

# Deficiency factors in rehabilitation and capacity building of local farmers national parks through interpretative structural modeling approaches

H Rujito<sup>1</sup>, M M D Utami<sup>2</sup>, Rizal<sup>1</sup> and H Y Riskiawan<sup>3</sup>

1 Department of Agribusiness Management, Politeknik Negeri Jember, Jl. Mastrip PO Box 164, Jember, Indonesia

2 Department of Animal Science, Politeknik Negeri Jember, Jl. Mastrip PO Box 164, Jember, Indonesia

3 Department of Information Technology, Politeknik Negeri Jember, Jl. Mastrip PO Box 164, Jember, Indonesia

e-mail: hrujito2@gmail.com

**Abstract.** The purpose of this study was made the structural model of the relationship between deficiency factors or constraints in Meru Betiri National Park (MBNP) rehabilitation and the empowerment of local farmers. Information from this research will be very useful for the consideration of policy development and its implementation in the rehabilitation and conservation of the area. The research method used a qualitative approach and the data and information are analyzed using Interpretative Structural Modeling (ISM). The procedure for obtaining information and data is carried out by depth-interviewing the head of the MBNP institution, the head of the agency of regional development, higher education experts, and the results of the Focus Group Discussion. The results showed that there were four factors of deficiencies that caused 12 other constraints. The four key deficiencies were the absence of a locally agreed organizational governance regulation, the lack of facilitation and assistance to local communities, not available technology for the development of regional potential yet, and the lack of synergy between related institutions. The implication of the results of this study is that the MBNP institution needs to formulate a policy to overcome these four key constraints so that other constraints can be overcome.

## 1. Introduction

In 1998-2000, the period of Indonesia experienced an economic crisis there was massive looting and illegal logging of teak forests in the conservation area of Meru Betiri National Park (MBNP) which was located in the province of East Java causing damage to 4023 ha. The identification of the causes of illegal logging by the MBNP institution shows that factors such as poverty, scarcity of employment, low education, ownership of narrow land are the cause of the looting of forests in the conservation area.

Considering these problems the MBNP Institute cooperates with communities around the area to rehabilitate damaged areas. Local communities around the area are educated to carry out rehabilitation and are expected to help maintain regional security and are given the right to plant intercrops among staple crops to increase their income. In addition, the rehabilitation partner farmers are empowered



economically through the institutional group of rehabilitation partner farmers to build their capacity and independence

However, after the rehabilitation of the area was carried out for more than 12 years, the achievement of the target of rehabilitating the area was not yet according to the target set. Likewise, the capacity and independence of empowered local communities are still low. Partner farmer groups still depend a lot on government programs and also have not been able to function as effective institutions to grow social capital for mutual trust, mutual cooperation and places to seek a solution to common problems.

Actually, there are several models of national park management in several places in the world to be used as comparative studies in an effort to improve national park management [1]. Based on the experience of managing the national park shows that the involvement of the surrounding community to help manage the national park can be done through several alternative approaches such as Adaptive Management [2], Collaborative Management [3], and Adaptive Co-management[4] which is a general concept of national park management based on the framework of ecological and social systems in the region [5]. Managers of protected area authorities realize that there is a need to consider local ecological aspects and social dynamics in the national park area [6] and need to adopt an interdisciplinary approach. Nevertheless, national park managers acknowledge the uncertainty and difficulties in predicting the ecological and social dynamics that occur [7].

Good collaboration with local communities for the management of the National Park is needed in order to provide good results. As reported by [8] in Zimbabwe the collaboration between the managers of Hwange National Park and the people around the area, resulted in good management and reduced conflict with residents. Meanwhile, [9] reported that community empowerment through community-based projects is very effective in improving the lives of poor people in Nigerian villages through increasing productive assets, increasing community incomes and increasing the welfare of villagers in general in Nigeria. In order a community-based development approach to be effective in reducing poverty, it must be carefully planned and monitored.

The purpose of this research is to identify and model the shortcomings of the rehabilitation program and the capacity building of local communities in the MBNP area. so that the hierarchical relationship structure between the constraints causing the lack of achievement of the rehabilitation target and community capacity building can be explained. Information on the results of the research will be very useful for the consideration of improving policies in the rehabilitation and conservation of the MBNP area.

## 2. Materials and Methods

The participants of this study were the stakeholders of the MBNP which included the Head of the MBNP, the head of the agency of regional development, the Agriculture and Livestock Service Office, the Plantation and Forestry Service, the experts from universities, the heads of farmer groups, rehabilitation partners, village heads in the region, local community leaders, companion facilitators.

Measurement of data and information used in this study is a qualitative measure in accordance with the qualitative research approach followed by the conversion of data into quantitative data in the form of binary numbers to be analyzed and modeled using the ISM (Interpretative Structural Modeling) method approach. The procedure for obtaining data and information in this study was carried out in several ways such as in-depth interviews with the heads of MBNP institutions and related technical services, university experts, and obtained through Focus Group Discussion (FGD) with stakeholders in the field such as rehabilitation partner groups, facilitating facilitator of village heads and local community leaders.

The method of analysis and modeling used in this research is the method of Interpretative Structural Modeling (ISM) a method proposed by [10] which was originally used as a problem-solving method based on the identification and understanding of relationships between components within a complex system. Many researchers use this model to describe the relationship between the elements

that cause problems in the system [11]. In the ISM approach, qualitative and interpretive data are used to solve complex problems based on mapping the structure of relationships between components and then transformed into a multi-level structure model [12]. The basic idea of identification of the components of a system is based on the opinions and experiences of competent practitioners and experts who understand how to decompose a complex system into several elements and sub-elements so that a multi-level structure model can be built [13].

The implementation of the ISM method begins by using the opinions of experts through several techniques such as brainstorming, FGD, in-depth interviews to develop relationships between attributes to identify interactions between system components. Thus interviews are conducted with experts in the field (experienced practitioners) and academic experts. Four symbols are used to indicate the type of relationship between components  $i$  and  $j$  as explained below:

V: if the relationship happens is that  $i$  influence  $j$  but not vice versa

A: if the relationship that occurs is that  $j$  influence  $i$  but not vice versa

X: if the relationships that occur are in  $j$  both influence each other

O; if the relationship that occurs  $i$  and  $j$  does not influence each other

These symbols (V, A, X, and O) are used to express opinions given by experts about the relationship between components of the system that are thought to cause problems. Then the information about the relationships between the components is arranged in a matrix of relationships between components called the Self Structural Interpretative Matrix (SSIM).

The next step of the symbols in the SSIM matrix is converted into a binary matrix form to compile the Reachability Matrix (RM) with the following rules:

If in SSIM the compound relation to component = V then  $e_i = 1$  and  $e_j = 0$

If in SSIM the compound relation to component  $e_j = A$  then  $e_i = 0$  and  $e_j = 1$

If in SSIM the component  $e_i$  relationship to component  $e_j = X$  then  $e_{ij} = 1$  and  $e_{ji} = 1$

If in SSIM the  $e_i$  component relationship to component  $e_j = O$  then  $e_{ij} = 0$  and  $e_{ji} = 0$

Thus, an RM matrix is a matrix that explores the range of the influence of each individual attribute (component) both on itself and on other attributes that can be reached, and also its dependence on other attributes that can reach or influence it. While the range of influence from other attributes that precede it also consists of the range of influence on itself and its range on other attributes that can be achieved and its dependence on other attributes that reach it or influence it. In other words, the driving force of a particular attribute is the total number of attributes that can be reached or affected (including the range in itself) while the amount of dependence is the total number of attributes that can reach it. The highest ability to reach (influence) an attribute is set equal to the size of the quadrant (sector) identified as the top level in the ISM hierarchy. One of the important characteristics of the highest level criteria in the hierarchy of the ISM model is that it does not help to reach other criteria at the level above it (because it is already at the top level of hierarchy). Therefore, once the top level can be identified, it is immediately separated from the other criteria. The same process is repeated to explore the next level until the level of each criterion is found. Then, the level of attributes that have been identified is used to construct the diagram and the last model of the ISM [14].

In principle the steps for implementing the ISM method are as follows:

Step 1: Make a list of attributes that are being considered influential in dealing with performance; then the attributes listed are reviewed through a comprehensive literature review so that the validity is fulfilled.

Step 2: Gather the structural interaction matrix (SSIM) that has been obtained. Contextual relations between criteria are assessed by the opinions of experts. Every expert has his own SSIM and interactions between experts will be avoided.

Step 3: Prepare a reachability matrix once the SIM collection process has been completed. This stage will convert the qualitative assessments of experts into binary code. Thus, these binary codes consist of an individual reachability matrix.

Step 4. Develop and partition (insulate) the levels of the reachability matrix. This means converting an individual reachability matrix which is the result of the assessment of the experts to then be

incorporated into the total reachability matrix. This aggregation process uses the average method to avoid extreme values in assessing relationships.

Step 5: build the ISM model. As outlined in the ISM methodology, the structural model of the criteria is built using the final multilevel partition and developed by eliminating transitivity.

Step 6: construct a diagram that states the driver power and the level of dependency after obtaining the total reachability matrix, where the horizontal axis states the size of the driver power of an element while the vertical axis states the level of dependency an element.

### 3. Results and Discussion

Based on the identification of some of the shortcomings of the rehabilitation system obtained through in-depth interviews with university experts and managers of MBNP and FGD that were followed by stakeholders and also by observing the socio-economic conditions of the community in the MBNP area there were 12 elements of the shortcomings in local community rehabilitation and development programs. in the MBNP area as follows: X1: low incomes of local communities, X2: lack achievement of rehabilitation target of MBNP area, X3: lack of participation and awareness of local communities, X4: lack of community learning process, X5: lack of social capital in local communities, X6: lack of capacity at the local community institution of MBNP area, X7: lack of adequate norms in managing local community institutions, X8: lack of facilitation or assistance to local communities, X9: lack of technology for community development of MBNP area, X10: lack of productivity of local community farming area, X11: lack of synergy between MBNP-related institutions, and X12: lack of self-reliance of local communities. Furthermore, relationship between the elements of deficiencies in the rehabilitation system and the capacity building of local communities based on the opinions of stakeholders and experts is expressed in the form of the SSIM (Structural Self Interaction Modeling) matrix as follows in Matrix SSIM (Structural Self Interaction Matrix) which states the relationship between elements of deficiency in the rehabilitation and capacity building of the local community of MBNP (Figure 1.)

No.	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
X1	A	A	A	A	A	A	A	A	A	A	A
X2		A	A	A	A	A	A	A	A	A	V
X3			V	V	V	A	A	A	V	A	V
X4				X	X	A	A	A	X	A	V
X5					V	A	A	A	V	A	V
X6						A	A	A	V	O	V
X7							V	X	V	X	V
X8								V	V	A	V
X9									V	A	V
X10										A	V
X11											V
X12											

**Figure 1** Matrix SSIM (Sutructural Self Interaction Matrix)

The letters (A, V, X, and O) in the SSIM Matrix are then converted to a binary code consisting of numbers 1 and 0 to become a matrix RM (Reachability-Matrix) (Figure 2.)

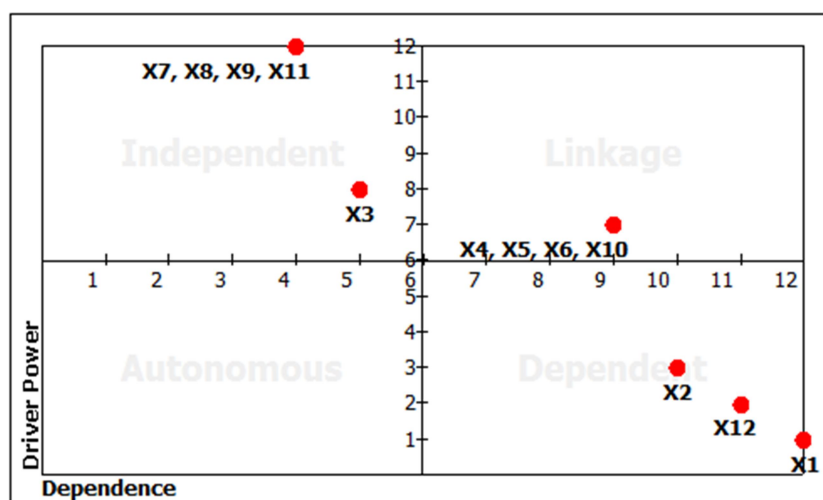
No.	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
X1	0	0	0	0	0	0	0	0	0	0	0
X2	1	0	0	0	0	0	0	0	0	0	1
X3	1	1	1	1	1	0	0	0	1	0	1
X4	1	0	1	1	1	0	0	0	1	0	1
X5	1	0	1	1	1	0	0	0	1	0	1
X6	1	0	1	0	1	0	0	0	1	0	1
X7	1	1	1	1	1	1	1	1	1	1	1
X8	1	1	1	1	1	0	1	1	1	0	1
X9	1	1	1	1	1	1	0	1	1	0	1
X10	1	0	1	0	0	0	0	0	1	0	1
X11	1	1	1	1	0	1	1	1	1	1	1
X12	0	0	0	0	0	0	0	0	0	0	1

**Figure 2** Reachability Matrix are conversions of elements SSIM matrix into binary code

Furthermore, the RM matrix which is the result of the transformation of the SSIM matrix is revised its consistency using transitivity rules so that the matrix RM has been revised its consistency. The RM Matrix can be seen as follows: Figure 3.

No.	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	Drv
X1	0	0	0	0	0	0	0	0	0	0	0	1
X2	1	0	0	0	0	0	0	0	0	0	1	3
X3	1	1	1	1	1	0	0	0	1	0	1	8
X4	1	0	1	1	1	0	0	0	1	0	1	7
X5	1	0	1	1	1	0	0	0	1	0	1	7
X6	1	0	1	1	1	0	0	0	1	0	1	7
X7	1	1	1	1	1	1	1	1	1	1	1	12
X8	1	1	1	1	1	1	1	1	1	1	1	12
X9	1	1	1	1	1	1	1	1	1	1	1	12
X10	1	0	1	1	1	0	0	0	1	0	1	7
X11	1	1	1	1	1	1	1	1	1	1	1	12
X12	0	0	0	0	0	0	0	0	0	0	1	2
Dep	10	5	9	9	9	4	4	4	9	4	11	

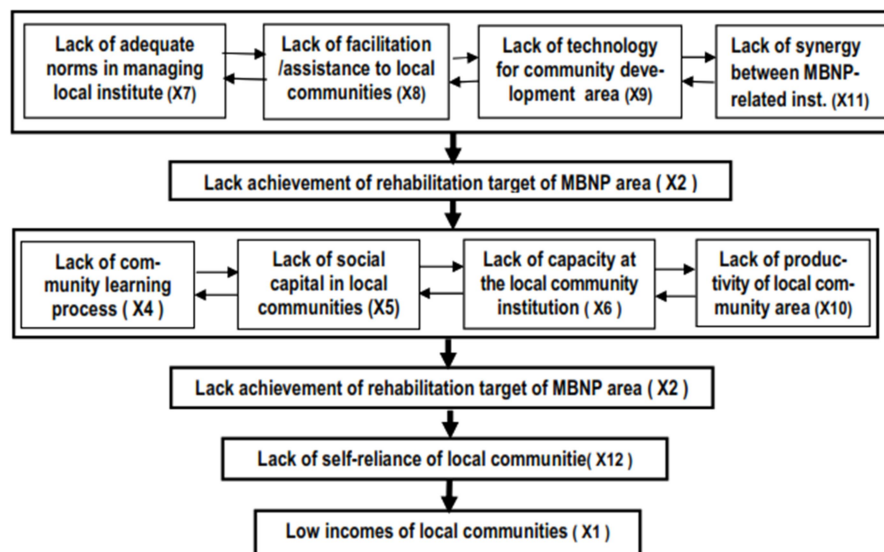
**Figure 3.** The RM Matrix



**Figure 4.** Structural model of all sub-elements Critical Factor "Disadvantages"

The next step is to map the deficiency elements based on the level of "driving force" and "dependency level" as in the following Figure 4. The four key deficiency elements are X7, X8, X9, and X11 whose position is in the same sector, namely in the IV sector or called Independent (not dependent on other elements) on interpretative structural models. The contextual meaning of each key deficiency interpretation is as follows: There is an element of X7 deficiency (= The absence of an instrument of governance rules for local community organizations that are mutually agreed upon by the TNMB), causing other problems to arise, one of which is when there is a distribution of assistance from the government (eg: capital, facilities, input resources, livestock assistance, etc.) to local community groups, so often the distribution of experiencing wrong targets means not falling to the poor who are entitled; but this assistance was more often accepted and enjoyed by the group administrators (who were relatively poor). As a result, poor group members who should be more entitled to receive aid become apathetic and are reluctant to participate in group activities. This condition causes no growth of social capital in the community. On the other hand, revolving capital assistance such as livestock, tools or machines or money and others are not clear in its development. This led to a waste of time, waste of energy and funds allocated by the government in the empowerment program of local communities.

The following is a diagram that is the result of conversion from the final output of the ISM analysis which illustrates the relationship between the elements of deficiencies of rehabilitation and empowerment of local farmers around the National Park as shown in Figure 5



**Figure 5.** Structural diagram of elements critical factors "Weaknesses"

The reality in the field shows that the absence of a locally agreed upon governance regulation for local community organizations has made the distribution of benefits and accountability of the revolving capital assistance unclear. This situation will cause the institutional capacity of the local community to be difficult to develop and not the formation of social capital in the community concerned. The absence of social capital in a community will cause the independence and empowerment of the community to be low so that they cannot make a positive contribution to the region [15].

Actually this can be overcome by intensive assistance to the group to make a written rule that is agreed upon jointly by all group members by using several indicators as recommended by [16] whose indicators include clear boundary principles, distribution of benefits aimed at anyone, how the mechanism for regulating collective choice must be done, how is the activity to monitor it, what kind

of sanctions are given for violations, how is the mechanism of conflict resolution, and how is the organization of joint ownership rights. By looking at the condition of the MBNP local community organization which is still lacking in power, it is necessary to increase facilitation and assistance compared to the previous one, including in making rules for local community institutional organizations.

Another key obstacle element is X8 (lack of facilitation and assistance by facilitators to local community groups of rehabilitation partners) which causes the local community group organization to not build its capacity. The indicator of the lack of capacity of local community groups is the lack of development of shared assets belonging to the community and also the absence of shared rules regarding the use of shared capital (both those that are self-supporting and those from government assistance) and the lack of social capital in the community. This situation naturally causes the participation of local communities into community groups as a place to work together and find common solutions to common problems to be low. The consequence is that there is no learning process for group members, no trust (mutual trust) between group members, no social capital in the group and conflict can easily occur. This situation can, of course, be overcome by intensifying group facilitation & intensive assistance.

Deficiency elements are the third key with the X3 notation (the absence of technology for the development of regional potential). The purpose of the lack of technology is the unavailability of appropriate technology that fits the needs of the community both its designation and capacity. For example for agricultural products that are quite abundant in conservation areas such as jackfruit, wood mushrooms, falcons, medicinal plants, bananas. But because the location of the market is far from the MBNP area and also the knowledge of the community for processing agricultural products is still lacking, and there are also no tools and machines for the handling and processing of these agricultural products, the agricultural products are often damaged or sold at low prices.

In addition to the need for technology for processing agricultural products, technology is also needed to open the isolation of local residents of the MBNP area in order to gain greater access to both access to marketing networks, technology, financial capital, agricultural inputs, market information, and others. So far, local residents of the MBNP area are relatively difficult to obtain market access, capital resources, technology because the location of the region is geographically rather remote and difficult to reach. To overcome perishable products and so far often suffer damage and can not be stored for a long time, it is necessary to design appropriate technology that is suitable for processing abundant agricultural products so that they can be stored longer and to increase added value. On the other hand, to increase the access of citizens in the MBNP area to other areas for access to capital, marketing networks, technology, input resources, etc., it is necessary to design and develop an information technology for the region and support the smart village model "Smart village" in the region.

The last key element about the lack of a system is X4 (lack of synergy between MBNP institutions and institutions in the regions related to MBNP). Based on the results of field research and observations in the field, there was a lack of coordination between the MBNP institutions and related institutions/agencies in Jember. This can happen because the MBNP institution is administratively under the direct control and supervision of the central government which in this case is the Ministry of Forestry, while the related agencies such as agency for regional development, Agriculture Agency, and Ministry of Trade. Because of the lack of adequate coordination between the relevant institutions, there was often an overlap of programs in the local community empowerment of MBNP because of the lack of equality of perception. This results in a lack of synergy between related institutions, especially in the MBNP regional development program so that its activities become inefficient and lack focus on the target.

This situation can be overcome if the MBNP institution as the regional management authority of the MBNP carries out an initiative to always coordinate with Bapekab and related agencies continuously and periodically. In this way, there will be a similarity in the perception and similarity of the focus on the target. Furthermore, from the four key constraints or 4 deficiency elements that are

the key together cause X3 deficiency elements (lack of participation and awareness of local communities). This lack of participation and awareness of local communities causes other problems to arise such as the emergence of other deficiency elements such as X4 deficiency elements (lack of learning process in the community concerned), X5 deficiency elements (less formed Social Capital in the community concerned, X6 deficiency elements (lack of institutional capacity of the local community in the MBNP area and elements of X10 deficiencies (lack of productivity of local community farming).

Furthermore, the deficiency factors such as X4, X5, X6, and X10 together lead to other deficiency elements, namely X2 (less effective achievement of regional rehabilitation targets). This means that if you want to eliminate or overcome the deficiency of X2 elements, you must eliminate the deficiency elements X4, X5, X6, and X10 first. It can be explained that the deficiency factors such as X4, X5, X6, and X10 together cause other deficiency elements to occur, namely X2 (less effective achievement of regional rehabilitation targets). This means that if you want to eliminate or overcome the deficiency of X2 elements, you must eliminate the deficiency elements X4, X5, X6, and X10 first. Furthermore, with the existence of the X2 element, it will cause the emergence of element X12 (lack of independence of the local community of TNMB) which then in a chain raises element X1 (low income of local communities in the rehabilitation area ).

Finally, to overcome the shortcomings in the TNMB area rehabilitation system and also in strengthening the capacity of local communities, what must be done is to eliminate key deficiency elements such as (X7, X8, X9, and X11) before removing other deficiencies.

## Conclusion

The conclusions of the research results that have been described as follows: there were 12 deficiency factors in the rehabilitation, conservation and capacity building system of the MBNP local community which together have a negative effect on the effectiveness of achieving rehabilitation and capacity building of local communities in the MBNP area and encourage the emergence of a final element of lack of independence and income of local communities. This condition is certainly not in accordance with the objective of rehabilitating the MBNP area and developing the capacity of local communities around the rehabilitation area. The results of the analysis using the Interpretative Structural Modeling method which is based on the level of driver power and dependency on other elements, shows that there are four key deficiency factors that cause other deficiencies in the TNMB area rehabilitation system; The 4 key elements were X7: there is no instrument for governance arrangements for community institutional organizations to be agreed upon and jointly monitored, X8: lack of facilitation and assistance to local communities by facilitators, X9: there is no appropriate technology available according to the needs of developing the potential of the region, X11: lack of synergy between institutions related to MBNP the elements of deficiency with the lowest driver power and the highest dependence (meaning their existence is largely determined by the presence or absence of other deficiency elements) are X1 (low income of local people), and X12: lack of independence of local communities

## Acknowledgment

The authors really highly appreciate to Politeknik Negeri Jember for a grant to research and present this paper on the 1st International Conference on Food and Agriculture 2018.

## References

- [1] Braasch M, García-Barrios L, Cortina-Villar S, Huber-Sannwald E, and Ramírez-Marcial N 2008 *Environ. Model. Softw.* **105** 153–170.
- [2] Birgé H E, Allen C R, Garmestani A S and Pope KL 2018 *J. Environ. Manage.* **183** 343–352
- [3] Ansell C and Gash A 2008 *J. public Adm. Res. theory* **18** 4 543–571
- [4] Fabricius C and Currie B 2015 Springer 147–179.



- [5] McGinnis M D and Ostrom E 2014 *Ecol. Soc.* **19** 2
- [6] Mathevet R, Thompson J D, Folke C and Chapin F S 2016 *Ecol. Appl.* **26** 15–16
- [7] Leys A J and Vancly J K 2011 *Land use policy* **28** 3574–584
- [8] Perrotton A, de Garine-Wichatitsky M, Valls-Fox H and Le Page C 2017 *Ecol. Soc.* **22** 1
- [9] Jayne T S 2003 *Food Policy* **28** 3 253–275
- [10] Kumar S, Luthra S and Haleem A 2013 *J. Ind. Eng. Int.* **9** 1 6
- [11] Attri R, Dev Nand Sharma V 2013 *Res. J. Manag. Sci.* **23** 19 1171
- [12] Wu K-J, Tseng M-L, Chiu A S and Lim M K 2017 *Int. J. Prod. Econ.* **190** 96–107
- [13] Govindan K, Kannan D, Mathiyazhagan K, de S. Jabbour A B L and Jabbour C J C 2013 *Int. J. Environ. Stud.* **70** 4 477–493
- [14] Lim M K, Tseng M-L, Tan K H and Bui T D 2017 *J. Clean. Prod.* **162** 806–816
- [15] Gibbs D and Jonas A E G 2000 *Geoforum* **31** 3 299–313
- [16] Fauziyah E and Sanudin S 2017 *J. Wasian* **4** 2 79–88