

## **Ensuring Higher Efficiency in the M&E Operational Process to Improve the Nutrition Service Delivery Effectiveness during Disaster**

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### **Abstract:**

**Background:** The current study investigated that how different line departments along with the nodal department for nutrition programme can ensure the effectiveness of service delivery through enhanced monitoring and evaluation (M&E) system with an increase in efficiency in M&E measurement and management under an uncertain environment experiencing extreme climatic events. The research investigated different factors influencing the efficiency of monitoring and evaluation system based on previous literature.

**Materials and Methods:** The study, used Stochastic Frontier Analysis (SFA) and recommended the M&E System as one convergent System under uncertainty incorporating System of Systems paradigm in SFA Model. Data has been collected using structured questionnaire from 112 government officials from different line departments who are responsible for ensuring health and nutrition service delivery in selected study area.

**Results:** Findings of the study show that if capacity building activities are conducted innovatively, and quality of process implementation improves (technical efficiency = 0.780), the impact of periodic comprehensive risk and impact analysis becomes more effective to ensure access to service during a disaster with more horizontal and vertical integration within departments. If M&E activities are outsourced there is further rise in technical efficiency from 0.780 to 0.827. If the implementation of risk analysis is conducted with quality in the M&E process and horizontally integrated manner, the predicted technical efficiency increases further to 0.901.

**Conclusion:** The study concludes that with innovative application of M&E process through generalizable child risk analysis, higher technical efficiency can be achieved, and it can be improved further with integration of multiple line departments. This efficiency gain will contribute to effective utilization of all the linked public services aimed to improve child health and nutrition.

**Key Word:** Efficiency; Effectiveness; Monitoring; Evaluation; Disaster Risk Reduction.

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Date of Submission: 28-11-2020

Date of Acceptance: 13-12-2020

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### **I. INTRODUCTION**

It is critical for the policymakers not only to bring socio-economic equality but also to ensure social justice through need-based access to public services<sup>1</sup>. In India, Integrated Child Development Service scheme (ICDS) is run by Government of India to ensure physical and cognitive development of children under the age of six through reduction of malnutrition among children<sup>2,3,4</sup>. Since malnutrition prevalence is higher among poor children, the target of the programme is children belonging to low-income families<sup>5</sup>. In addition to this further, exposure of children to multiple covariate shocks like natural disasters, for example, floods, cyclones, droughts etc., aggravates different health issues leading to creating pressure on service delivery system and consequently increases malnutrition<sup>6</sup>. In such circumstances, if ICDS service providers are not well-equipped the exposure to risk and vulnerability, further deteriorates outcome achievement – leading to an increase in the prevalence of malnutrition<sup>7</sup>. The current research is focused in generating **Innovative Integrated Monitoring & Evaluation Model** for eliminating inequality in access to child-specific nutrition services in disaster-prone areas after critical analysis of efficiency and effectiveness of monitoring & evaluation mechanism of intervention started in an integrated manner.

Consequently, the level of malnutrition is not falling at the rate of execution of the programme components<sup>8</sup>. Literature inferred that increasing the effectiveness of the nutrition programme reduces malnutrition by 20 per cent and child mortality by 15 per cent<sup>9</sup>. For instance, two other studies reflect that if the programme is effective, then scale-up of these programmes influences sustainability towards achieving and maintaining the improved nutritional status of children<sup>10,11</sup>. As well, one other study concluded that an increase

in efficiency and effectiveness of these programmes increase the rate of growth and developmental process among children<sup>12</sup>.

Multiple research studies in literature exist who studied the strategic effectiveness towards achieving operational efficiency of different programme components in domains like the financial sector, transport sector etc. In the World Bank study (2013) conducted by Independent Evaluation Group to assess the relevance, effectiveness, and efficiency of IFC M&E system, the gaps visible are – irrelevant logical framework; less capable staffs; no periodic performance evaluation of staffs; no measurement of the impacts of processes followed to reach an outcome<sup>13</sup>.

Literature argues that performance measurement tools are used in assessing the effectiveness and efficiency of social programmes which needs handling with care while social, political and other contextual factors affect the results<sup>14, 15, 16, 17</sup>. To strengthen the performance measurement and management of one department while aligning it with other line departments under uncertainty require some deviation or addition of attributes in methodology, which can provide an overall direction. To consider that, along with SFA and BSC, System of Systems approach has been integrated in order to design the M&E theoretical framework inclusive of ensuring convergent service delivery even under the exposure to covariate shocks<sup>18</sup>.

## II. MATERIAL AND METHODS

This deductive research under positivism philosophy was conducted retrospectively on officials of different government departments in four administrative districts in the state of West Bengal in India in January 2020 to February 2020 where the sample size was 112.

**Study Design:** The method followed purposive sampling from the responsible departmental officials in different departments.

**Study Location:** According to National Family Health Survey, 2015 – 16<sup>3</sup>, the state-level report shows that the prevalence of malnutrition is higher in the state (32.5 per cent) and among 19 districts of West Bengal it varies from 23.3 to 45.5 per cent whereas the coverage of services is 90 to 100 per cent everywhere<sup>3</sup>. Based on this evidence, primary data is collected from 3 disaster-prone districts of West Bengal – Malda, South 24 Parganas and Purulia where the prevalence of malnutrition are 37.8 per cent, 27.3 per cent and 45.5 per cent, respectively.

**Study Duration:** January 2020 - February 2020.

**Sample size:** 112 government officials.

**Sample size calculation:** The sample size was estimated following purposive sampling method covering mid-level management – Child Development Project Officers (CDPO) and Block Welfare Officer (BWO), from Department for Women and Child Development (DWCD), Block Disaster Management Officers (BDMO) from Disaster Management and Civil Defence Department (DM&CD), Block Medical Officers, Health (BMOH) from Department of Health and Family Welfare (DH&FW), School Inspectors (SI) from School Education Department (SED), Assistant Engineers (AE) from Public Health Engineering Department (PHED). In four selected districts in the state of West Bengal, India based on the degree of disaster proneness, prevalence of malnutrition and morbidity among children under the age of five. Interviews were conducted with 60 to 75 officials of respective departments where the data has been collected by face-to-face individual interview.

### **Inclusion criteria:**

1. Mid-level officials at community development block – the next jurisdiction level in the district who deal with data related to health and nutrition service uptake of the children in the respective locations and try to ensure the effective service during normal as well as disaster time.
2. Officials who are the domain expert in respective department, coordinate with other selected departments for assuring integrated service delivery with quality and efficiency.

### **Exclusion criteria:**

1. Community members – The study focused on improving the process efficiency in rendering service delivery, therefore, community members are not included.
2. Community Development Blocks which are not vulnerable to any natural disaster.

### **Procedure methodology:**

Respondents were asked for free and informed consent and after receiving the consent, a structured close-ended questionnaire was used to collect data from the officials. The questionnaire included nature of service, structure of M&E system, extent of learning, innovation and development evident, quality of process implementation followed, efficiency indicators of M&E outputs (degree of availability of evidence on Operational system related practice change after disaster, Increase in coverage, Success in overcoming

Challenges, Success of Lessons learnt, Supply evidence for district level governance, Detailed documentation through comprehensive report, Dissemination and discussion), inputs like degree of autonomy achieved through agile learning and adaptation, convergence in decentralized system and vertical-horizontal integration of implementation after risk analysis.

**Statistical analysis:** The current study investigated that how different line departments along with the nodal department for nutrition programme can ensure the effectiveness of service delivery through enhanced M&E system with an increase in efficiency in M&E measurement and management under an uncertain environment experiencing extreme climatic events. The study, therefore, used Stochastic Frontier Analysis (SFA) and recommended the M&E System as one convergent System under uncertainty incorporating System of Systems paradigm in SFA Model – using modified attributes compared to existing dominant paradigm combining the concepts of Vitezić et al. (2019) and Bourne et al. (2018)<sup>18,19</sup>.

Following the theoretical grounding, the quantitative data was analyzed using STATA version 14 (STATA Inc., Texas, USA)<sup>20</sup>.

**Econometric Model:** The Stochastic Frontier Model equation is given below,

$$\begin{aligned} y_i &= \alpha + x_i' \beta + \varepsilon_i, i= 1, \dots, N \dots \dots \dots (i) \\ \varepsilon_i &= v_i - u_i \dots \dots \dots (ii) \\ v_i &\sim N(0, \sigma^2_v) \dots \dots \dots (iii) \\ u_i &\sim F \dots \dots \dots (iv) \end{aligned}$$

In the model  $y_i$  is the logarithm of M&E efficiency of ICDS system in disaster-prone three districts – Malda, South 24 Parganas and Purulia. The set of independent variables are  $x_i'$  representing the inputs – hypothesised as may affect the efficiency of the M&E system in the process of child risk and impact assessment to ensure service delivery during a disaster. Values of  $\beta$ s represent the magnitude of influence of 'x' covariates. The “composed error term”  $\varepsilon_i$  is the sum (or difference) of one normally distributed noise,  $v_i$ , depicting measurement and specification error, a one-sided noise,  $u_i$ , measuring inefficiency. Furthermore,  $u_i$  and  $v_i$  are assumed to be independent of each other, independent as well as identically distributed across the observations<sup>20</sup>.

**Variables:** There are three independent variables and three moderating variables to be used for testing the hypothesis using the stochastic frontier model.

**Dependent Variable** – Output of the M&E system is created by Principal Component Analysis method measured by items like the success of lessons learnt, challenges overcome, increased coverage etc., measured in interval scale – Excellent, Satisfactory, Partly unsatisfactory, Unsatisfactory – as used in the World Bank study<sup>13</sup>.

**Independent variable** – There are three independent variables which represent **System of the Systems** indicating

1. Degree of Autonomy established within departments – Risk analysis conducted by DWCD<sup>1</sup> in coordination with DM&CD<sup>2</sup>, DH&FW<sup>3</sup>, SED<sup>4</sup>, PHED<sup>5</sup>,
2. Degree of convergence developed in decentralized governance – Convergence Methods followed to create M&E operational plan and strategies followed to incorporate risk analysis in the plan,
3. Degree of diversity and connectivity built – Vertical and Horizontal integration methods followed for M&E strategies, M&E implementations designed and implemented for handling service to the vulnerable population,

These variables are constructed using Principal Component Analysis based on information related to these constructs where responses are collected through an interval scale – Excellent, Satisfactory, Partly unsatisfactory, Unsatisfactory – as used in the World Bank study<sup>13</sup>.

**Moderating Variables**

1. Effectiveness of M&E strategy – The effectiveness of the strategy is represented by two constructs – Learning and Innovation Development and Quality of implementation process where responses are collected using an interval scale. These variables are created using Principal Component Analysis based on information related to the effectiveness of M&E strategic activities which may lead to reach a specific

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efficiency level. The information is collected on the interval scale - Highly successful, Successful, Unsuccessful, Highly unsuccessful – as used in the World Bank study<sup>13</sup>.

2. Outsourcing of M&E service – also measured in interval scale - Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree – as used in the World Bank study<sup>13</sup>.

Continuous values of predicted factor scores are considered for analysis.

### III. RESULT

**Table no1:** Out of total respondents, 24 per cent belong to Malda, 44 per cent belong to Purulia, and 32 per cent belong to South 24 Parganas district. In all the studied districts, it is evident that the primary analytic division is situated at block offices where raw data comes from Gram Panchayats. District officials estimate at an aggregate level and send to the state authorities. More than 90 per cent of the departments at block and district level shared that they have dedicated M&E persons and very less dependency on external consultants is reflected. In Purulia and South 24 Parganas most of the departments collect data on a monthly basis; however, in Malda, some of them collect annually, for example, disaster management and civil defence. Evaluations of the programme effectiveness and impact are mostly conducted at GP and block-level across districts.

**Table no1: Background Profile of the district M&E system in the three study districts of West Bengal, India**

	Malda(%)	Purulia (%)	South 24 Parganas (%)
Respondents interviewed	24.1	43.8	32.1
<b>Nature of M&amp;E</b>			
District level	14.8	24.5	22.2
Block level	85.2	71.4	75.0
GP Village level	0.0	2.0	2.8
Implementing partner level	0.0	2.0	0.0
<b>M&amp;E Structure</b>			
Dedicated M&E person	100.0	98.0	91.7
Depend on external firms / consultants	0.0	2.0	8.3
<b>Data collection frequency for Monitoring</b>			
Monthly	33.3	83.7	65.7
Quarterly	0.0	0.0	14.3
Annually	51.9	12.2	17.1
Need based	11.1	4.1	2.9
Not conducted	3.7	0.0	0.0
<b>Nature of Evaluation</b>			
GP level evaluation	55.6	77.6	36.1
Block-level evaluation	74.1	30.6	47.2
District level evaluation	25.9	22.5	2.8
State-level evaluation	11.1	2.0	0.0
Overall Risk evaluation	7.4	6.1	8.3

Source: Primary Survey 2020

**Table no2:** The table represents the nature of the data by presenting the summary statistics. It is evident that standard error is low and almost for all the variables it is either less than 0.1 or equal to except the variable M&E outsourcing.

**Table no2: Summary statistics of dependant and independent variables used in regression analysis**

	Mean	Standard Error	Standard Deviation	Variance
Output - Performance of M&E	3.031	0.026	0.253	0.064
Learning and Adaptation	3.162	0.036	3.090	3.235
Convergence in Decentralised System	0.178	0.122	0.905	0.819
Diversity in Connectivity	2.695	0.025	0.237	0.056
Learning and Innovation Development	3.169	0.027	0.245	0.060
Quality in Process Implementation	3.288	0.027	0.204	0.042
M&E Outsourcing	-0.737	0.807	2.192	4.803

Source: Primary Survey 2020

**Table no3:**Internal consistency among operational items manifesting each variable of interest is tested by using Cronbach Alpha test on the items constituting the variables. Cronbach Alpha values show most of the variables are showing higher internal consistency among the items manifesting the variable.

**Table no3:Cronbach Alpha test results of the variables used in the analysis**

	Cronbach Alpha values
Learning and Innovation Development	0.8062
Quality of Process Implementation	0.7983
Output of M&E system	0.6938
Learning and Adaptation	0.7019
Convergence in Decentralised System	0.8914
Diversity in Connectivity	0.5372
Outsourcing of M&E activities	0.8762

**Table no4:**In **Model 1** only two input factors under the system of systems – Convergence in Decentralised System and Diversity in Connectivity – are introduced to investigate whether these factors have any significant influence on the annual outputs of the existing M&E system. The factor Learning & Adaptation is not included as it is moderately correlated with Convergence in Decentralised System (Coefficient of Correlation = 0.5926). Output or the dependent variable of the stochastic frontier model is operationalised by items such as degree of lessons learnt from the implementation, how far the programme is successful in overcoming challenges during the intervention, whether they are successful in increasing the population coverage, the vertical network of information and data sharing is working well, modification of implementation process takes place after a disaster, and finally how far they are successfully developing comprehensive reports for discussion and dissemination.

**Model 1** is testing  $H_1$  that whether the system of systems affects the efficiency of the M&E system in generating social outcomes. The model reflects that excellent to a satisfactory level of departmental convergence in the M&E process including capacity building of a team of frontline workers from each department, integrated coordination and activities to prepare a joint action plan checklist to design comprehensive plan to be implemented in pre, during and post-disaster situation adopting scientific risk and impact analysis technique significantly increases the efficiency of M&E system of the programme which is significant at 99% level of significance and the magnitude of influence on the mean efficiency is 0.88. However, the influence of the components like vertical or horizontal integration of departments covered under diversity and connectivity is not significant. The level of technical efficiency estimated from this model is **0.765**. In **Model 2**, variables constructing the moderator ‘effectiveness of M&E strategies’- Learning and Innovation Development and Quality of Implementation Process– are incorporated to test  $H_2$ . Model 2 presents the evidence that both the factors positively and significantly influence M&E efficiency; however, weakens the influence of departmental convergence. However, if the diversity in integration is abolished then it significantly increases M&E efficiency, and as a consequence, the technical efficiency marginally increases from **0.765** to **0.780**. In other words, if capacity building activities are conducted innovatively, and quality of process implementation improves, the impact of periodic comprehensive risk and impact analysis becomes more effective to ensure access to service during a disaster with more horizontal and vertical integration within departments.

Furthermore, the situation improves in **Model 3** if M&E activities are outsourced- in such a situation there is further rise in technical efficiency which implies the H<sub>3</sub> is acting as moderator and amplifies the influence of the system of systems on M&E efficiency like H<sub>2</sub>. In other words, part of M&E outsourcing strengthens the impact of the system of systems via improving the quality of process implementation of child risk analysis. This model reflects a further increase in technical efficiency from **0.780** to **0.827**.

In order to increase the positive deviation in technical efficiency further, different ways are investigated, and it has been found (**Model 4**) that if the interaction between diversity & connectivity and learning & innovation development is allowed with quality of implementation process the situation improves. Therefore, if the implementation of risk analysis is conducted with quality in the M&E process and horizontally integrated manner and also the implementation of risk analysis follows quality and innovation in M&E process the influence of the system of system strengthens. However, the strategic effectiveness factors in isolation significantly fail to bring success in risk analysis. It is evident that in this model, after allowing all such interactions, the predicted technical efficiency level increased from **0.827** to **0.901**.

**Table no4: Findings from Stochastic Frontier Models**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>
	<b>β</b> <b>[CI]</b>	<b>β</b> <b>[CI]</b>	<b>β</b> <b>[CI]</b>	<b>β</b> <b>[CI]</b>
<b>Convergence in Decentralised System</b>	0.884***	0.622**	0.800***	0.591*
	[0.407,1.361]	[0.138,1.106]	[0.194,1.406]	[-0.025,1.206]
<b>Diversity in Connectivity</b>	-0.388	-0.634*	-0.275	-0.895* *
	[-1.062,0.286]	[-1.282,0.013]	[-0.922,0.373]	[-1.680,-0.110]
<b>Learning and Innovation Development</b>		0.193**	0.133	-0.478
		[0.026,0.359]	[-0.039,0.305]	[-1.060,0.104]
<b>Quality in Process Implementation</b>		0.141**	0.177***	-0.733**
		[0.007,0.275]	[0.057,0.296]	[-1.399,-0.066]
<b>Outsourcing of M&amp;E</b>			-0.26	
			[-0.675,0.154]	
<b>Implementation of CRIA with quality in the M&amp;E process and horizontally integrated manner</b>				0.117*
				[-0.053,0.286]
<b>Implementation of CRIA with quality and innovation in the M&amp;E process</b>				0.022* *
				[0.003,0.041]
<b>Intercept</b>	19.604***	11.293**	10.233	28.129***
	[13.706,25.502]	[4.215,18.371]	[-16.573,37.039]	[12.462,43.796]
<b>Sigma 'v'</b>	3.040***	2.916***	2.391***	2.854***
	[2.778,3.303]	[2.654,3.179]	[1.984,2.799]	[2.591,3.117]
<b>Sigma 'u'</b>	-5.487	-5.487	-5.219	-8.614
	[-232.802, 221.829]	[-224.247, 213.274]	[-906.083 ,895.646]	[-229.516, 218.541]
<b>Technical Efficiency</b>	<b>0.765</b>	<b>0.780</b>	<b>0.827</b>	<b>0.901</b>
<b>Wald Chi-squared<sup>6</sup></b>	15.653	32.523	40.003	41.781

<sup>6</sup>The **Wald** test (also called the **Wald Chi-Squared Test**) is a way to find out if explanatory variables in a model are significantly explaining it.

<b>p Value</b>	0.0004	0.0000	0.0000	0.0000
<b>N</b>	112	112	55	112

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Source: Primary Survey 2020

#### IV. DISCUSSION

In line with these earlier initiatives, the present research work tested that how far factors related to the system of systems affect the technical efficiency of integrated M&E system to ensure ICDS service run by public authority, whether M&E strategic effectiveness and outsourcing of M&E influence that relationship are examined and finally the research investigated how to maximize the positive deviation from the deterministic frontier by running different causalities to increase technical efficiency. The Stochastic Frontier Model is used to estimate the technical efficiency first by testing hypotheses and then estimating the best possible combination of inputs or factors to increase technical efficiency of the integrated M&E system. The geographical setting selected for the primary study is the disaster-prone areas of West Bengal. Three districts of West Bengal are selected – Malda, South 24 Parganas and Purulia which are prone to flood, cyclone and drought respectively.

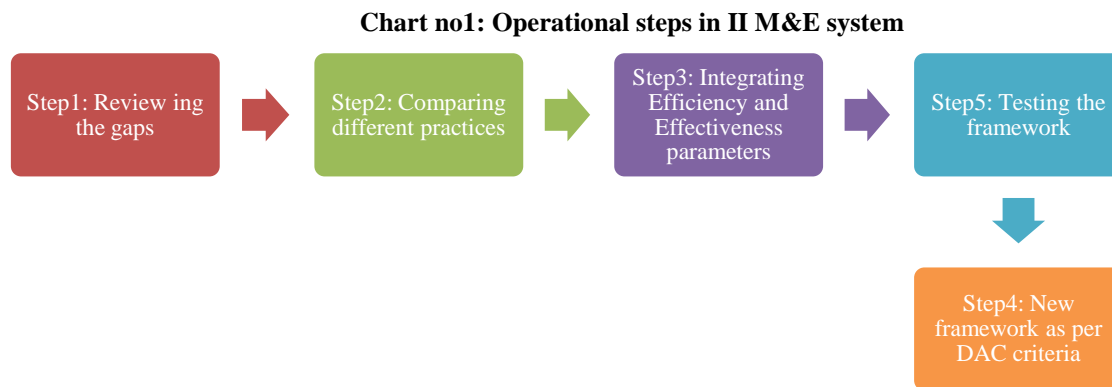
To ensure ICDS service delivery and other child-specific services during the disaster, the Disaster Management and Civil Defence department with technical support from one international inter-governmental organization initiated the process of unique integrated M&E programme in these focused districts – namely child risk analysis. It consists of components to assess the existing risks and vulnerabilities in service delivery and access, the extent of increasing gaps in service delivery due to exposure to risk, how far service delivery gets affected during the disaster and ultimately how it impacts on child well-being. Child risk analysis aims to reduce child-specific vulnerabilities through situation analysis, design of action plan based on analysis followed by the implementation to ensure sector-specific delivery of child-centric services during a disaster. The present research work is a valuable addition to this programme given the objective of strengthening the integrated M&E process looking at one dimension of child-centric services – nutrition.

From the results of the stochastic frontier model followed by estimation of average treatment effect in districts where it already has been started implementation, different inferences arise. Firstly, **Model 1** shows that implementation of child risk analysis in departmental convergence has a significant high magnitude of positive influence on child risk analysis efficiency. Previous studies also have explored how far nutrition intervention programme is trying to gain success through convergent mode with the department of health or education<sup>21, 22, 23, 24, 25</sup>. However, one such study by Hawkes et al. (2019) found that these opportunities are not fully utilized<sup>26</sup>. Therefore, following these studies, it can be inferred that if capacities are utilized optimally, technical efficiency will significantly rise.

Secondly, **Model 2** shows that factors representing strategic effectiveness significantly amplify the impact of system of systems through the reduction of diversity element in vertical and horizontal integration. The reason behind significance of effectiveness, i.e. convergence in the decentralized system handling diversity in connectivity may be argued as an integrated plan for service delivery in the disaster-prone area if gets included in a common platform with consensus among all the line departments responsible for child-specific services the efficiency and impact will increase – as found in similar programme implementation in other studies<sup>27, 28, 29, 30</sup>. In another state of India, it has been observed that monitoring of frontline workers by a higher level of governance is not adequate due to lack of vertical integration which results in sub-optimal efficiency in achieving performance standard – as found in Gujarat<sup>31, 32</sup>. Similar findings are evident in model 2 and 3 as integration or convergence increases along with better strategic decisions, efficiency also increases. So, **Model 3** depicts that if a part of child risk analysis M&E is outsourced, it will further strengthen the impact of the system of systems via improvement in process quality.

It is visible that in **Model 4** two interactions are allowed in the stochastic frontier model – first is **between** one moderator and one driver and second is **within** the two items of the moderating construct, i.e., M&E effectiveness. The first one investigates whether vertical and horizontal integration between line departments with disaster management and periodic child risk and impact analysis can be done by forming one team of people from all the six departments (offer child-centric services) to be available at all level of governance. The literature also found that the existence of higher prevalence of malnutrition among poor and marginalised population subgroup is persisting and one primary reason may be a weaker implementation which requires focus in research<sup>33</sup>. They tested how to maximise the random positive deviation through identifying the causalities and then utilising them to increase efficiencies for which exponential distribution of the mean value of the standard error is taken (where the standard error 'u' measures the percentage deviation from deterministic frontier – the degree of technical inefficiency). Following such method, it is evident that even if departments make integrated teams if those are not utilised maintaining quality in the process of child risk and impact analysis followed by contextual action plans, then the integration strategy fails significantly.

**Chart no1:** The framework is designed to provide M&E model to reduce M&E systemic gaps and increase efficiency and effectiveness. According to the results, evaluation framework must include operational efficiency, service quality parameters and allocative efficiency of financial resources. Saeed et al. (2018) collected case study and built an analytical foundation to explore gaps in performance evaluation with the help of pattern matching and time series analysis followed by comparative case building. Case built by Saeed et al. (2018) to develop the evaluation framework is partly followed to construct the process towards setting up the innovative M&E model<sup>34</sup>.



## V. CONCLUSION

In this study, the research hypotheses are tested, and the results show that, firstly, stronger the institutional factors, higher is the efficiency; higher the effectiveness of integrated M&E strategies or M&E outsourcing on a partial basis, stronger is the influence of institutional factors on M&E efficiency.

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Moumita Mukherjee, et. al. "Ensuring Higher Efficiency in the M&E Operational Process to Improve the Nutrition Service Delivery Effectiveness during Disaster." *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 25(12), 2020, pp. 47-55.