Irrigation Management Characteristic Model Assessment based on Historical Experience Perspective in Indonesia

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ABSTRACT

Participatory Irrigation Management was formally adopted in Indonesia around 2001 in which the involvement of farmers in water management decision making is necessary to meet the implementation challenges of this initiative. The study presented in this paper considered the level of farmer involvement in irrigation network management (INM) as well as the management activities of irrigation operation and maintenance, and the lessons learned by both local wisdom oriented and government policy implementation in order to support INM in Indonesia from selected province in the country. The objective is to assess and evaluate the appropriate irrigation management model based on four alternative characteristic such as: purely local wisdom management, purely government intervention management, combination for both management consists of local wisdom domination and government intervention domination management approach. The case study covers 12 provinces within 37 districts and represents the four irrigation management characteristics. In addition, analytical Hierarchy Process is applied in order to select the recommended management model strategy to achieve the effectiveness in supporting INM. The result of the assessment indicates that purely government intervention management model would be the best strategy followed by the local wisdom domination within government intervention management approach.

Keywords: irrigation management, community behavior, local wisdom, government policy, multi-criteria analysis

BACKGROUND

In Indonesia Current social and economic growth have encouraged a pattern change in water resources management specifically in irrigation management as well. Historically considered as a social good, water has been altered into an economic good with a social and environmental purpose. The growth has also impacted on the responsibility of management strategies related to the regulation regarding to water: from provider to enabler, from centralized to decentralized system, from individual sector approach to a multi sector approach, and from limited to wide-ranging stakeholder participation (DGWR, 2003).

Historical perspective in managing irrigation system, farmer and its community has widely experiences to establish irrigation management planning and strategy from time to time based on local wisdom approach from their ancestors. However, recent decades, the performance of irrigation network management (INM)

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is experiencing degradation in function and agriculture productivity because of political, economical and social change i.e. from farmer to labour, from agriculture business to industrialization, etc. This paradigm encouraged the government to reform the regulation in irrigation management. The policy changes impact on irrigation system management in Indonesia influence significantly in management and investment responsibility and institutional setting. More investment intervention into institutional setting of local communities occured in 1970s and 1980s encouraged the government burden in irrigation infrastructure operation and maintenance. By establishing the framework of decentralization and new water law, the crucial policy and regulation reform is corresponding to acceptable function and responsibility in irrigation management between government and local communities (Pasandaran, 2004).

The issue of irrigation management in order to increase the performance is very important along the historical experience i.e. from centralization to decentralization, from less government management intervention to more intervention. Therefore, this study focuses on comparing and selecting the most appropriate irrigation management characteristic among purely local wisdom management, purely government intervention management, their management combination approches within more local wisdom domination and or more government intervention domination. In order to solve the problem mentioned above, Analytic Hierarchy Process (AHP) will be adopted to reach optimal decision for evaluating and determining the most appropriate strategy as well as performing the sensitivity analysis of four alternatives based on the proposed criteria.

The case study consists of 12 province such as West Sumatera, Banten, Daerah Khusus Ibukota, West Java, Daerah Istimewa Yogyakarta, Central Java, East Java, Bali, Central Sulawesi, Maluku, Papua and South Kalimantan and covers 37 Districts within 487 samples.

CASE STUDY

The case study covers 12 province and 37 district with 487 respondens consists of *Dinas PU Pengairan* (Public Work Agency at Provincial Level, water division), *Badan Perencana Daerah* (Board of Regional Planning) and *Lembaga Pengelola Irigasi* (Irrigation Management Institution) and *Perkumpulan Petani Pemakai Air* (Water User Association).

The four irrigation management approaches such as purely local wisdom management, purely government intervention management, combination for both management approaches consists of more local wisdom domination (less government management intervention) and more government intervention domination (less local wisdom) management approach as the alternatives and namely Pattern1, Pattern2, Pattern3, and Pattern4, respectively. Pattern 1 includes province of Central Sulawesi. Pattern 2 includes province of Banten, Daerah Khusus Ibukota, Daerah Istimewa Yogyakarta, Papua and South Kalimantan. Pattern3 includes province of West Java, Central Java, East Java, Maluku. Finally, Pattern4 includes province of West Sumatera and Bali,

The data used in this study is based on the model of irrigation management corresponding to local wisdom concern proposed by Supadi (2009). The irrigation management model characteristic has four scheme such as Pattern1, Pattern2, Pattern3, and Pattern4, respectively. Supadi (2009) carried out the study by applying Structural Equation Method (SEM) within Partial Least Square (PLS) in order to evaluate the correlation of farmer behavior (PM) toward water allocation services (PAI), physical condition of irrigation infrastructure (KFJ), irrigation management participatory (PPI), irrigation network management (PJI) (Table 1). In addition, this technique also evaluate the contribution and description of significant influence between PM

and PJI through direct and indirect relation of PAI, KFJ, and PPI (Figure 1). The detail presentation of latent variables and indicator construct can be recognized in Supadi (2009).

Table 1. Typical Correlation among Variables for Pattern 2 (Supadi, 2009)

	PAI	PM	KFJ	PJI	PPI
PAI	1,000				
PM	0,796	1,000			
KFJ	0,829	0,802	1,000		
PJI	0,617	0,745	0,707	1,000	
PPI	0,639	0,727	0,784	0,731	1000

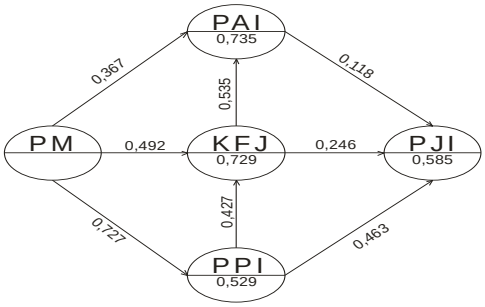


Figure 1. Typical output of SEM for Pattern 3 (Supadi, 2009)

IRRIGATION MANAGEMENT MODEL SELECTION USING AHP TECHNIQUE

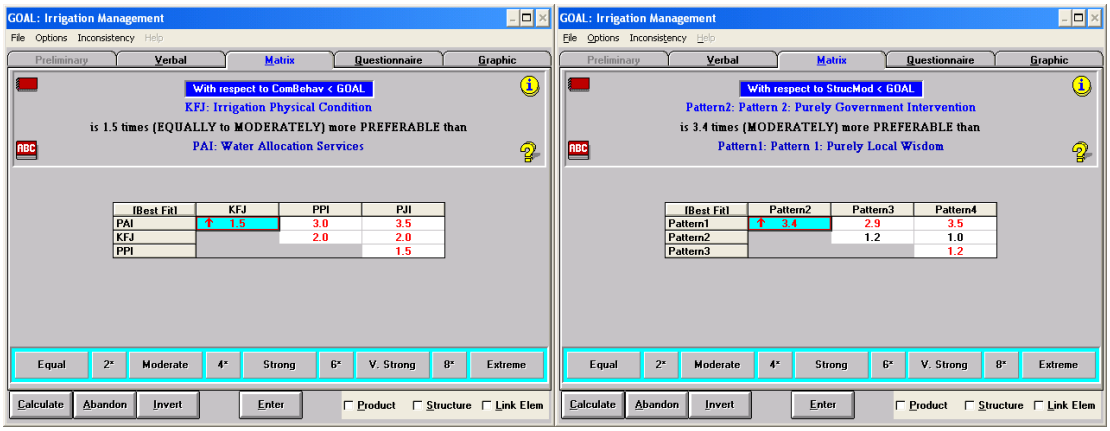
AHP is one of multicriteria Decision-making technique and based on hierarchical additive weighting, utilizing the pair-wise assessment method to evaluate the alternatives using quantitative or qualitative decision weights (Dzemydiene et al., 2008). Thomas Saaty proposed this method in which it applies an procedure to obtain the cardinal ranking of alternative scale-ratio associated with Multiatribute decision-making problems (Saaty, 1980). In Indonesia, Hadihardaja and Grigg (2010) used AHP for determining proportional budgeting strategy for seven irrigation region in West Java Province due to the routine operation and maintenance.

The method is used in order to obtain the appropriate irrigation management approaches such as purely local wisdom management, purely government intervention management, combination for both management consists of more local wisdom domination (less government management intervention) and more government intervention domination (less local wisdom) management approach as the alternatives of Pattern1, Pattern2, Pattern3, and Pattern4, respectively.

There are four main criteria assigned in this method such as Community Behavior Correlation of Community Behavior toward PAI, KFJ, PPI and PJI (ComBehav), Contribution of Community Behavior to PJI (StrucMod), Irrigation Management Performance (IRPerfor), and finally Physical Irrigation Condition and Regulation Implementation (SWOT). The first criteria (ComBehav) consists of four sub criteria that indicate the correlation variables between farmer behavior (PM) and water allocation services (PAI), physical condition of irrigation infrastructure (KFJ), irrigation management participatory (PPI), irrigation network management (PJI). The criteria are adopted from SEM result as indicated in Table 1, for example. The second criteria (StructMod) have no sub criteria and adopted from SEM result as indicated in Figure 1, for example. Those values are justified into the pair wise matrices as the input values in AHP and typically can be presented in Figure 2(a) and (b) for typical the first and second criteria, respectively.

The third criteria has no sub criteria and proposed based on the assessment of irrigation region in the case study that classifies the performance of the irrigation network within cardinal scale from 1 (worst) to 5 (best). The last criteria (SWOT) consist of three sub criteria that indicate the strength, opportunity-threat, and weakness related to the implementation participatory program. Briefly, the strength and weakness are corresponding to water policy and crop pattern regulation implementation, irrigation infrastructure and network function, water user association, operation and maintenance, infrastructure degradation, awareness,

and supervisor, etc. Another sub criteria opportunity-threat is corresponding to farmer motivation, rice self reliance program, irrigation infrastructure development program, potential water allocation conflict, illegal water withdrawal, etc. (Supadi, 2009).



(a) (b)

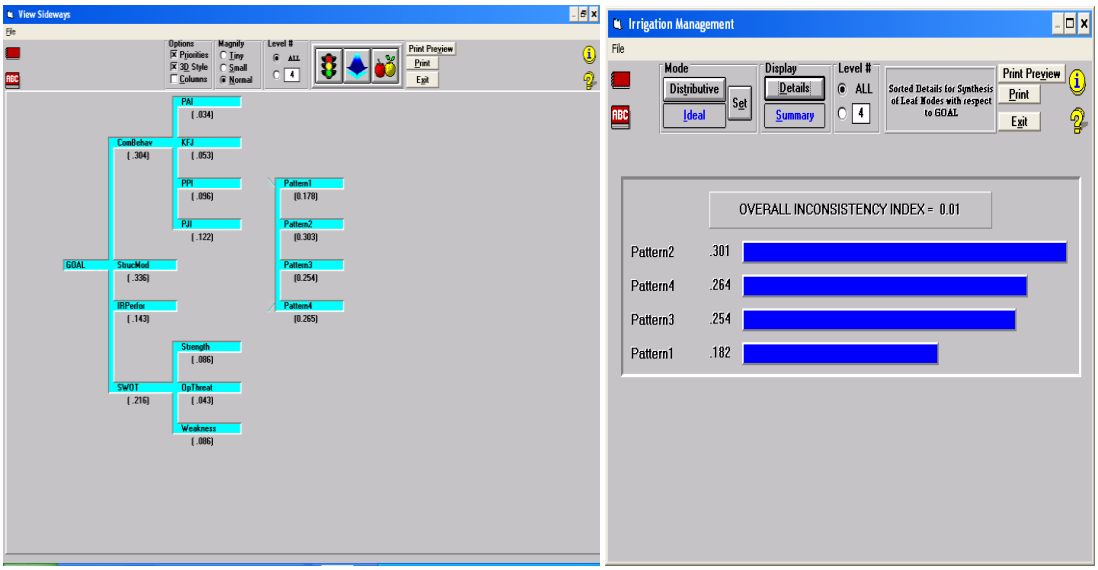
Figure 2. (a) Typical Pair wise Matrices related to the first criteria and (b) the second criteria

RESULT AND DISCUSSION

The result of the AHP procedure (using Expert Choice) corresponding to the hierarchy structure and global priority can be presented in Figure 3 (a) and (b). The appropriate or the best model is purely government intervention management approach. Of course, if the regulation and system spproach is well implemented in the irrigation region that would be increasing irrigation management performance. The combination of irrigation management between local wisdom implementation and the government intervention management whether less or more intervention indicates relatively better approach in increasing irrigation management performance. However, purely local wisdom management without involving any government intervention management approach is less performance than the other existing management strategy alternatives.

The priority of each irrigation management characteristic based on each criteria or overall criteria is presented in Figure 4. Purely local wisdom management approach can be increased in term of INM performance if the farmer behavior, in this case, increasing the role of the farmer in supervising water withdrawal, awareness of water use in term of water balance at upstream and downstream region, awareness for following crop pattern regulation and discipline in gate operating for water allocation.

The sensitivity analysis if the criteria has been change (for example: impact of political and economic change in the future) can be presented in Figure 5, 6, 7 and 8. Overall, alternative Pattern2 (blue bold line) dominates the priority for each criteria although there is a change or shift of vertical red line moving to the left or right. The vertical red line indicates the priority result based on the survey. This situation provides optimistic recommendation that the government will push the irrigation management intervention to increase INM performance and be getting stronger since the local wisdom approach combination with government management intervention approach also has the second best performance compared to purely local wisdom management approach.



(a) (b)

Figure 3. (a) Hierarchy Structure and (b) Global Priority of Irrigation Management Characteristics

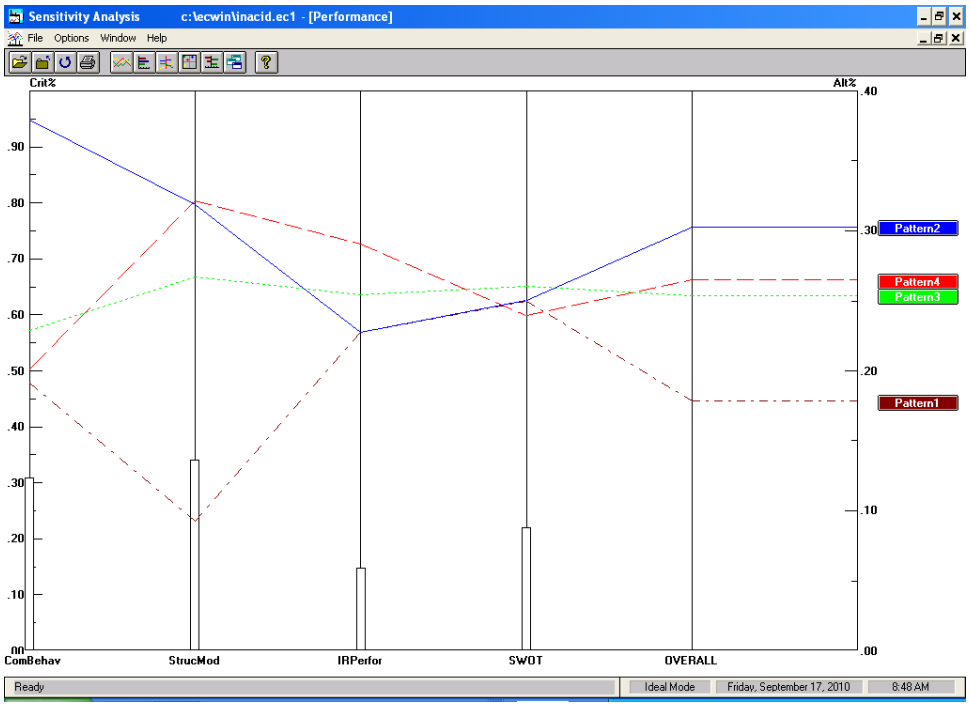


Figure 4. Local and Global Priority of Irrigation Management Characteristics Based on Proposed Criteria

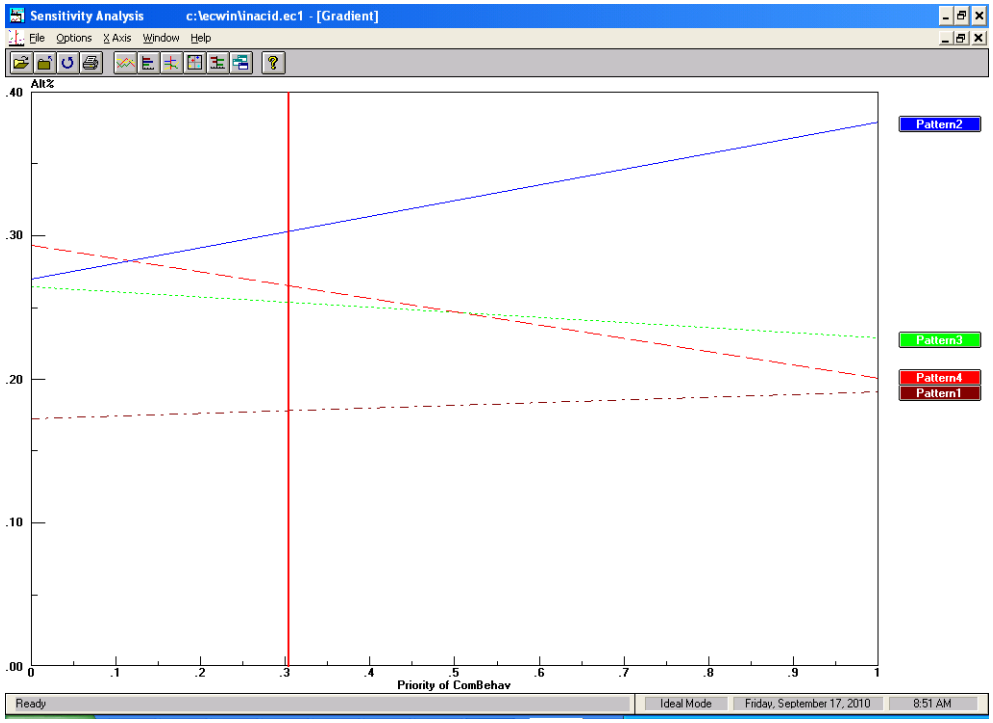


Figure 5. Sensitivity Analysis of Global Priority based on Community Behavior Correlation of Community Behavior toward PAI, KFJ, PPI and PJI

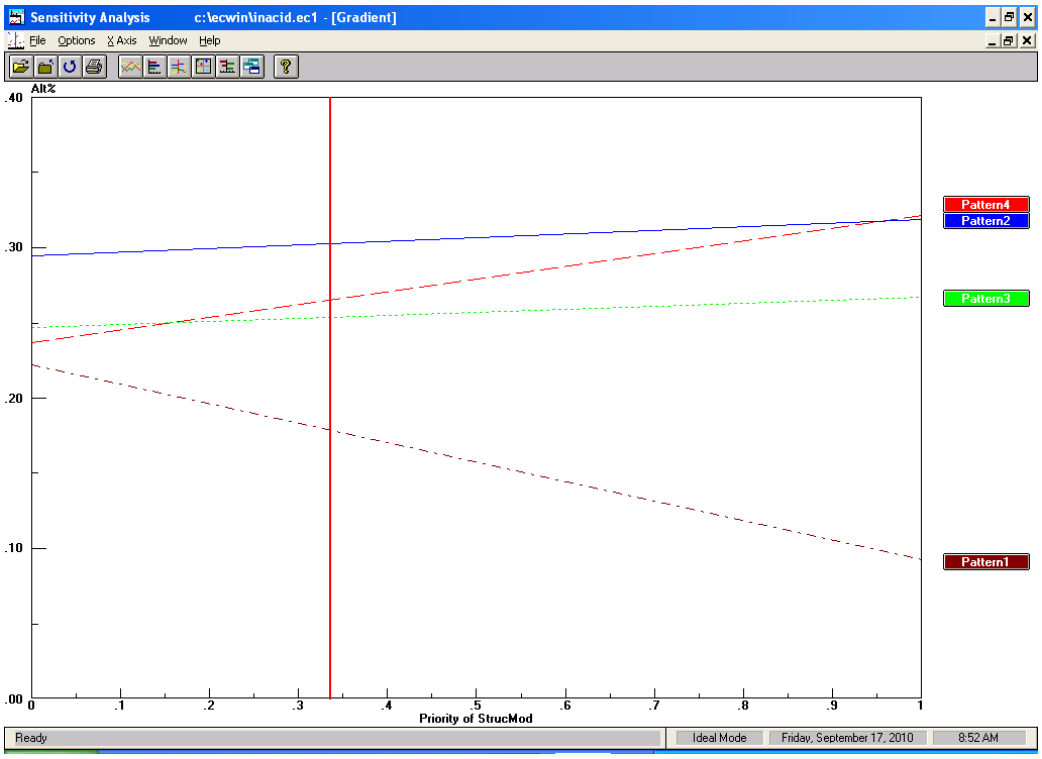


Figure 6. Sensitivity Analysis of Global Priority based on Contribution of Community Behavior to PJI

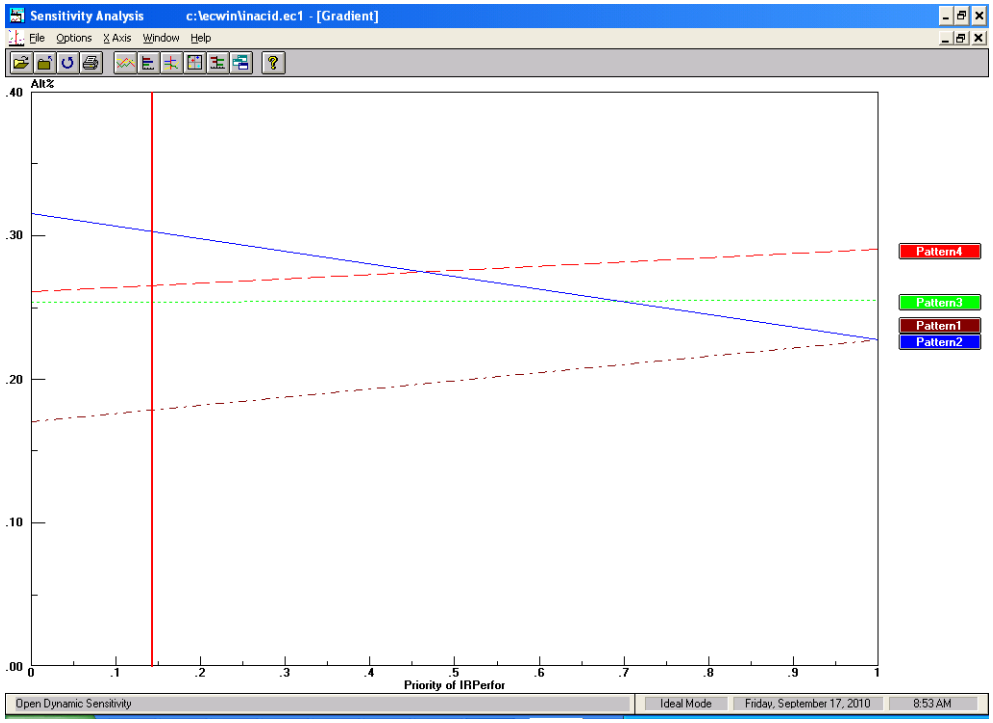


Figure 7. Sensitivity Analysis of Global Priority based on Irrigation Management Performance

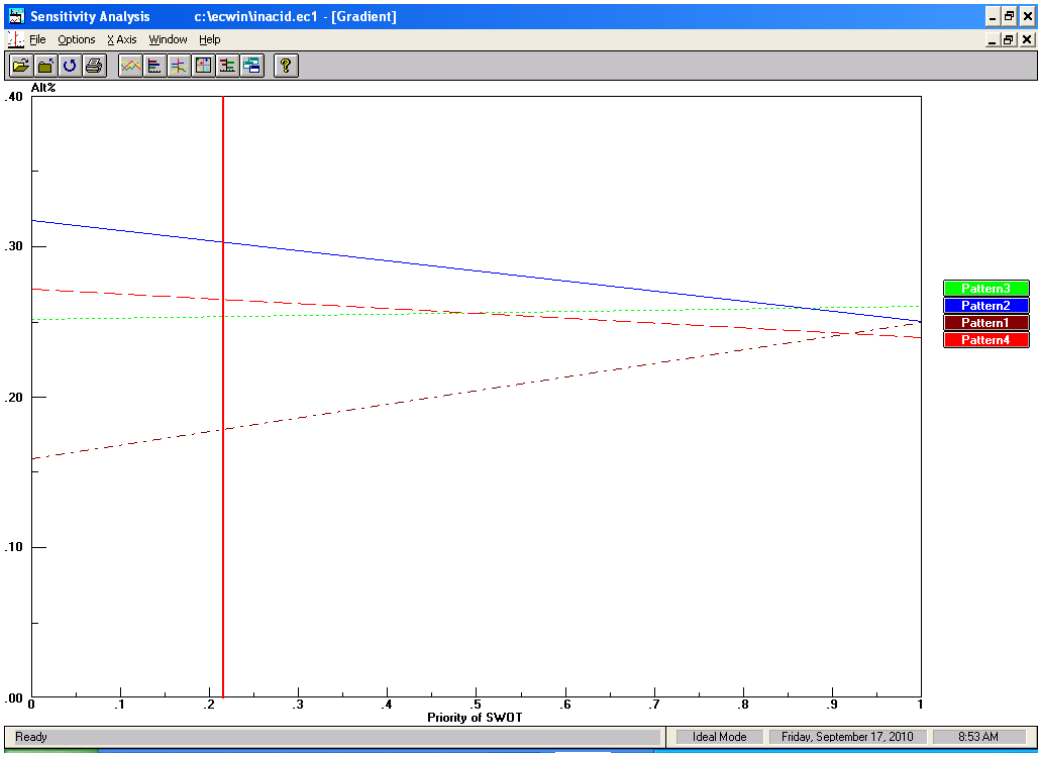


Figure 8. Sensitivity Analysis of Global Priority based on Physical Irrigation Condition and Regulation Implementation

CLOSURE

The study proposes the selection of irrigation management characteristic model strategy by taking into consideration four selected criteria. The best practice management in increasing INM performance coresponding to purely government intervention management followed by local wisdom management, more local wisdom management domination (less government intervention), less local wisdom management domination (more government intervention and, finally, purely local wisdom management approach. If the irrigation region has local wisdom culture in irrigation management, then, it would be a benefit for the government by less support in irrigation management intervention to increase INM performance. However, more management intervention could be not optimal action in order to increase INM performance. Then, wise management approach is needed in this case.

The sensitivity analysis can be developed in order to evaluate possibilities of priority changes in the future beause of political shift or economic uncertainty and docial change of the farmer community. This analysis also help the decision maker to evaluate the irrigation management model characteristic strength recomended as the best appropriate management scheme when political, economic and docial change occur in the future.

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