private firms should be encouraged to participate in such bilateral activities. When considering technology transfer between countries aimed at improving regulatory or policy frameworks in the waste management sector, it is

important to recognize differences between host and donor countries, and to ensure that the proper solutions are developed [3]. Technology and process is to be identified at Pre-TT stage as part of the framework of development under the vision of the Government. Along with it will be the outline for governance for implementation. For the pre-TT, the two most important factors from the analysis conducted for this research were technology identification and local government policies and advocacy.

2.2 During- Technology Transfer (During-TT)

During phase is the actual implementation of the integrated TT. By the start of the phase, the policies are determined and the resources involved would have been built for receiving of the TT. Another area for focus is capacity building. There are several types of technology transfer for capacity building within countries, and many of the same approaches can be used between countries. The infrastructure for waste management shall be made available as it should be built. The knowledge shall be transferred via the implementation of the technology and in this case it can be the infrastructure itself. For waste management it shall include methods for receiving and disposing of the waste which integrates the logistics and the receiving facility in which the waste gets sent to. Technology is best applied in the facility as different technologies can be utilized from thermal treatment such as gasification or pyrolysis to anaerobic to refused derived facilities. The operation phase of a facility or the technology roll out shall be executed by the local team supervised and trained by the technology provider. The built, operate and transfer (BOT) method best applies in which then the receiving nation has its local technical resources working on the project as part of the TT process. The entire during-TT process is the BOT time frame.

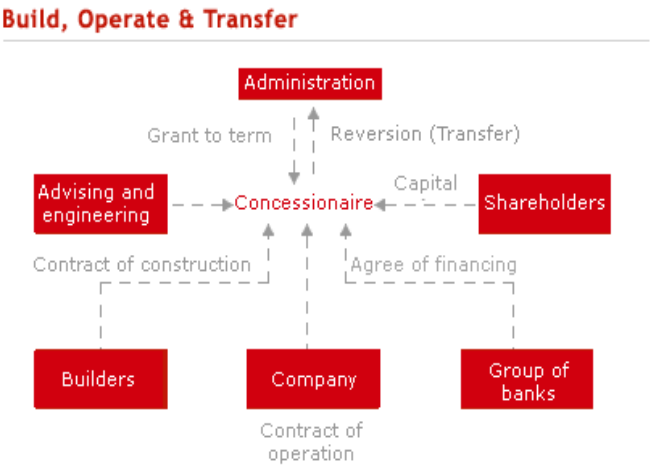

Fig.2. Model for Waste Management BOT

The conceptual model in Fig 2 was created after much review of previous authors' work in the waste management and technology transfer sector. For during-TT, infrastructure and transferor to transferee relationship affected most for the waste management

context. This was reflective to the local government's policies in exercising funding for infrastructure development and advocating of policies in place for international trade relations.

2.3 Post- Technology Transfer (Post-TT)

The Best Practicable Means for proper operation and maintenance should focus on the equipment, its supervision when in use and the training and supervision of properly qualified staff. Unrestricted employment of foreign knowledge workers may hobble the transfer of technical know-how from foreigners to locals. Consistent with the policy framework, the contract for service provision in a specified geographical area would define public service obligations by recruiting locals to operate and maintain the waste management facility in the long post-TT era. This is developed as part of the BOT. Part of the technology transfer process involves the prosecution of patents which is overseen by the national Patent and Trademark Office which as an example in Malaysia is governed by the Ministry of Trade and Industry. In addition to the common licensing agreement, a company may negotiate an industrial contract after reviewing the invention disclosure [1]. This could be in the form of a material transfer agreement, a collaboration agreement, a master agreement or a sponsored research agreement during the early stages of the project. It is vital that the closeout of the TT covers the following;

- Administrative – All status reports, logging.
- Financial reports – usage, overruns, balances
- Intellectual Property – Patenting
- Materials and Equipment – Inventory

The new owner is the now the local government and all assets belong to the government. The above four areas constitute the TT being a success which is done in post-TT. Measures of success in waste management technology transfer need to be designed to cover the technology transfer mission and the resources available to the organization. Even if commercialization is a primary goal, the technology's value to further research or improvement of a process should not be overlooked or minimized. This is evaluated by the local government.

3. Analysis Findings

The research hypotheses for this study are as shown below;

- RH1-Local government policies and advocacy (LGPA) is positively related to the effectiveness of waste management pre-technology transfer.
- RH2-Technology identification (TI) is positively related to the effectiveness of waste management pre-technology transfer.
- RH3-Technology transferor to transferee relationship (TTTR) has a great impact in the effectiveness of waste management during-technology transfer.
- RH4-Infrastructure (I) is positively related to the effectiveness of waste management during-technology transfer.
- RH5-O&M (OM) is positively related to the effectiveness of waste management post-TT.

- RH6-Local R&D (LRDD) is positively related to the effectiveness of waste management post-TT.

Based on the selected determinants and stated hypothesis the basic empirical model is expressed as:

$TT = \beta 0 + \beta 1$ **LGPA** $+ \beta 2$ **TI** $+ \beta 3$ **TTTR** $+ \beta 4$ **I** $+ \beta 5$ **OM** $+ \beta 6$ **LRDD** $+ \varepsilon$

Post-TT has operations and maintenance and research and development as the final metrics of measurement that concludes whether a TT was successful or not. The local Government policies and advocacy was most referred to as per the survey conducted with Technology Transfer professionals in Malaysia as a benchmark study. The key information is summarized as below;

- Funding constraints and Return on Investment or economic feasibility was needed to satisfy the local client which was the Government of Malaysia.
- Adaptation to foreign culture differences or poor knowledge sharing was apparent in previous technology transfer programs.
- Quality of recipient basic knowledge. Open mind concepts to evolve from training to field or practical implementation. This relates to the quality of the chosen technology transfer recipients who have to have the easy leaning capability to absorb the knowledge transferred during the technology transfer.
- The apparently simple, "low-tech" techniques proper operations and maintenance in fact require sound engineering practice and extensive experience (both being essential ingredients of expertise) for successful implementation and this is the basis for the technology recipient selection.
- Identification, defining and preparation of the target process should be identified by the Government of Malaysia for the technology transfer program so that it can be easily monitored and audited.
- Appropriate technology works from the bottom up; it is not an overlay to the situation; it is a genuine grassroots solution to industry and economic needs of the receiving country.

The interaction was examined for every independent variable against the factors within the survey statements. For Government of Malaysia Involvement and Advocacy, the interaction and view of respondents from government, private and foreign firms were matched against each other. The demographic analysis was carried out using cross tabulations and the results show that all relationships were positive towards the Agree answer except for the Government formed the role of technology driver to lessen the burden of the receiving local firm had a high average percentage of 36.3% answer of neutral. This proves that the respondents have less importance on the fact of technology driver as the point of focus for the effectiveness of technology transfer.

Table 2. Demographic Analysis using Crosstabs for Local Government Policies and Advocacy against Representation

GOM formed the role of technology driver to lessen the burden of the receiving local firm		**Representation**				**Total**
		GOM	**Private Firms**	**Foreign Firms**	**Others**	
Strongly Disagree	Count	2	9	2	0	13
	% Within Representation	2.6%	8.1%	2.2%	0.0%	2.3%
	Adjusted Residual	-0.9	2.5	-1.2	-1.1	
Disagree	Count	16	20	16	4	56
	% Within Representation	20.5%	18%	17.8%	16.7%	18.5%
	Adjusted Residual	0.5	-0.2	-0.2	-0.2	
Neutral	Count	29	41	31	9	110
	% Within Representation	37.2%	36.9%	34.4%	37.5%	36.3%
	Adjusted Residual	0.2	0.2	-0.4	0.1	
Agree	Count	25	26	30	5	86
	% Within Representation	32.1%	23.4%	33.3%	20.8%	28.4%
	Adjusted Residual	0.8	-1.5	1.2	-0.9	
Strongly Agree	Count	6	15	11	6	38
	% Within Representation	7.7%	13.5%	12.2%	25	12.5%
	Adjusted Residual	-1.5	0.4	-0.1	1.9	
	Count	78	111	90	24	303
Total	Representation	100%	100%	100%	100%	100%

The same relationship of answers was further tested for Local Government Policies and Advocacy (LGPA) against the answers from project management and recipient participations to learn the higher preference for the technology transfer to be more Built, Operate and Transfer (BOT) based or research based within the contexts of the LGPA in terms of implementation or knowledge transfer.

The recipients were more towards a neutral stand on all the local government statements unlike the project managers who agreed on all. For the local R&D, the statistics proved that all statements were agreed upon except the "Look East Policy" was a good policy to duplicate for waste management R&D technology transfer in terms of ethical values.

In terms of factors that affect the effectiveness of technology transfer for the pre, during and post context, Government of Malaysia offered fiscal benefits to local firms receiving technology and Government of Malaysia is accountable for the technology transfer program status, had neutral as the most popular answer with an average of 37% and 35.3% proving that majority of the respondents viewed this factor as not significant.

As noted in the conceptual framework, local government policies and advocacy concerns the government's proactive behavior in seeking and responding to new technologies. Previous waste management technology transfers have indicated failures due to lack of resources or funds from the government resulting in the transfer being incomplete. What's interesting at this point is also the combination of items resided in the local government policies and advocacy construct. The organizational antecedents in local government policies and advocacy are not only constrained to technological aspects, funds and resources alone.

This study also manages to bring newness to the existing concept of local government

policies and advocacy as it incorporates the importance of the government's financial willingness, namely to allocate a budget within a National Plan. The inclusion of such financial consideration is due to the fact that the process of sensing and responding to new technologies reflects an effort towards research and development.

4. Conclusion

Table 3. Summary of the Hypothesis Testing Results

Hypothesis	Test/ Analysis	Significant findings
Research Hypothesis No.1 Local government policies and advocacy (LGPA) is positively related to the effectiveness of waste management pre-TT.	Demographic Analysis/Crosstabulation	Significant, positive relationship

For the response rate as per the survey conducted the responses from the Government agencies were the poorest at 78 persons giving feedback for response rate of 22.6**%.** The foreign company personal did slightly better with a 30.4**%** response rate. The best rate was obtained by the local private companies that pulled in a 47**%** response rate. The participation was done to segregate the respondents according to their field or expertise or background in terms of waste management technology transfer. Based on historical data concluded from the interview sessions with waste management experts, project management was deemed as the scope most represented by the Government agency personnel and this showed only 83 persons who replied the survey from the 250 sent out. Technology recipients were represented from the local private companies that formed the government privatization objective in terms of waste management in Malaysia and the respondents totaled at 58.

Price was a surprise factor as price for a waste management technology which is actually the facility itself has always been high based on which ever country it comes from. On this note, the government agency personnel answers were mostly in that line of price as the most critical factor. The project consultants from the local and foreign firms' answers were higher towards features and with the technology recipients vouching for quality factors as their more popular choice. Basically the receiving government can support technology acquisition by only two viable methods:

- The direct foreign investment strategy, where foreign firms set up operations in the host country on their own or jointly with local interest and bring with them their own technology and management.
- The non-equity technology transfer strategy, where foreign technology is purchased directly by local entrepreneurs, primarily through licensing arrangement.

The research acknowledges and justifies that local governance has a high impact on waste management technology transfer being successful.

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References

Bastani, B., Mintarno. E, Fernandez, D., April (2004) Technology Transfer: Licensing Intellectual Property from Universities to Industry, Journal of IPLoft, Fernandez and Associates LLP.

CAF USA, (2014) Sevilla Metro Report, Concessions Section.

IPCC (2014) Methodological and Technological Issues in Technology Transfer, IPCC Special Reports, Section 3.7

MITI (2001) Transfer of Technology Policies, MITI report.

Malaysian Palm Oil Board, MPOB (2003) Transfer of Technology and Commercialization, MPOB Research Development Review.

WorldBank.org (2014) Urban Development Series-Knowledge Paper, Section 3.

Work, G. L. (1995), The Role of the National Labs in Technology Partnering, Conference on Opportunities for Technology Transfer and Partnering, Santa Fe, New Mexico.