PERFORMANCE ASSESSMENT OF IRRIGATION AND DRAINAGE NETWORKS:

INTRODUCTION OF “NPAIS” PROGRAM

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ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS

1-Introduction: Project execution impact on environment. Here are some examples:

- Change in climate
- Change in air quality
- Change in surface and groundwater quality
- Change in soil texture and structure
- Change in rate of contaminants in soil
- Change in wildlife condition
- Change in groundwater levels causing water lugging

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

Therefore, monitoring environmental impacts is necessary.

2-Irrigation and drainage project execution requirements

- EIA
- EIS
- Necessary measures and actions

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

3-Assessment of causes and effects, measures and tools

Major indices and Parameters are as follows:

ENVIRONMENTAL WINDOW'S INDICES

No	Indices	Abrr.	Relation
1	Short term Operational Index	ECR	$\frac{AECD - ECI}{AECO}$
2	Increased Biologic Contaminate Ratio	EOR	$\frac{EOI}{EOD}$
3	Increased Organic Contaminant Ratio	OMR	$\frac{OMI}{OMD}$
4	Increased Chemical Contaminant Ratio	CMR	$\frac{CMI}{CMD}$
5	Ratio of Salinity Performance	ECPR	$\frac{AECD}{DECD}$
6	Sustainability of Irrigated Area	ESI	$\frac{PIA}{IIA}$
7	Relative Change in Groundwater Depth	RCD	$\frac{DGWD}{IGWD}$

ENVIRONMENTAL WINDOW'S INDICES (CONTINUED…)

No	Indices	Abrr.	Relation
8	Ratio of Negative Affected Neighboring Area	NEISA	$\frac{SAD}{PECS}$
9	Relative Soil Salinity changes	ECSR	$\frac{PECS}{IECS}$
10	Ratio of roundwater Salinity Increase.	WDCR	$\frac{IGWEC}{PGWEC}$
11	Ratio Of roundwater Biologic Contaminant Increase	WEOR	$\frac{IGWED}{PGWED}$
12	Ratio of groundwater Organic Contaminant Increase	WOMR	$\frac{IGWOM}{PGWOM}$
13	Ratio of roundwater Chemical Contaminant Increase	WCMR	$\frac{IGWCM}{PGWCM}$
14	Relative Irrigated Area Changes	WAR	$\frac{IWA}{PWA}$

ENVIRONMENTAL PARAMETERS

- ECR=Increase Salt Ratio
- ECI=Inflow Rate of Salt to the project
- AECD=outflow Rate of salt from the Project
- EOR=Increase Ratio of Biologic Contaminants
- EOI= Inflow Rate of Biologic Contaminants to the project
- EOD= outflow Rate of Biologic Contaminants to the project

ENVIRONMENTAL PARAMETERS (CONTINUED…)

- OMR= Organic Rate Increased in the project
- OMI=Organic rate of inflow to the project
- OMD= Organic rate of outflow from project
- CMR=Increased rate of chemical contaminant
- CMI=Chemical Inflow Rate to the Project
- CMD= Chemical Outflow Rate from Project
- ECPR=Performance Ratio of Salinity

ENVIRONMENTAL PARAMETERS (CONTINUED…)

- DECD=Designed Rate of Salt going out From Project
- ESI=Sustainability of the Irrigated Command Area
- PIA=Existing Command Irrigated Area
- IIA=Initial Command Irrigated Area
- RCGD=Relative Change of Groundwater Surface Depth
- PGWD=Present Depth of Groundwater Surface

ENVIRONMENTAL PARAMETERS (CONTINUED…)

- IGWD=Initial Depth of Groundwater Surface
- NEISA=Ratio of Distracted Neighboring Area
- SAD= Area of Distracted Land out of the Project
- ECSR=Relative Soil Salinity Ratio
- PECS=Present Salinity Ratio of the soil
- IECS=Initial Salinity Ratio of the soil
- GWECR=Ratio of Increased Groundwater Salinity

ENVIRONMENTAL PARAMETERS (CONTINUED…)

- PGWEC=Present Rate of Groundwater Salinity
- IGWEC=Initial Rate of Groundwater Salinity
- GWEOR=Ratio of Increased Biologic Contaminant in Groundwater
- PGWEO=Present Rate of Groundwater Biologic Contaminant
- GWEO=Initial Rate of Groundwater Biologic Contaminant

ENVIRONMENTAL PARAMETERS (CONTINUED…)

- GWOMR= Ratio of groundwater Organic Contaminant Increase
- PGWOM=Present Rate of Organic contaminant in Groundwater
- IGWOM=Initial Rate of Organic contaminant in Groundwater
- GWCMR= Ratio of Groundwater Chemical Contaminant Increase
- PGWCM=Present Groundwater Rate of Chemical Contaminant

ENVIRONMENTAL PARAMETERS (CONTINUED…)

- IGWCM=Initial Rate of Groundwater Chemical Contaminant
- WAR= Relative Irrigated Area Changes
- PWA=Present Irrigated Area
- IWA=Initial Irrigated Area

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

4-Outcomes of IRNCID activities

- PAIS (Performance Assessment of Irrigation and Drainage Systems)
- NPAIS (New Performance Assessment of Irrigation and Drainage Systems)

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

5-Interactive capabilities of NPAIS

The abilities of this very user friendly program is listed bellow

- It enables user to run it for either:
  - Rapid Appraisal or
  - Comprehensive performance assessment
- In either above choices user has the following options
  - To choose his own intended indices
  - Leave it to the code and it will take all indices into account.

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

- User is able to:
  - Define his/her own weighting coefficients for indices
  - Let the program take them from its default list.
- Performance assessment of the project can be done for normal situation or critical conditions [Regarding water availability, weather conditions, groundwater level, and environmental parameters and so on]

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

- The program is set up to assess performance of modern-semi modern-and traditional irrigation network.

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

- User has the option to assess project performance in one, several, or all following windows.
  - Economic
  - Technical
  - Physical
  - Environmental
  - Social

  It is obvious that any combination of choices has its own indices' basket and coefficients

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

6-Output of NPAIS

- The out puts of the program shows the list of the indices in the basket related to the chosen window.
- It shows the list, value, and weighting coefficients used for indices which have been able to calculate.
- It shows the reliability of the results regarding the ratio of the number of calculated indices to the number of the indices in the basket.

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

6-Output of NPAIS (continued…)

- The program diagnoses project's symptoms and issues recommendations and remedies to improve performance
- Through a sensitivity analysis it will show the user by graph which action has the most improvement effect. So by looking at the results the manager is able to take proper actions suitable for him.

ENVIRONMENTAL ASSESSMENT OF IRRIGATION PROJECTS (CONT.)

6-Output of NPAIS (continued…)

- If more than one window is open the user is asked whether wants to enter indices' weighting coefficients or leave it to the computer to use built in coefficients.
- For details and discussion the attached PowerPoint is prepared. So if we did not face time shortage and the panel recognized its necessity, it will be presented.

CONCLUSION:

This program is a powerful tool for assessing and monitoring environmental impact of irrigation and drainage projects which will be briefly presented bellow.

1-GENERAL ASPECTS:

- Water and soil resources are limited and not enough to meet human needs .
- What should be done to overcome world food deficiency due to water scarcity and negative impacts of the human activities to the environment?
- In this regard the efficiency and productivity of water and soil must be increased.
- The international slogan is:

"More Crop Per Drop"

2- WHAT CAN BE DONE

To fulfill this goal, productivity of water resources must be improved by:

a: Improvement of water conveyance and distribution network efficiencies.

b: Increasing the productivity of unit volume of water

c: Expanding conjunctive optimal use of surface and groundwater

d: Improvement of operational systems' management quantitatively and qualitatively

2- WHAT CAN BE DONE (CONTINUED…)

To take effective steps towards these objectives:

"The managers must continuously and systematically conduct performance assessment of their systems."

3- WHAT IS PERFORMANCE ASSESSMENT?

By implementation of performance assessment the one responsible for an activity, like the manager of an organization, a factory ,a cultural institute or an agricultural firm asks himself all the time:

“Am I Doing Right?”

If not

“What am I doing Wrong?”

“How Can I Correct Myself or Cure the Illness?”

4- NECESSITY OF CONTINUOUS ASSESSMENT

If the above questions are not repeatedly asked:

1. Available potential resources will be exploited in the lowest level.
2. System diagnosis can not be performed and detrimental causes would not be recognized.

4- NECESSITY OF CONTINUOUS ASSESSMENT (CONTINUED…)

3. Weariness and incapacitation of system components occurs gradually so it is not perceptible.
4. The weak points of the system which can be amended easily would not be appeared, resulting in the slow down of the whole system.

5- EVOLUTIONS

Although The history of performance assessment does not go far back in the past, it has been expanded and grown very fast in different countries and many international organizations including FAO , ICID , W.B , IWMI and IPTRID and researchers have gotten involved.

At the same time, performance assessment of irrigation and drainage has been in the focal point of attention in Iran.

5- EVOLUTIONS (CONTINUED…)

The most active Iranian organizations in this field have been:

- Iran National Committee on Irrigation and Drainage
- Different Universities
- Chancellor of Power Ministry for research.
- States' Water Organizations
- Management of Iran Irrigation and Drainage Networks

6- THE OUTCOMES

The fruit of above attempts besides many research reports, books and theses have been several computer programs.

Some of these programs have been applied by different managers, consultants and governmental organizations. Here are a few examples:

6- THE OUTCOMES (CONTINUED…)

- PAIS
  - Performance Assessment of Irrigation and Drainage Systems
- NPAIS
  - New Performance Assessment of Irrigation and Drainage Systems
- SW – FIPA
  - An improved version of NPAIS enhanced for fuzzy characters of the systems

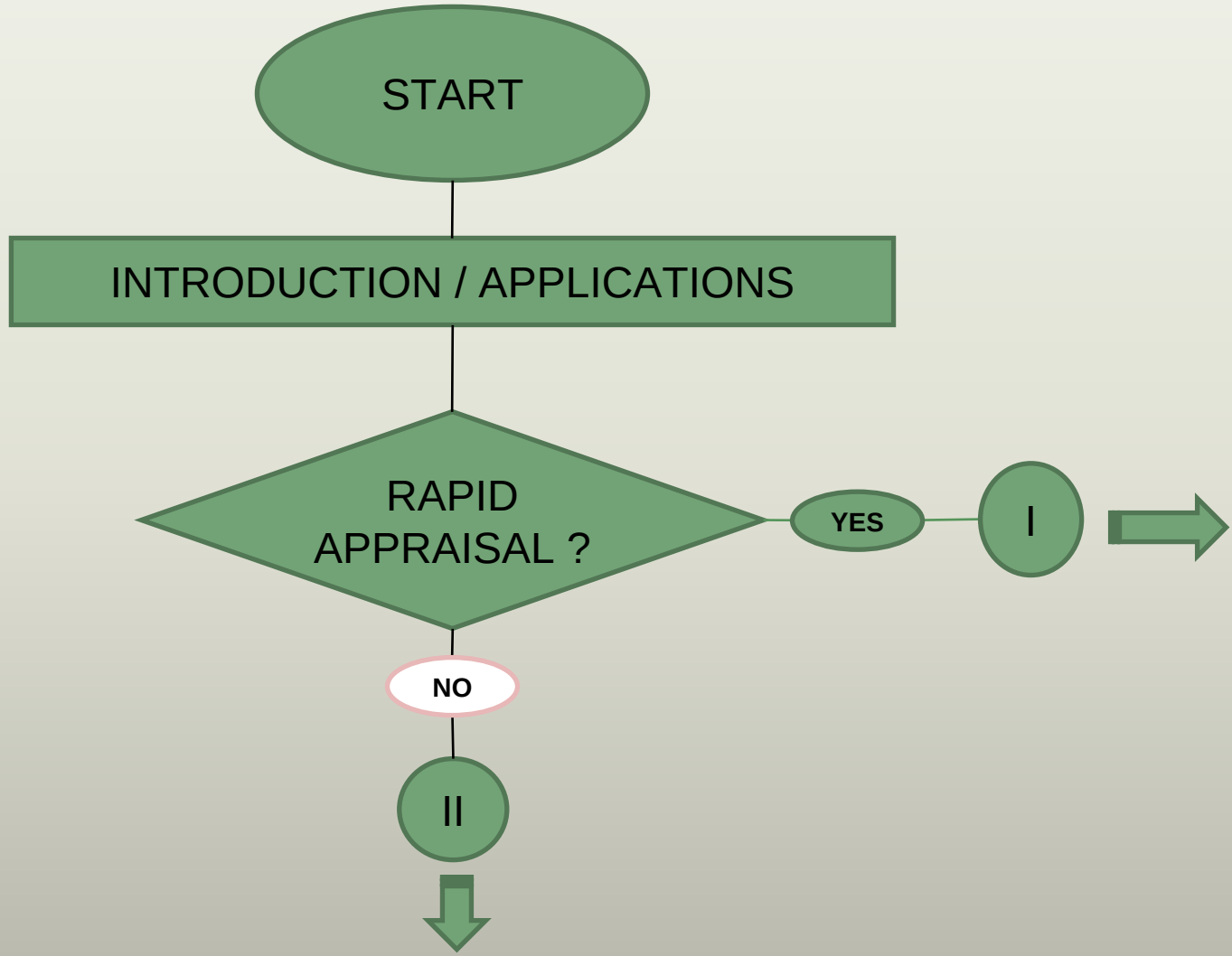
7-FINAL NOTE

NPAIS has been used by different private sectors and governmental organizations since:

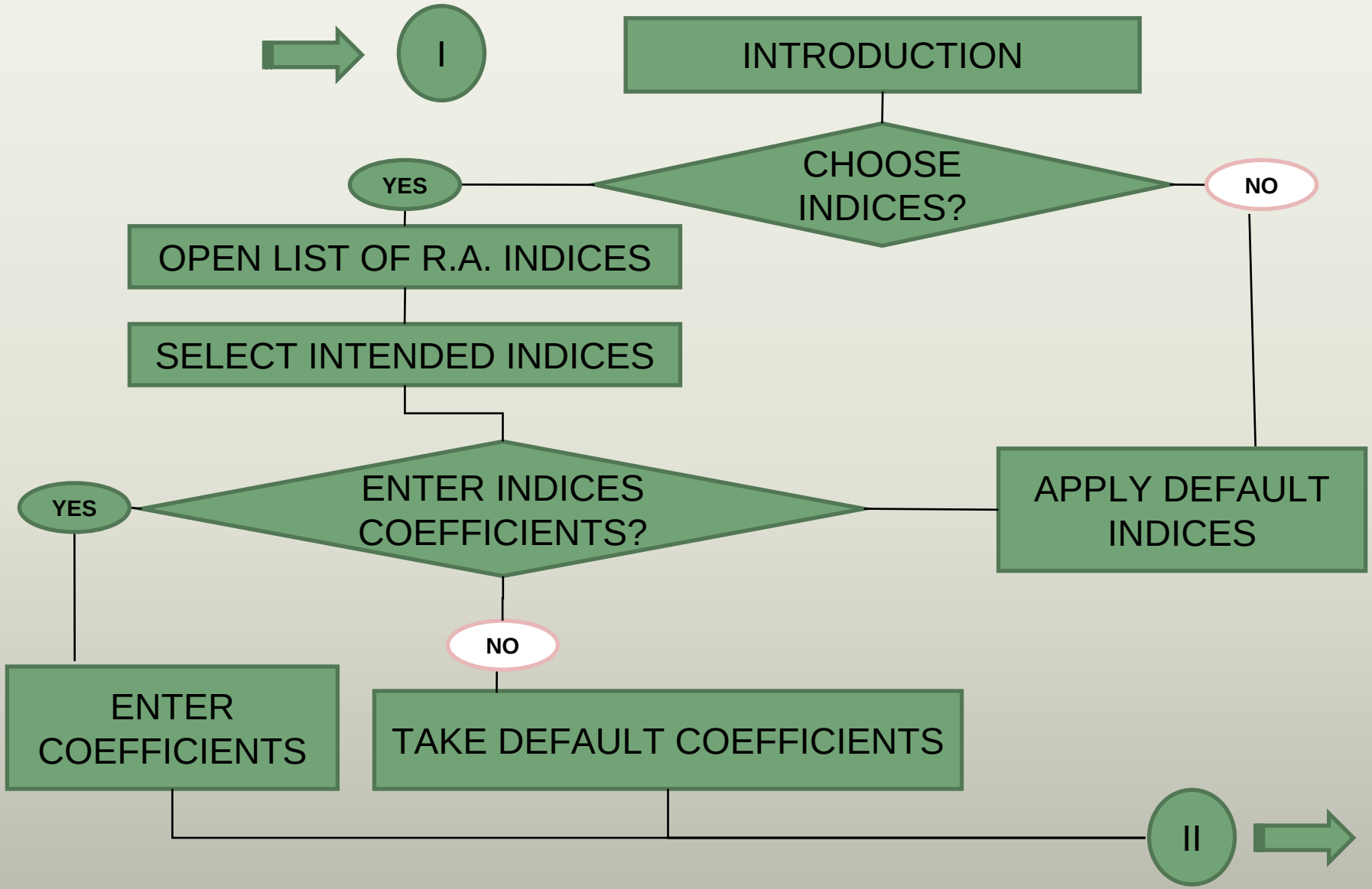
- It is very easy to use
- It is the most comprehensive available code so far

The following flowcharts will briefly introduce NPAIS:

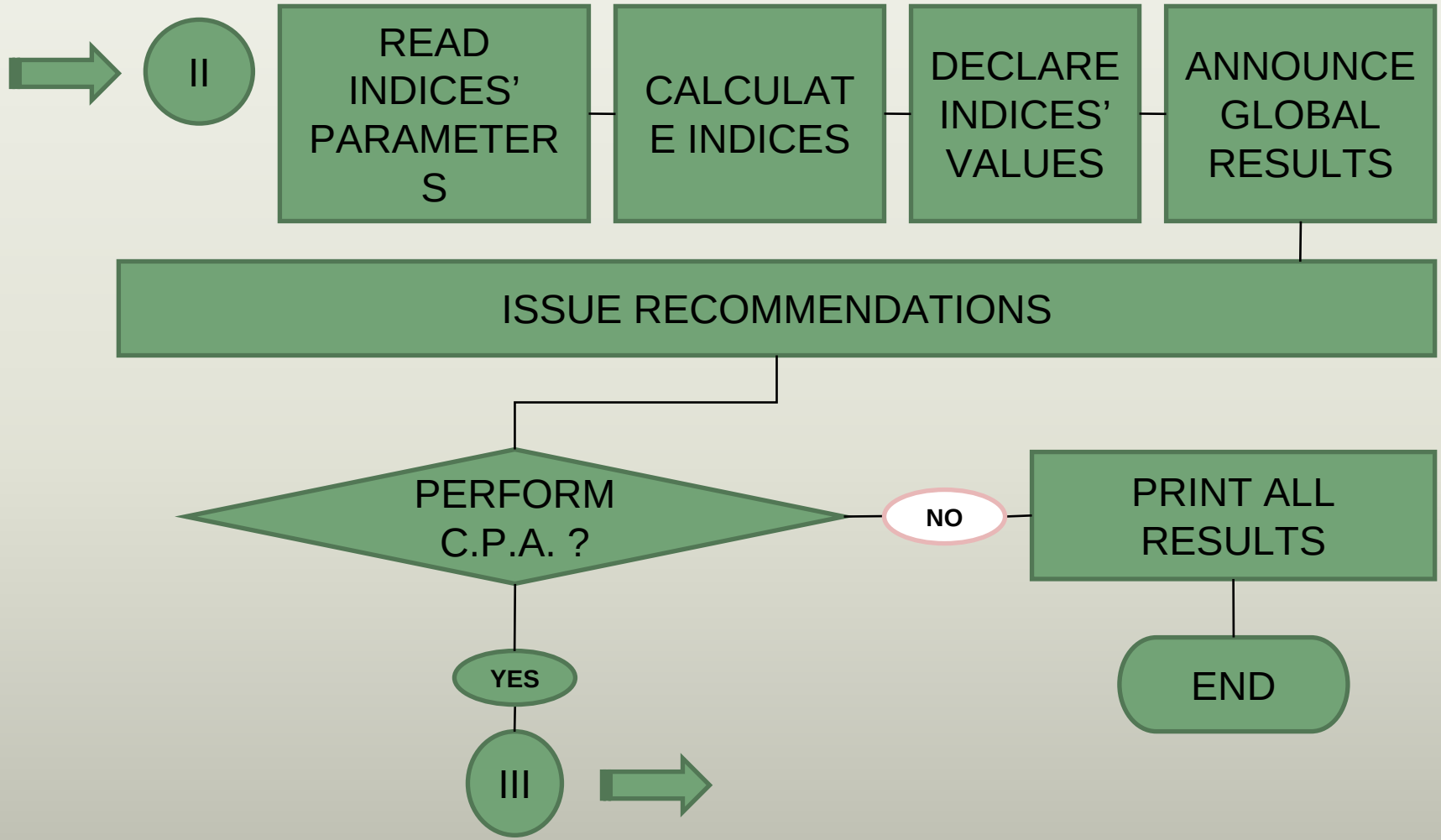
NPAIS FLOWCHART



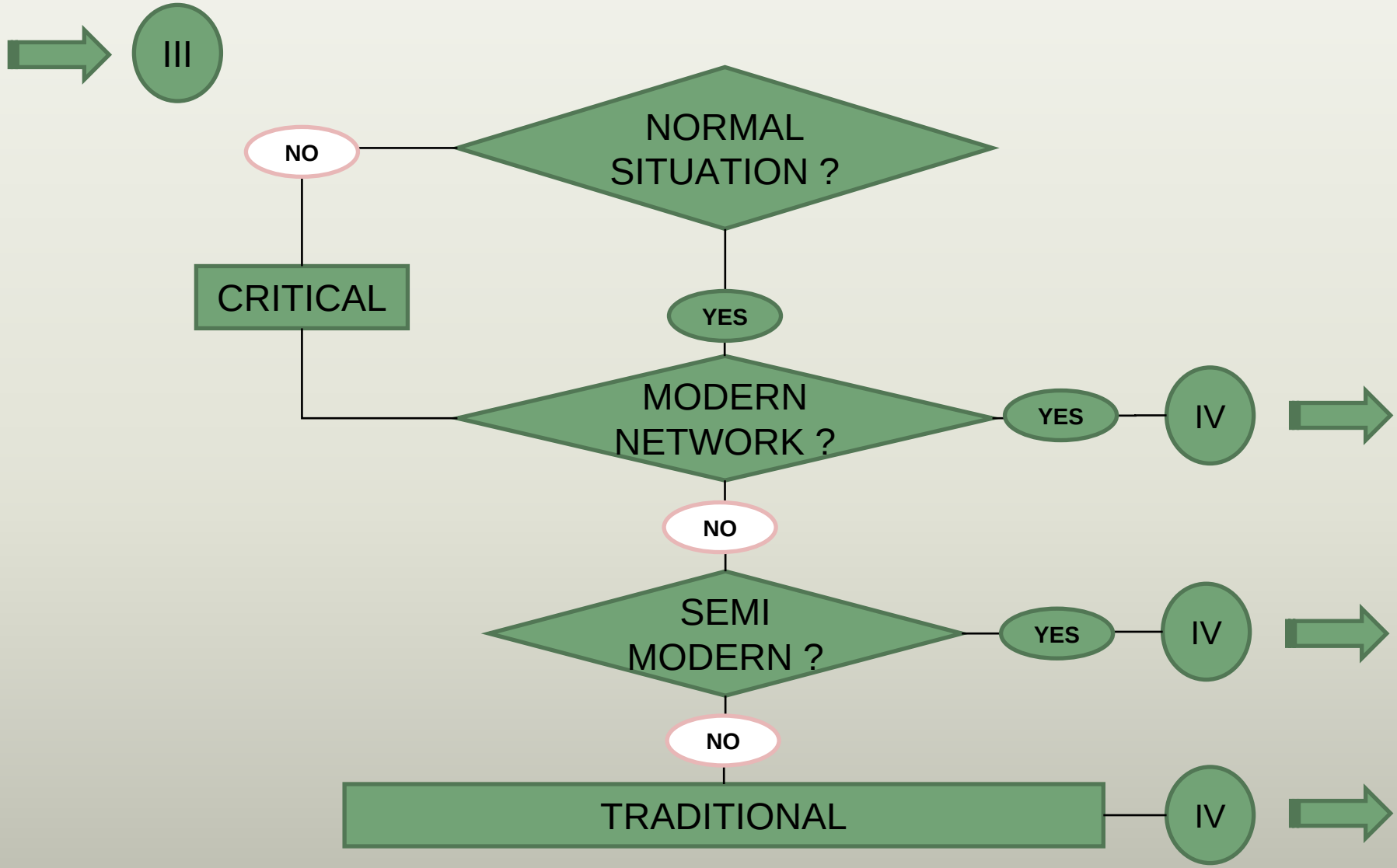
RAPID APPRAISAL (R.A.)



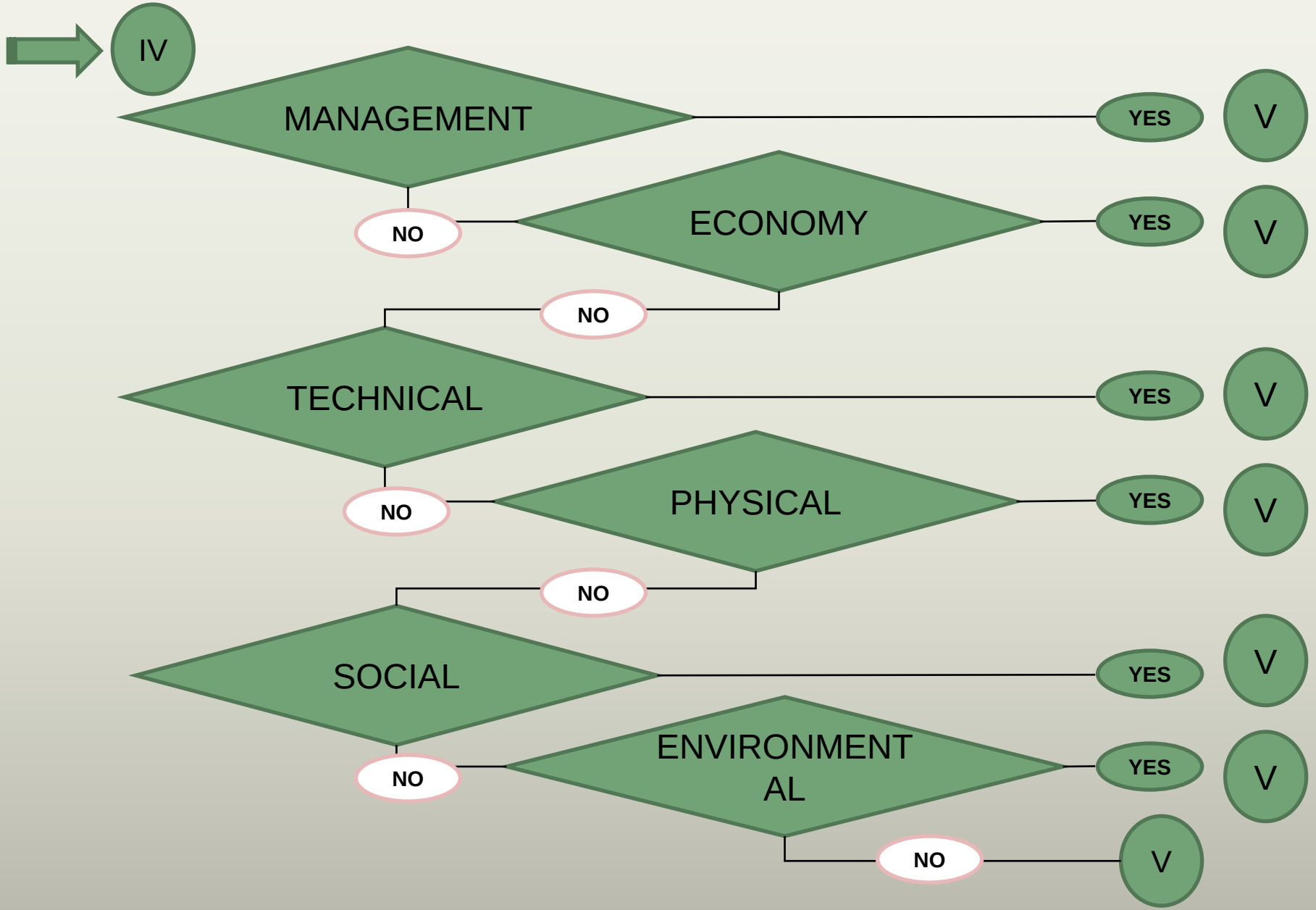
RAPID APPRAISAL (R.A.) (CONTINUED…)



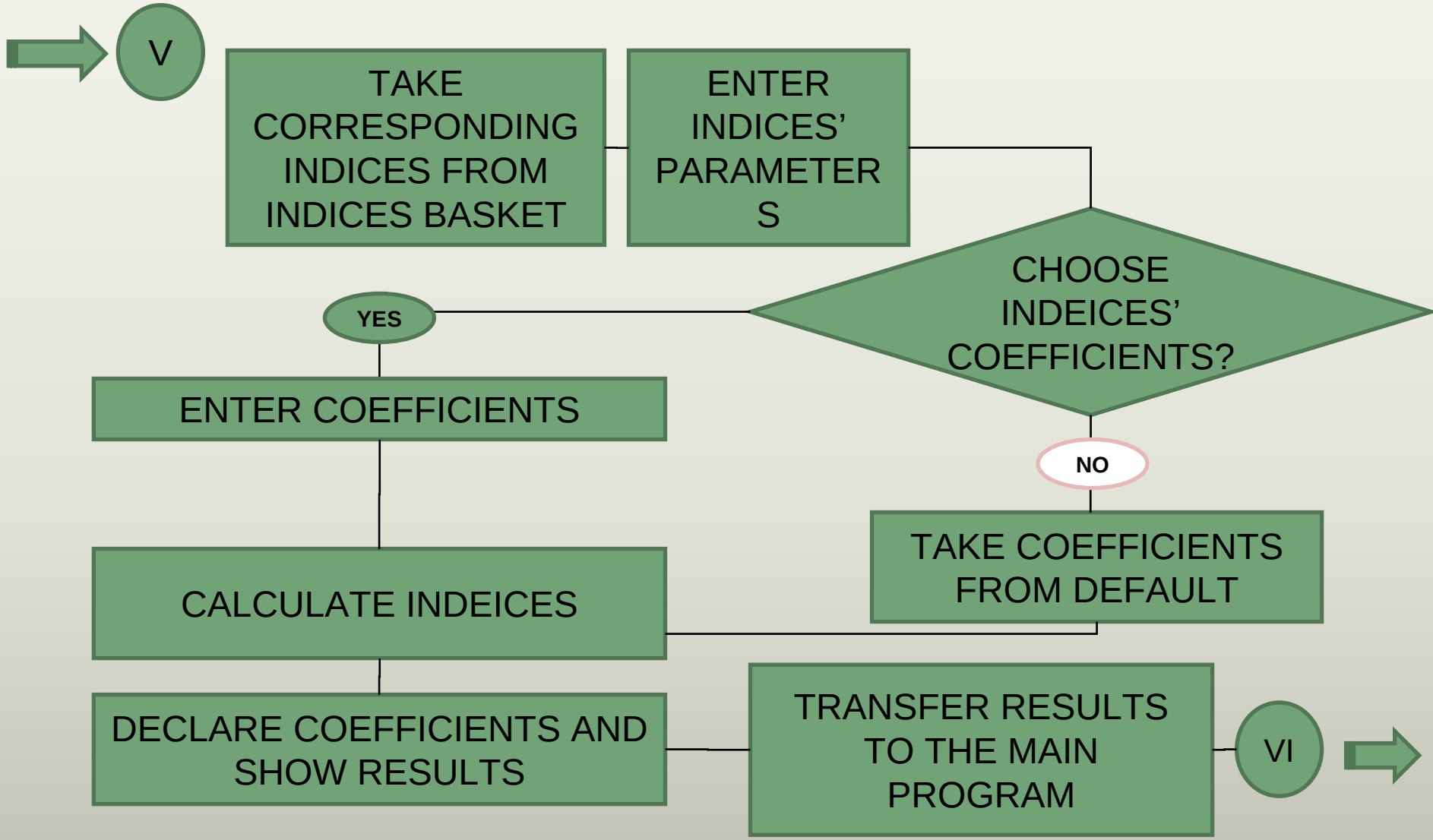
COMPREHENSIVE APPRAISAL



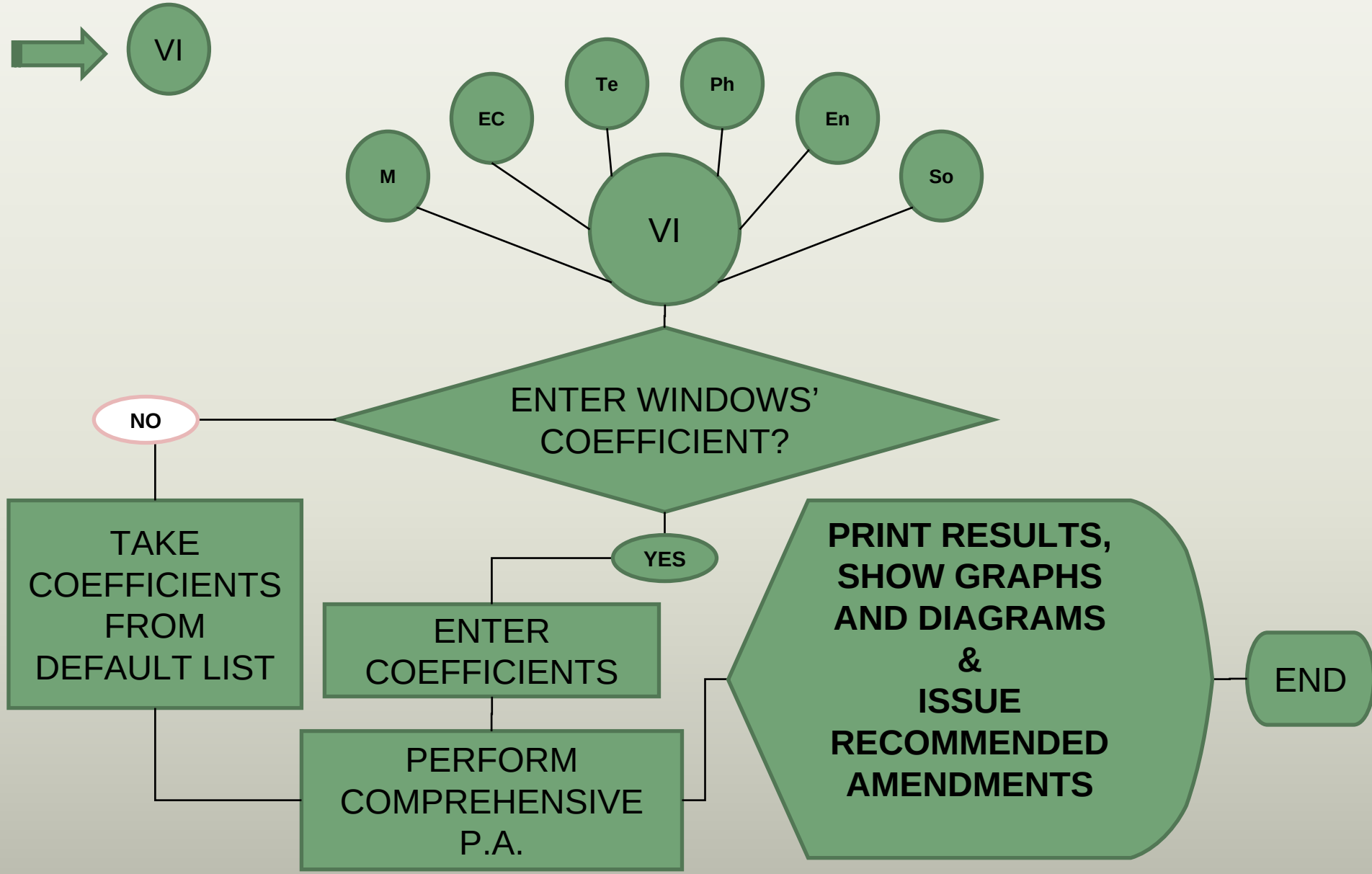
SELECTION OF WINDOWS



WINDOWS' EVALUATION



GLOBAL ASSESSMENT



Thank you.