Information Systems

… Data and Information

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DATA versus INFORMATION versus KNOWLEDGE

Data differs from **information** in which way?

A. Data is output and information is input
B. Information is output and data is input
C. Data is meaningful bits of information
D. There is no difference

DATA vs INFORMATION
- Important to understand the difference

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DATA versus INFORMATION versus KNOWLEDGE

DATA:

Facts or Figures

- Collected
- Recorded
- Stored
- Processed

Not meaningful on its own

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DATA versus INFORMATION versus KNOWLEDGE

INFORMATION:

PROCESSED DATA

data that has been organized and processed to be meaningful to a person (or other information system) who (or which) will use it.

Another definition of information is anything that reduces uncertainty.

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DATA versus INFORMATION versus KNOWLEDGE

KNOWLEDGE:

RESULTS and CONCLUSIONS

Inferred from Information

Using the information derived from data

to *support* conclusions.

A means to end, not an end unto itself

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DATA versus INFORMATION versus KNOWLEDGE

Important to understand the difference

Example:

Data – hourly wage

Information – average wage

Knowledge – competitive within your industry

Note: Some people discus Wisdom (Common Sense) as being above these three levels. But this can not be taught or even explained (rare indeed).

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DATA is processed into information in two (2) types of activities:

Computation creates information by carrying out a predefined process on two or more data items.

example: average age of students in CS1032

Comparison selects processing steps on the basis of data in an information system.

example: comparing the difference between the youngest and oldest student in CS1032

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QUALITY:

Data Quality

- Dirty Data
- Missing Values
- Inconsistent Data
- Data not Integrated

Bad Data produces bad information
- regardless of the quality of the comparison or computation.
- data quality comes before analysis

- **Data Quality**
  A final challenge in decision making is the quality of data. Up to this point, we have assumed that the data stored in systems are clean and accurate.

  But this is the exception rather than the rule in most systems. It is hard enough to make decisions when you have good-quality data. But what if the data are of low quality?

  How would this affect your decisions? Data from operational systems can be processed to create basic reports with few issues.

  If we want to know, for example, current sales and how those sales relate to sales projections, we simply process data in the order-entry database.

  However, raw operational data are seldom suitable for more sophisticated reporting or data mining.

- Next is a lists the major problem categories.

- First, the data may be problematic or what is commonly termed **dirty data**.
  Examples include
  using values such as B for customer gender;
  213 for customer age;
  999-999-9999 for a phone number;
  gren (instread of green) for a part colour;
  WhyMe@GuessWhoIAM.org for an email address.

- All these values can be problematic for data-mining purposes.

- **Missing values** are a second problem.

  A nonprofit organization can process a donation without knowing the donor's gender or age,

  but a data-mining application is impaired if many such values are missing.

- **Inconsistent data**,

  the third problem listed, are particularly common in data that have been gathered over time.

  When an area code changes, for example,
  the phone number for a given customer before the change will not match the customer's number after the change.

  Likewise, part codes can change, as can sales territories.

  Before such data can be used, they must be recoded for consistency over the period of the study.

- **Data not integrated**,
  the fourth problem, can occur
  if the data reside in different sources
  or are incompatible with the intended purpose.

- Because data that are critical for successful operations must be complete and accurate,

  data that are only marginally necessary or were not designed and collected with the specific purpose in mind may not be.

  In the case of the National Hockey League, for example, information about where each player was on the ice when a goal was scored has only recently been collected and matching it up with the timing of each player's shift for analytic purposes is difficult.

- Data can also be too fine or too coarse.
  Data granularity refers to the degree of summarization or detail.

  Coarse data are highly summarized; fine data express details that are too precise. For example, suppose we want to analyze the placement of graphics and controls on an order-entry webpage. It is possible to capture the customers' clicking behaviour in what is termed clickstream data. Those data are very fine; they include everything the customer does at the website. In the middle of the order stream are data for clicks on the news, email, instant chat, and a weather check. Although all those data are needed for the study of consumer computer behaviour, such data will be overwhelming if all we want to know is how customers respond to advertisement locations.

  Because the data are too fine, the data analysts often throw away millions and millions of clicks to avoid the problem of having too much data and too many attributes to work with. Generally, it is better to have granularity that is too fine than too coarse. If the granularity is too fine, the data can be made coarser by summing and combining.

- Google Analytics (www.google.com/analytics) provides a good example of the power of summing and combining data.
- Only analysts' labour and computer processing are required. If the granularity is too coarse, however, there is no way to separate the data into constituent parts.
- This section has suggested that a number of factors, including complexity, uncertainty, information overload, and data quality, make management decision making challenging.
- Information from information systems has the potential to meet some of these challenges. Later in the course, we outline categories of systems that support the decision-making process.

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INFORMATION QUALITY:

RELEVANCE

CORRECTNESS

ACCURACY

PRECISION

TIMELYNESS

USABILITY

COMPLETENESS

ACCESSABILITY

COST

- Accurate
- Timely
- Relevant
  - To context
  - To subject
- Just sufficient
- Worth its cost

- **Accurate**

  Good information is accurate information.

  Good information is based on correct and complete data that have been processed correctly and as expected. Accuracy is crucial; managers must be able to rely on the results of their information systems. The information system (IS) function can develop a bad reputation in the organization if the system is known to produce inaccurate information. In such a case, the IS becomes a waste of time and money as users develop workarounds to avoid the inaccurate data. A corollary to this discussion is that you, a future user of information systems, ought not to rely on information just because it appears on a webpage, in a seemingly well-formatted report, or as part of a fancy query. It is sometimes hard to be skeptical about information that is delivered with beautiful, active graphics. Do not be misled. When you begin to use an IS, be skeptical. Cross-check the information you are receiving. When you are certain that it is accurate, you may be able to relax a little. Begin, however, with skepticism, and keep in mind that, over time, information may lose its level of accuracy. In fact, because this can often occur gradually, it can sometimes create serious problems.

- **Timely**

  Good information is timely information

  —produced in time for its intended use. A monthly report that arrives six weeks late is most likely useless. An IS that tells you not to extend credit to a customer after you have shipped the goods is unhelpful and frustrating. Note that timeliness can be measured against a calendar (six weeks late) or against events (before we ship). When you participate in the development of an IS, timeliness will be part of the requirements you will request. You need to give appropriate and realistic timeliness needs. In some cases, developing systems that provide information in near real-time is much more difficult and expensive than producing information a few hours later. If you can get by with information that is a few hours old, it is important to say so during the requirements specification phase. Consider this example. Suppose you work in marketing and you need to be able to assess the effectiveness of new online ad programs. You want an IS that will not only deliver ads over the web but also enable you to determine how frequently customers click on those ads. Determining click ratios in near real-time can be very expensive; saving the data and processing them some hours later may be much easier, cheaper, and sufficient for your needs.

- **Relevant Information**

  Should be relevant both to the context and to the subject. A chief executive officer (CEO) needs information that is summarized to an appropriate level for her position. A list of the hourly wage of every employee in the company is unlikely to be useful to a CEO. More likely, she will expect the average wage information by department or division.

  A list of all employee wages is irrelevant in the CEO's context. Information should also be relevant to the subject at hand. If you want information about short-term interest rates for a possible line of credit, then a report that details 15-year mortgage interest rates is irrelevant.

  Similarly, a report that buries the information you need in pages and pages of results is also irrelevant to your purposes.

- **Just Barely Sufficient**

  Information needs to be sufficient for the purpose for which it is generated, but just barely so. We live in an information age;

  a critical decision that each of us must make is what information to ignore. The higher you rise in management, the more information you will be given and the more information you will need to ignore.

  So, information should be sufficient, but just barely so. Knowing what information to ignore is, of course, difficult.

  Studying, for example, would be so much easier and more efficient if your professors told you exactly which questions were going to be on their exams. But their input might not help you to learn or prepare you for your career.

- **Worth Its Cost**

  Information is not free. There are costs associated with an IS

  —the costs of developing, operating, and maintaining the system, and the costs of your time and salary for read-ing and processing the information the system produces.

- For information to be worth its cost, there must be an appropriate relationship between the cost of information and its value.

  You need to ask, “What is the value of the information?” or “What is the cost?” or “Is there an appropriate relationship between value and cost?” For example, spending $10 to find out how to save $8 is not particularly useful. Information and information systems should be subject to the same financial analyses to which other assets are subjected.

- **Precision (measure of information quality):**
  The maximum accuracy with which a data element is stored or presented.

- **Relevance (measure of information quality):**
  The extent to which information applies to a task being performed.

- **Timeliness (measure of information quality):**
  The relationships between the time that information is available to users and (a) the time it is needed and (b) the period to which its underlying data refers.

- **Usability (measure of information quality):**
  The ease with which the intended users of information can put it to its intended use.

- **Accessibility (measure of information quality):**
  The degree to which authorized users of information can obtain it with minimal effort.

- **Accuracy (measure of information quality):**
  Difference between an information value and the value that a perfect calculation using perfect data would produce.

- **Boundary (of a system):**
  A conceptual line separating components of a system from its surroundings.

- **Comparison:**
  Selecting one or more alternative processing paths on the basis of a data value.

- **Completeness (measure of information quality):**
  The degree to which information is based on all the relevant data, omitting none of it.

- **Computation:**
  Creating information by carrying out a predefined process on two or more data items.

- **Conformity to expectations (measure of information quality):**
  The degree to which the way an information item was obtained matches the expectations of its users.

- **Consistency (measure of information quality):**
  The degree to which all the data items that contribute to information are based on the same time period, assumptions, etc.

- **Correctness (measure of information quality):**
  The extent to which information is derived from the proper data values through the proper processing steps.

- **Cost (measure of information quality):**
  A measure of the resources an organization expends to obtain information.

- **Effectiveness:**
  The degree to which a person or organization achieves an objective.

- **Efficiency:**
  The degree to which an activity is carried out using the least possible resources.

- **External feedback (in a system):**
  Passing a system output back to its inputs through something that is outside the system.

- **Feedback (in a system):**
  Using a system output as a system input.

- **Information:**
  (a) Data that has been organized and processed so as to have meaning,
  (b) anything that reduces uncertainty.

INFORMATION QUALITY:

CONCLUSION

Put all this together – comes down to simply:

- get the right information to the right people at the right time in the right format.

COMMON SENSE

- not very, many documents are:
  - too long
  - too late
  - too incomprehensible

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EFFICIENCY:

GOAL

- use information to decide your competitive strategy
- the better your information the better your decisions are

METHOD

- use an Information System

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INFORMATION SYSTEM:

SYSTEM

A group of components that interact to achieve some stated purpose.

- a car is a 'system'
- so is a University

INFORMATION SYSTEM

A *system* whose purpose is to process information.

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INFORMATION SYSTEM:

A system whose purpose is to process information.

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INFORMATION SYSTEM:

The Five (5) components of an Information System.

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INFORMATION SYSTEM:

The Five (5) components of an Information System.

… From the simplest
to the most complex

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INFORMATION SYSTEM:

The Five (5) components of an Information System.

… From the easiest to
change to the most complex

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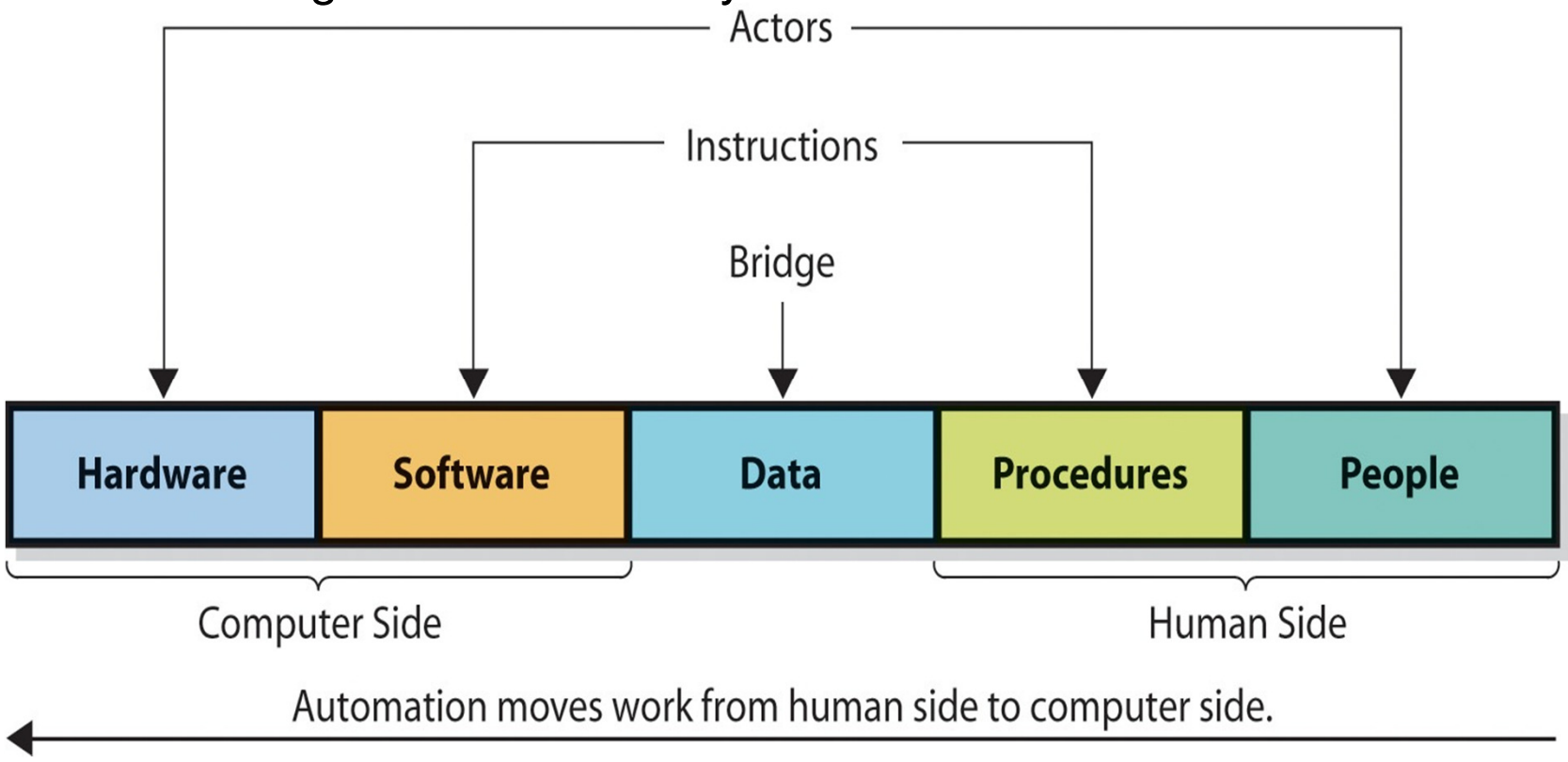
INFORMATION SYSTEM:

Automating a Process Activity.



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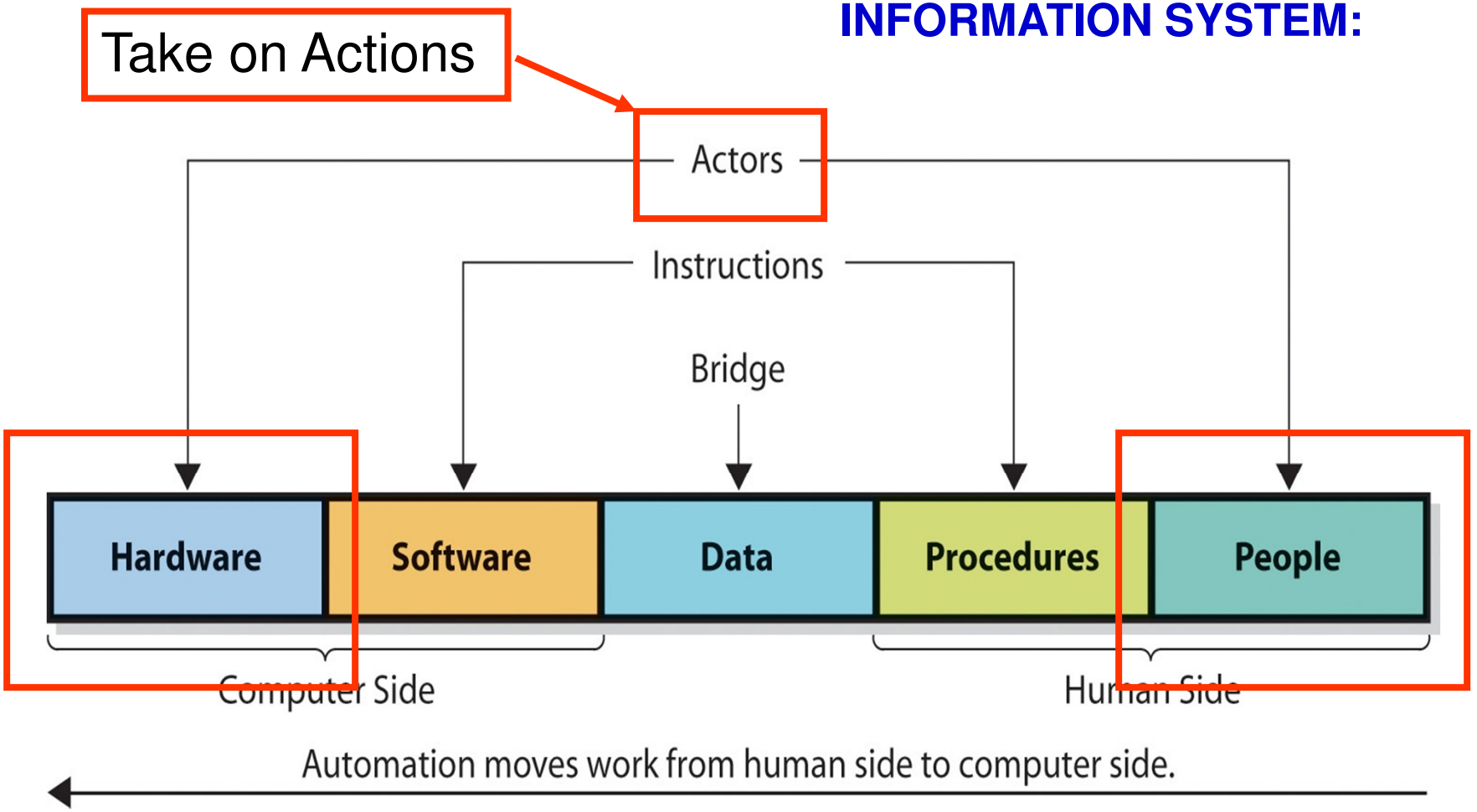

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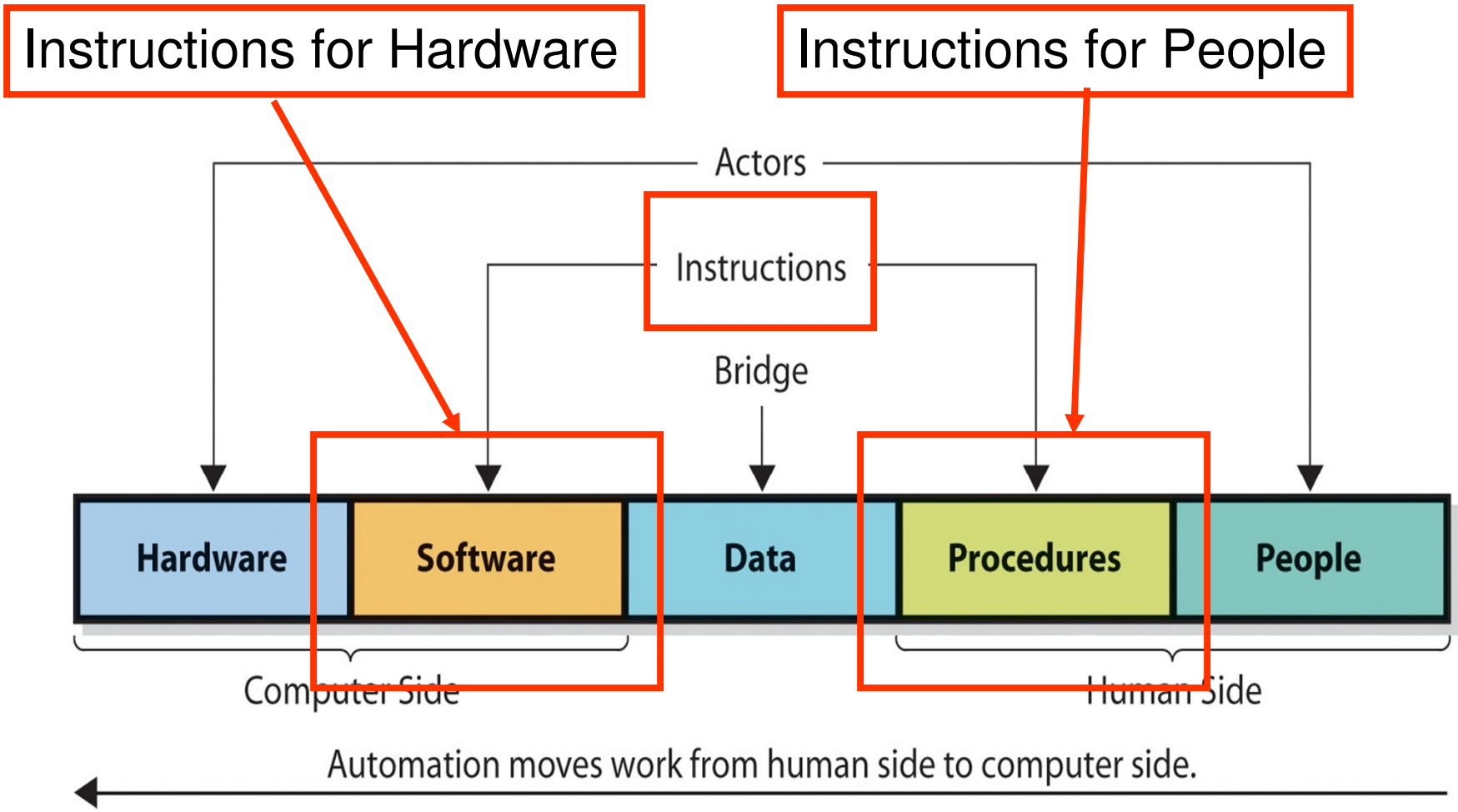

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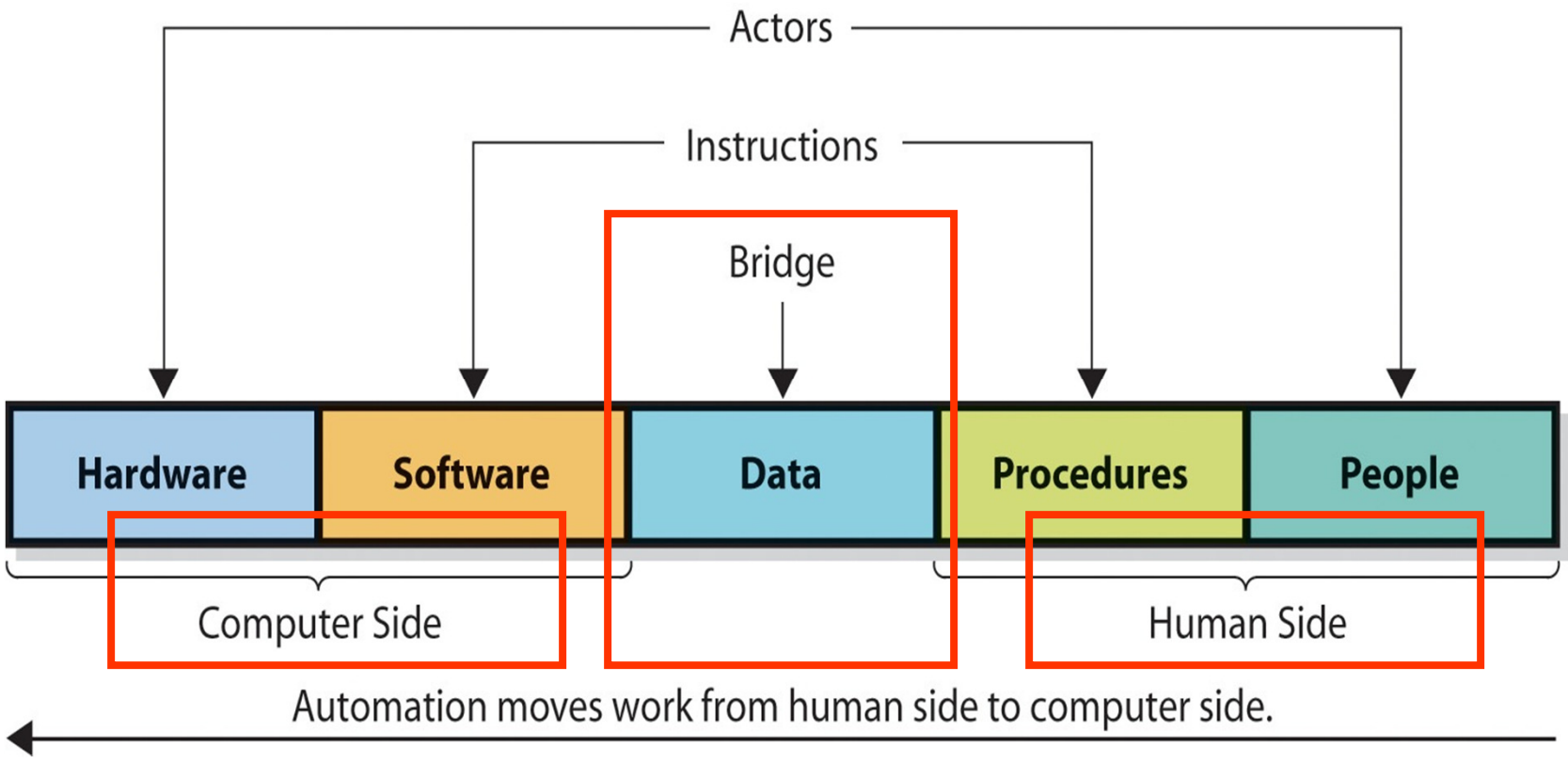
INFORMATION SYSTEM:



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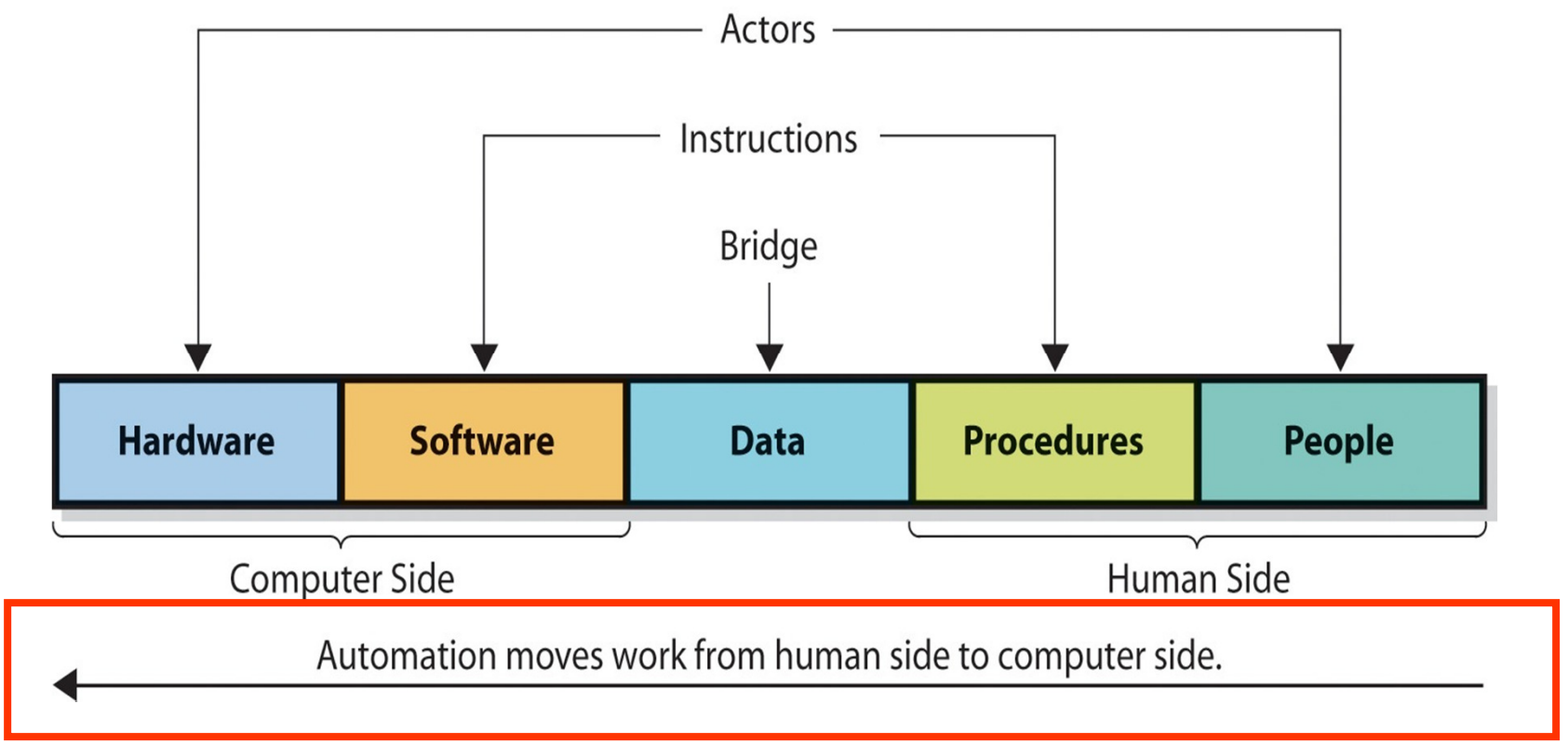

Transfer of work done by people to computers:

- People follow procedures
- Computers follow software instructions

- **Information system:**
  System whose purpose is to process information.

- **Information technology:**
  The electronically based elements of an information system: hardware, software, data, and communications.

- **Intellectual property:**
  Something that comes from a person's mind and in which the law recognizes property rights.

- **Internal feedback (in a system):**
  Passing a system output back to its inputs within the system.

- **Knowledge:**
  The ability to apply information in a business situation.

- **Open system:**
  System that communicates with its environment across its boundary.

Example: Information System Supporting Counter Sales

Hardware	Software	Data	Procedures	People
– Cash register computer – Database host computer	– Sales-recording program on cash register	– Sales data – Inventory database	– Operate cash register	– Cashier

Mostly an automated system.
Almost all work is done by computers and software.

Program record sales and makes changes

Computer in cash register communicates with computer that hosts Inventory Database

Mostly automated:
- No extensive training required
- Cashiers don't work with computer programs

Example: Information System to Support Payment Activity

Hardware	Software	Data	Procedures	People
– Personal computer	– Adobe Acrobat Reader – Email	– *QuantityReceived* – *ShippingInvoice*	– Reconcile receipt document with invoice. – Issue payment authorization, if appropriate. – Process exceptions.	– Accounts payable

Example: Payment receives QuantityReceived & ShippingInvoice and produces SupplierPayment

Mostly a manual system.
Little work is done by computers and software.
Most work is done by Accounts Payable clerk.

Manual: Accounts Payable Clerk reads documents & issues payment or investigates discrepancies, Processing exceptions complicated, Programming expensive & not effective

Example: Information System to Support Purchasing

Hardware	Software	Data	Procedures	People
– Personal computer – Database host computer	– Inventory application program – Purchasing program	– Inventory database	– Issue *PurchaseOrder* according to inventory management practices and guidelines.	– Purchasing clerk

Balance between computer and human work.

Purchasing clerk's computer runs a program that queries database & identifies stock levels to generate a PurchaseOrder

Work balanced between automation and manual activity

Selecting suppliers is complicated (manual)
Searching database is repetitive (automated)

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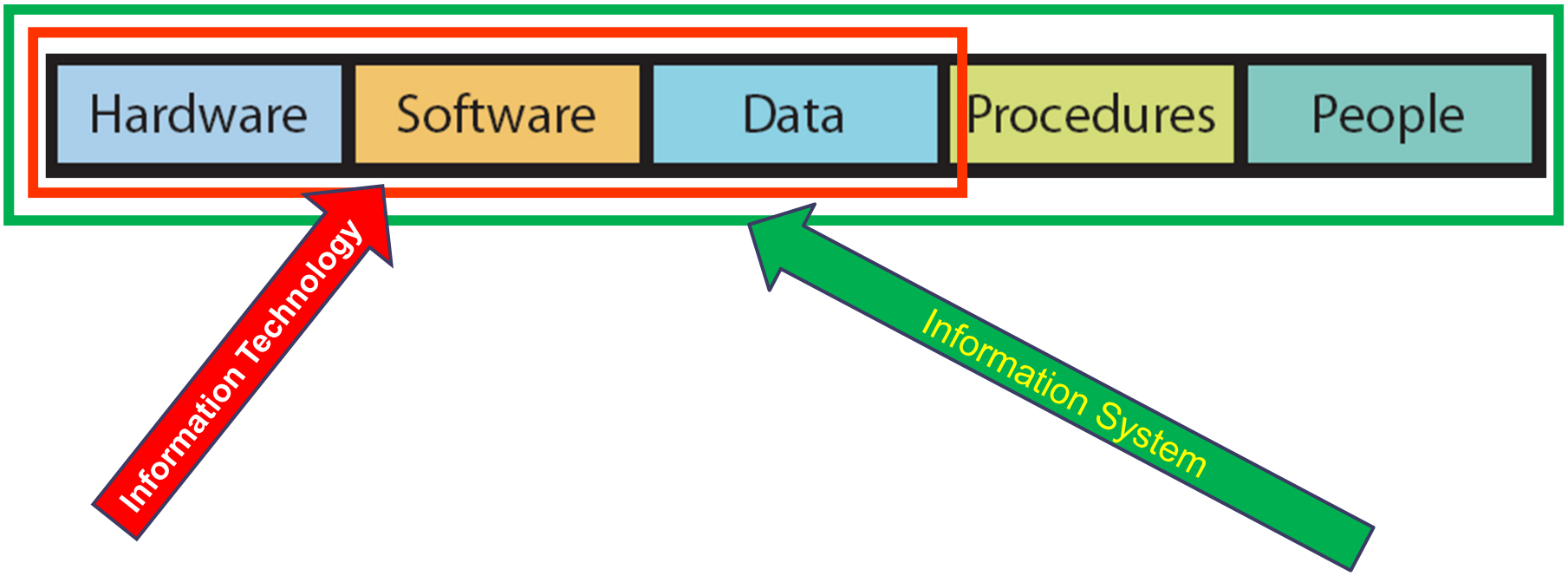
INFORMATION SYSTEM versus INFORMATION TECHNOLOGY:

The Five (5) components of an Information System **(IS)**
- contains –
The Three (3) components of Information Technology **(IT)**.



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INFORMATION SYSTEM: Examples

EFFECTIVE

- how to price your product or service to maximize revenue

- how to market your product the most effectively

- feasibility of creating a new product or service

- monitoring the results of advertising

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INFORMATION SYSTEM: Examples

EFFECTIVE

Pricing your product or service to maximize revenue.

How ?

Guessing ????

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INFORMATION SYSTEM: Examples

EFFECTIVE

Pricing your product or service to maximize revenue.

How ?

Collect all the data

- cost of producing the product / service
  - material costs
  - man-hours
- cost of marketing
- delivery
- support

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INFORMATION SYSTEM: Examples

EFFECTIVE

Pricing your product or service to maximize revenue.

How ?

Enter the data into an Information System

- as simple as Access or Excel
- as complex as Logianalytics or ITNode Software

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INFORMATION SYSTEM: Examples

EFFICIENT

Running your company balancing:

minimizing costs

with

maximizing output.

How ?

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INFORMATION SYSTEM: Examples

EFFICIENT

Running your company balancing:

minimizing costs

with

maximizing output.

How ?

Collect the relevant data

- cost of raw material
  - cost man-hours per unit
- efficiency of suppliers
- customer satisfaction
- inventory

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INFORMATION SYSTEM: Examples

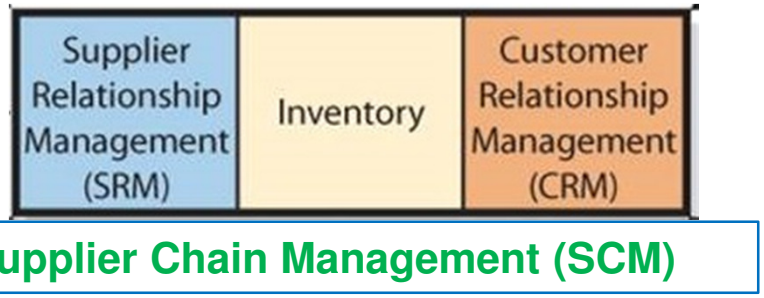
EFFICIENT

Running your company balancing:

minimizing costs

with

maximizing output.



How ?

Supplier Relationship Management Systems

Inventory Control Systems

Customer Relationship Management Systems