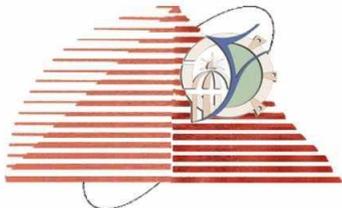


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

*Measurements  
and  
Metrology*



**Fayoum University**



**Faculty of Engineering  
Industrial Engineering Dept.**

*Lecture (9)*

*on*

*Experiment Planning*

*By*

*Dr. Emad M. Saad*

*Industrial Engineering Dept.*

*Faculty of Engineering*

*Fayoum University*

*2015 - 2016*



# key to success in experimental work

3

**The key to success in experimental work is to ask continually:**

1. What am I looking for?
2. Why am I measuring this—does the measurement really answer any of my questions?
3. What does the measurement tell me?

**These questions may seem rather elementary, but they should be asked frequently throughout the progress of any experimental program.**





# key to success in experimental work

4

**Some particular questions that should be asked in the initial phases of experiment planning are:**

1. What primary variables shall be investigated?
2. What control must be exerted on the experiment?
3. What ranges of the primary variables will be necessary to describe the phenomena under study?
4. How many data points should be taken in the various ranges of operation to ensure good sampling of data considering instrument accuracy and other factors?
5. What instrument accuracy is required for each measurement?
6. If a dynamic measurement is involved, what frequency response must the instruments have?





# key to success in experimental work

5

7. Are the instruments available commercially, or must they be constructed especially for the particular experiment?
8. What safety precautions are necessary if some kind of hazardous operation is involved in the experiment?
9. What financial resources are available to perform the experiment, and how do the various instrument requirements fit into the proposed budget?
10. What provisions have been made for recording the data?
11. What provisions have been made for either on-line or subsequent computer reduction of data?
12. If the data reduction is not of a “research” nature where manipulation and calculations depend somewhat on the results of measurements, what provisions are made to have direct output of a data acquisition system available for the final report?

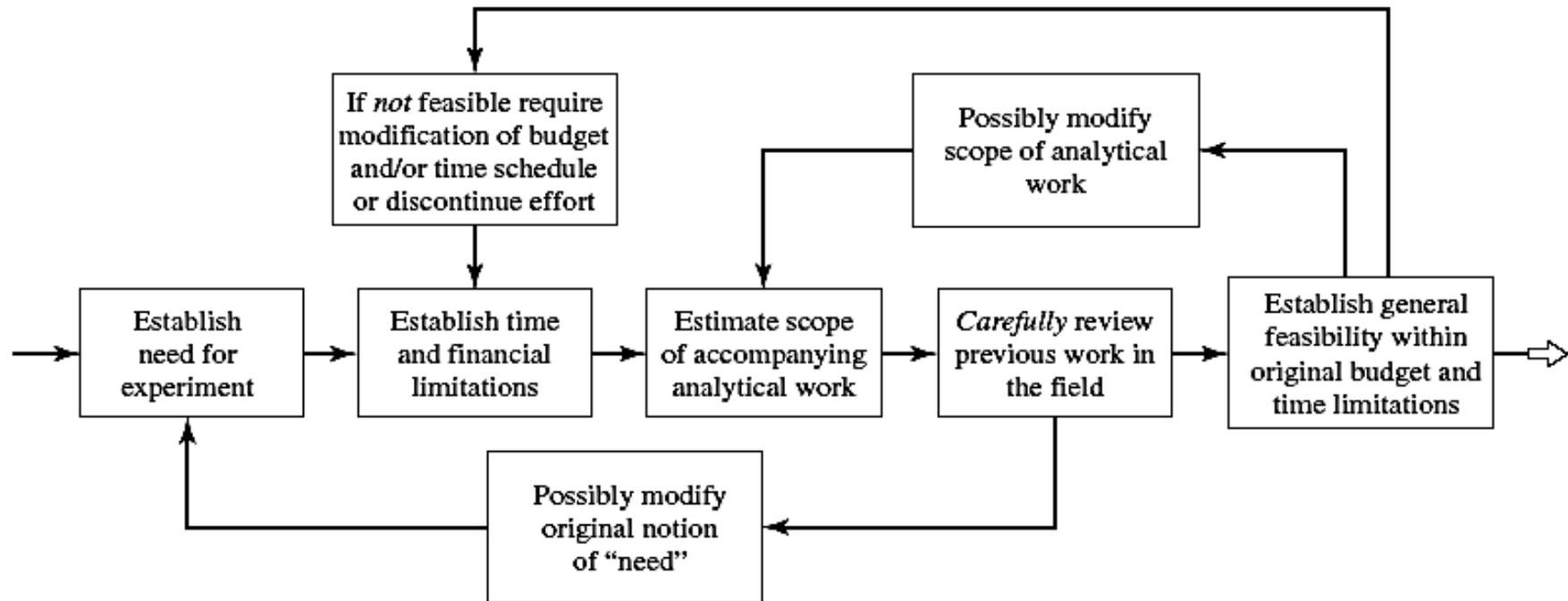




# Generalized experimental procedures

6

## Preliminary stages of experiment planning

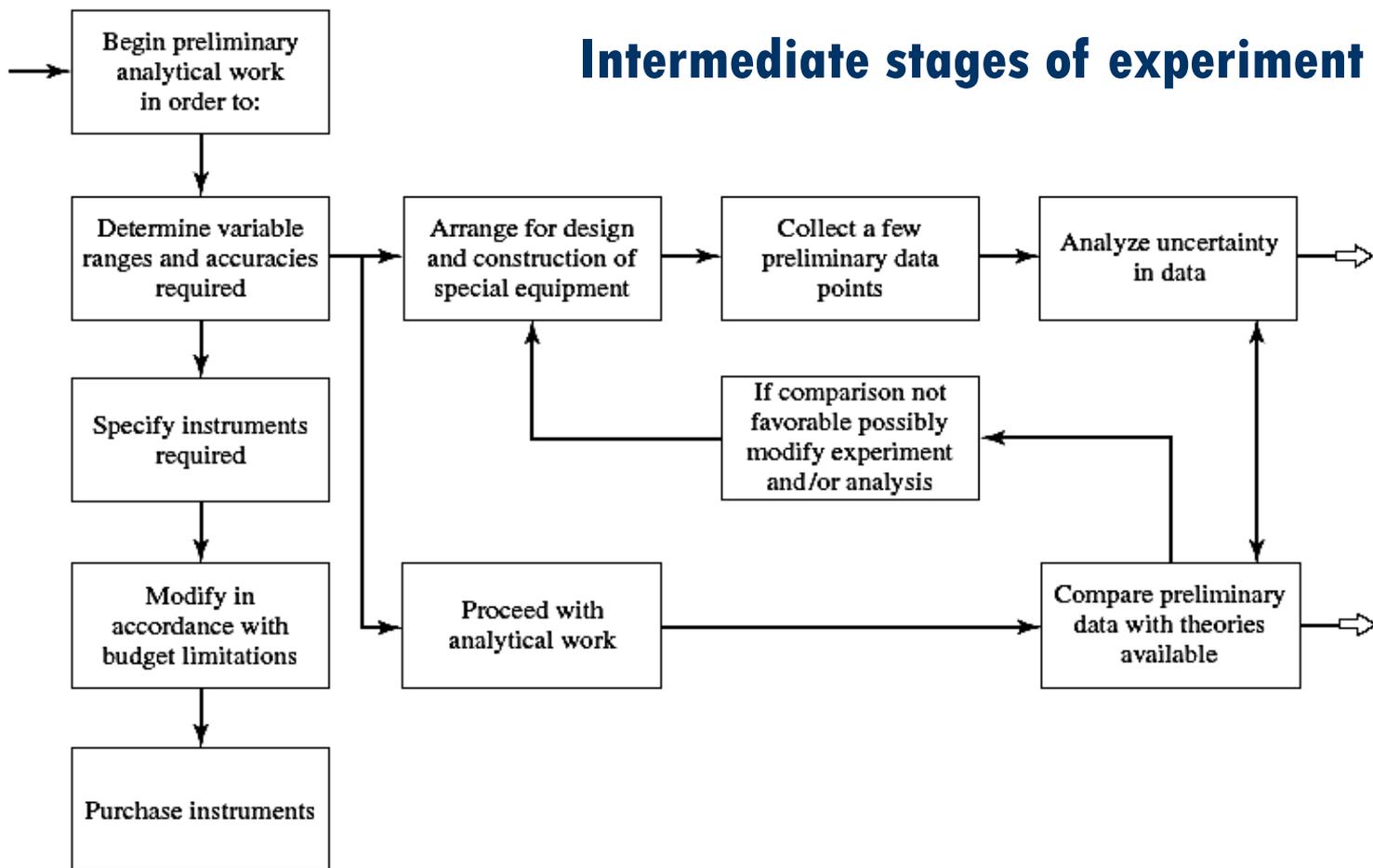




# Generalized experimental procedures

7

## Intermediate stages of experiment planning

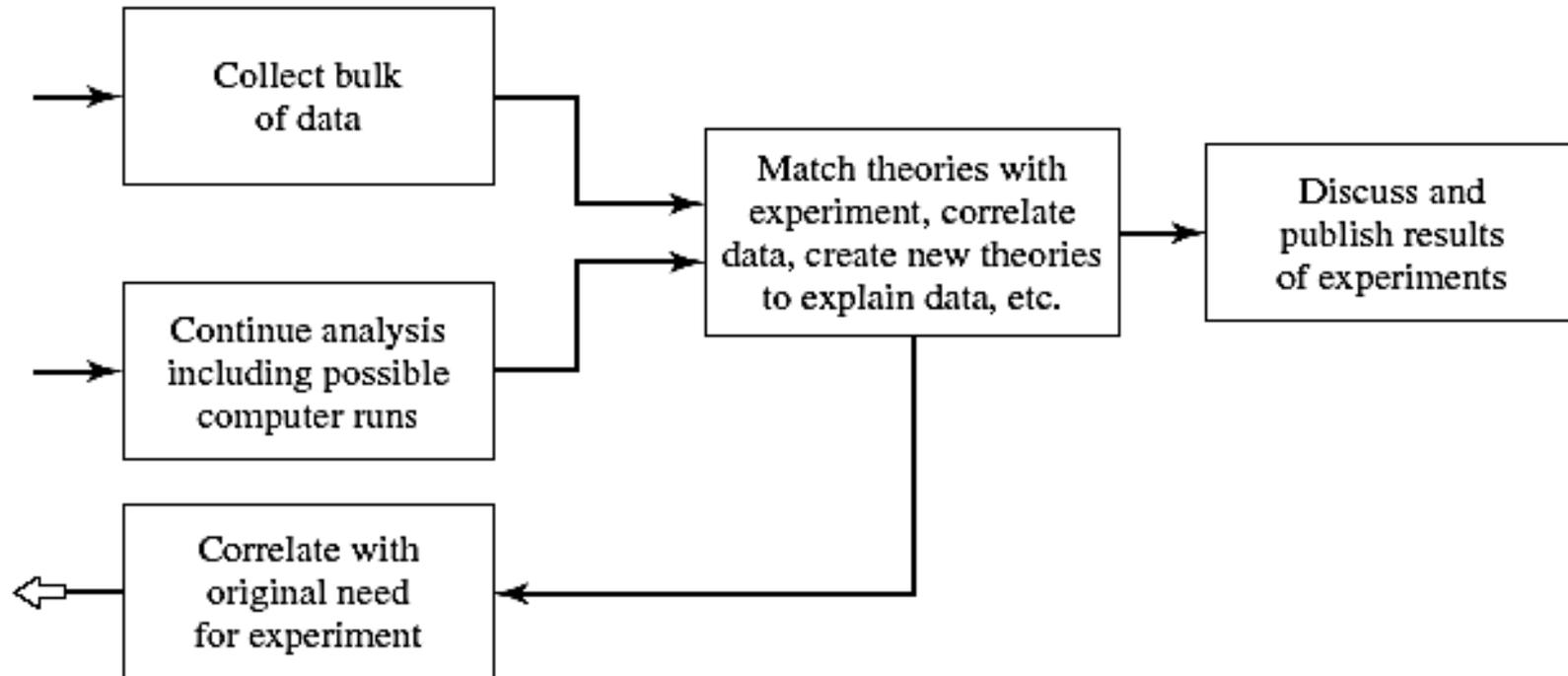




# Generalized experimental procedures

8

## Final stages of experimental program.





# The Role of Uncertainty Analysis in Experiment Planning

9

The point is that a careful uncertainty analysis during the experiment planning period may **enable the investigator to make a better selection of instruments for the program.**

Briefly, then, an uncertainty analysis enters into the planning phase with the following approximate steps:

1. Several alternative measurement techniques are selected once the variables to be measured have been established.
2. An uncertainty analysis is performed on each measurement technique, taking into account the estimated accuracies of the instruments that will actually be used.
3. The different measurement techniques are then compared on the basis of cost, availability of instrumentation, ease of data collection, and calculated uncertainty. The technique with the least uncertainty is clearly the most desirable from an experimental-accuracy standpoint, but it may be too expensive.



Thank  
You