Understanding the Supply Process: Evaluating Process Capacity

Chapter 3

Learning Objectives

- Process flow chart (diagram)
- Capacity, bottleneck, utilization
- Chase and level production plans

Trinidad's "circored iron ore" plant

Fluidized bed based Circored® technology: The process uses hydrogen from natural gas to reduce iron ore fines, significantly decreasing the costs of the steelmaking process due to the elimination of the agglomeration step. The high quality, low cost product can be used as pure scrap substitute in electric arc furnaces as well as for increasing the capacity of existing blast furnaces with corresponding coke savings.

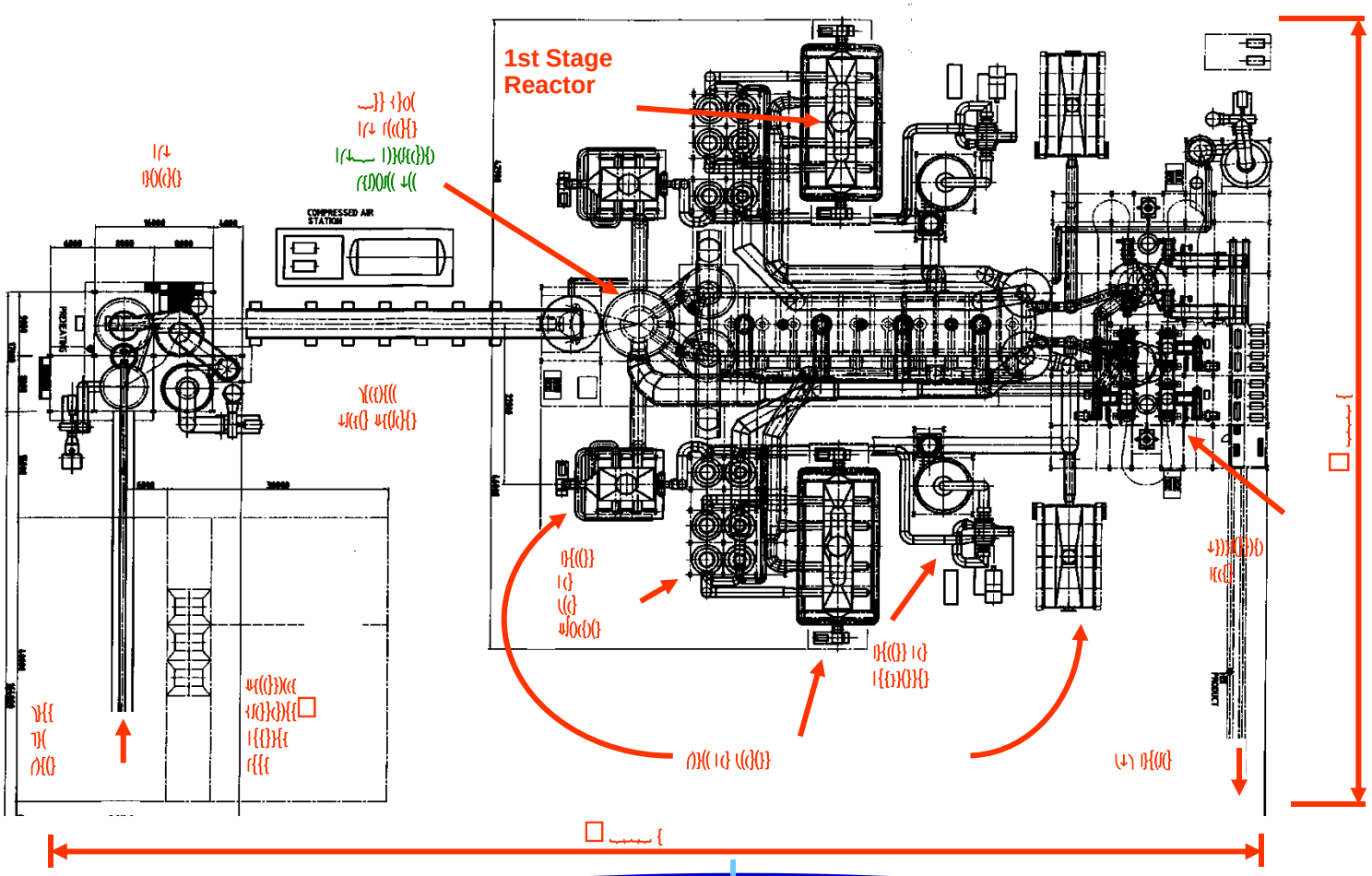
Why Metal Makers locate around Port Lisas?

- "Natural gas and a port."
  - According to Les Hart, Manager of Nucor Corp.'s Iron Refinery.
- Series of fat pipelines bringing cheap, abundant natural gas from an undersea fields to Claxton Bay and Port Lisas.
- "The fuel supply's economics are so compelling that Nucor cut a refinery into pieces and shipped it [on 13 barges] across the sea from its original home near New Orleans to take advantage of the lower costs." Luckily, transfer was completed 5 days before Hurricane Katrina.
  - According to the WSJ article titled "Metal makers go far for cheap fuel" published on July 6, 2007.
- Port Lisas in the Claxton Bay, most dependable port in the Caribbean
- Risks:
  - Some estimate Trinidad has only 30 years of natural-gas reserves left. Ken Julien, chairman of Trinidad's Natural Gas Task Force, says: "more untapped deposits could be discovered".
    - » As the gas prices rise so do the economically extractable deposits.
    - » Another option: Gas purchases from Venezuela.
  - Highly skilled labor shortage:
    - » University of Trinidad and Tobago, with an engineering focus, started

Circored plant in Trinidad

Case at insead.edu/alliance/faculty/CircoredPlantinTrinidad-w.pdf

To Create a Process Flow Chart (Diagram)



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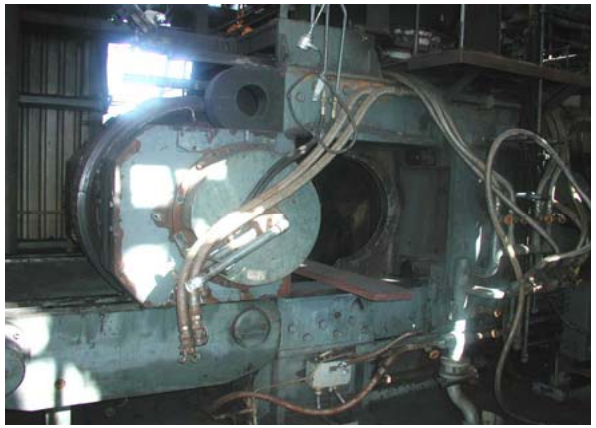
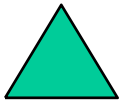


Activities
- Carried out by resources
- Add value and are required for completion of the flow unit
- May or may not carry inventory
- Have a capacity (maximum number of flow units that can flow through the activity within a unit of time)

Arrows
- Indicate the flow of the flow unit
- Multiple flow unit types possible

Inventory / Buffers
- Do NOT have a capacity; however, there might be a limited number of flow units that can be put in this inventory space at any moment of time
- Multiple flow unit types possible



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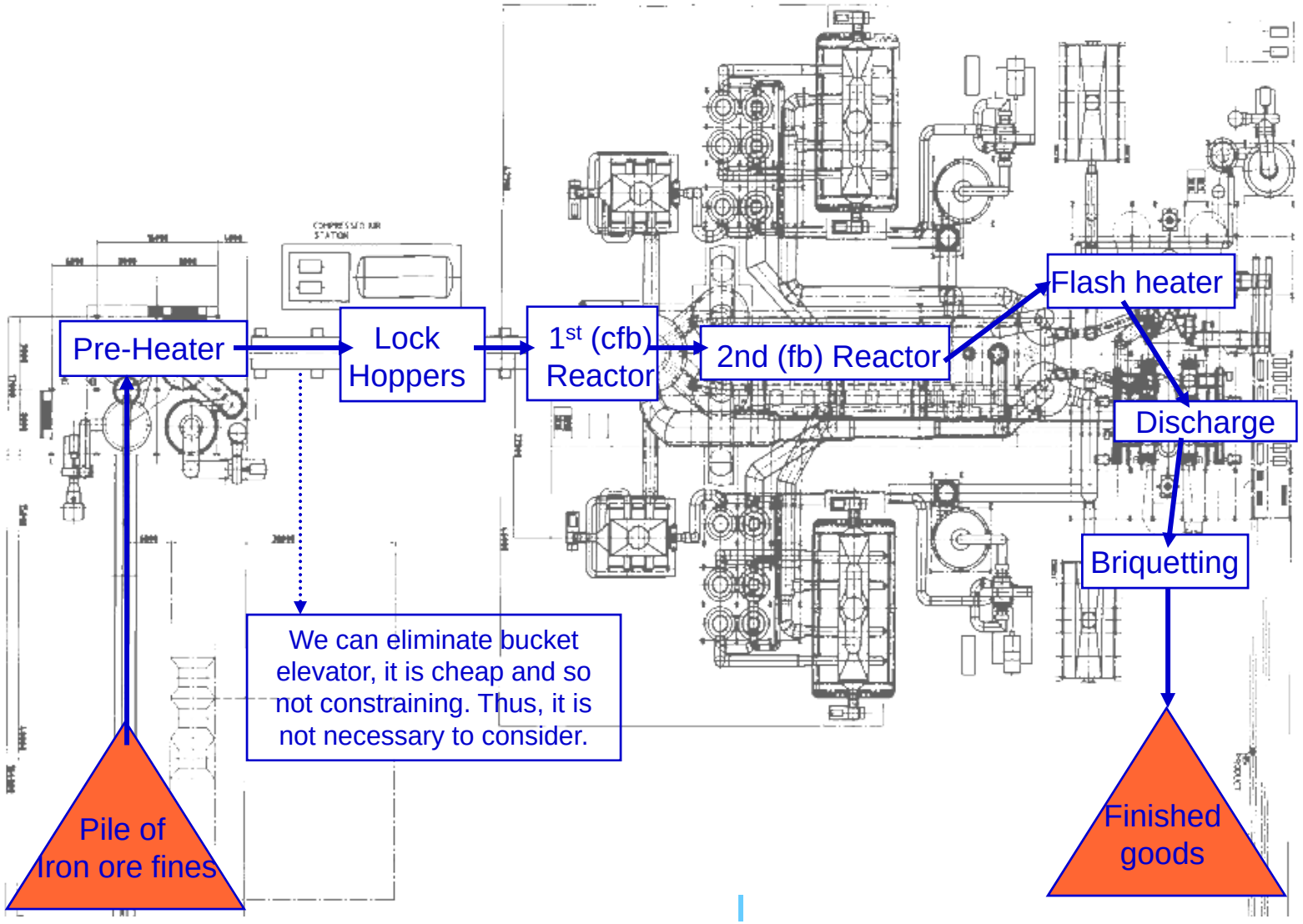
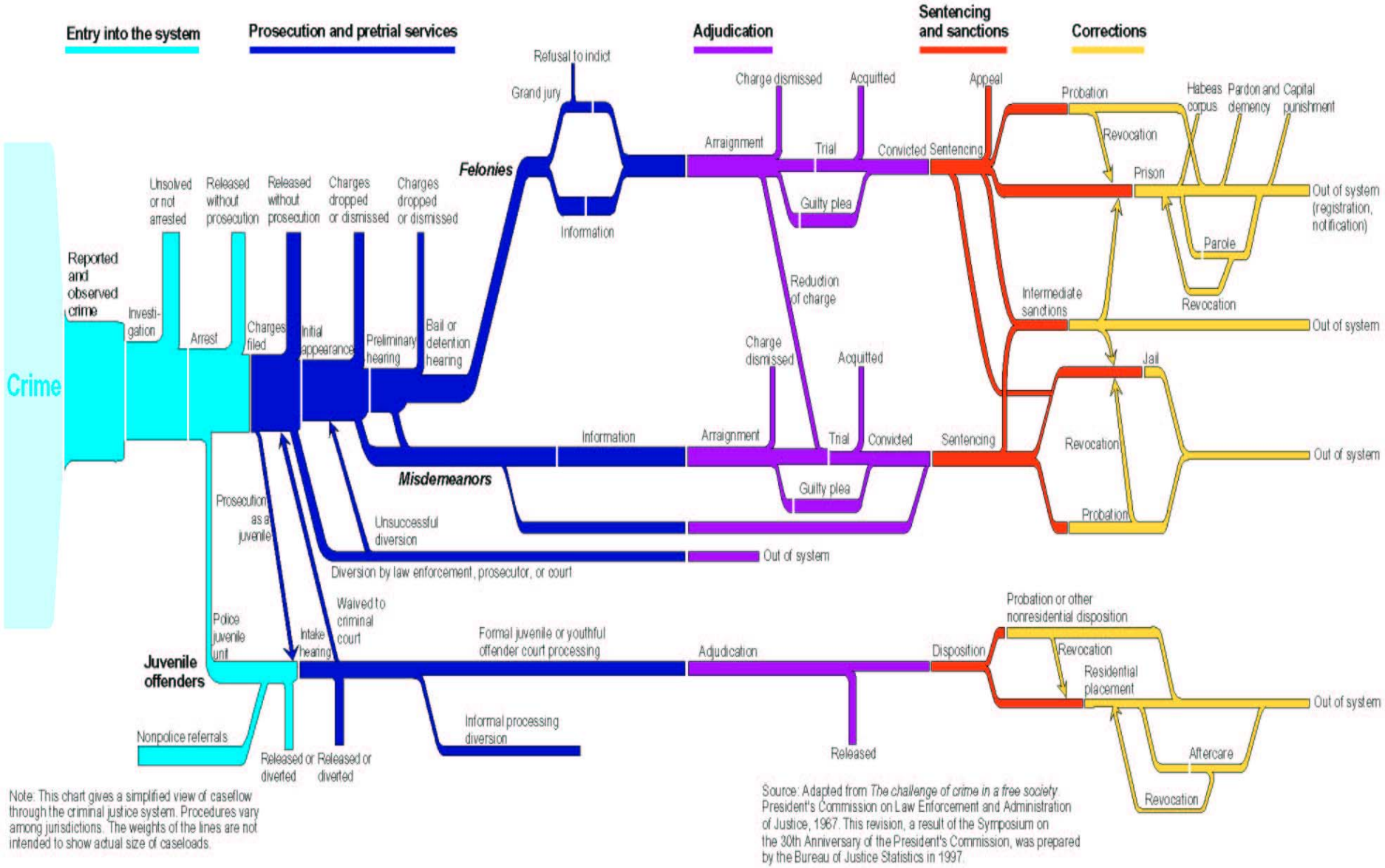


What is the sequence of events in the criminal justice system?

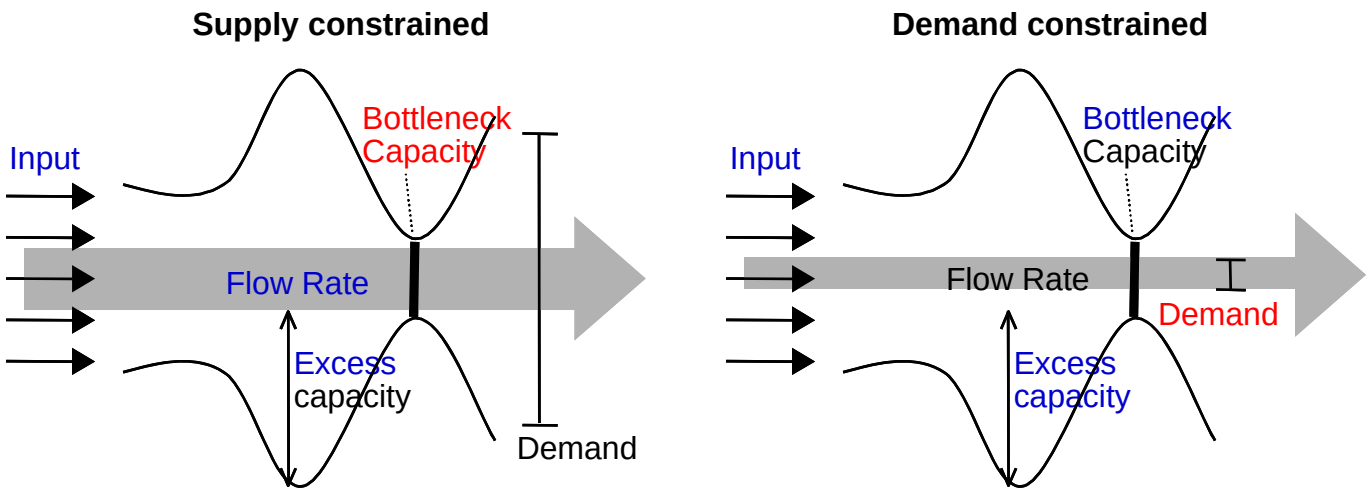


Note: This chart gives a simplified view of caseflow through the criminal justice system. Procedures vary among jurisdictions. The weights of the lines are not intended to show actual size of caseloads.

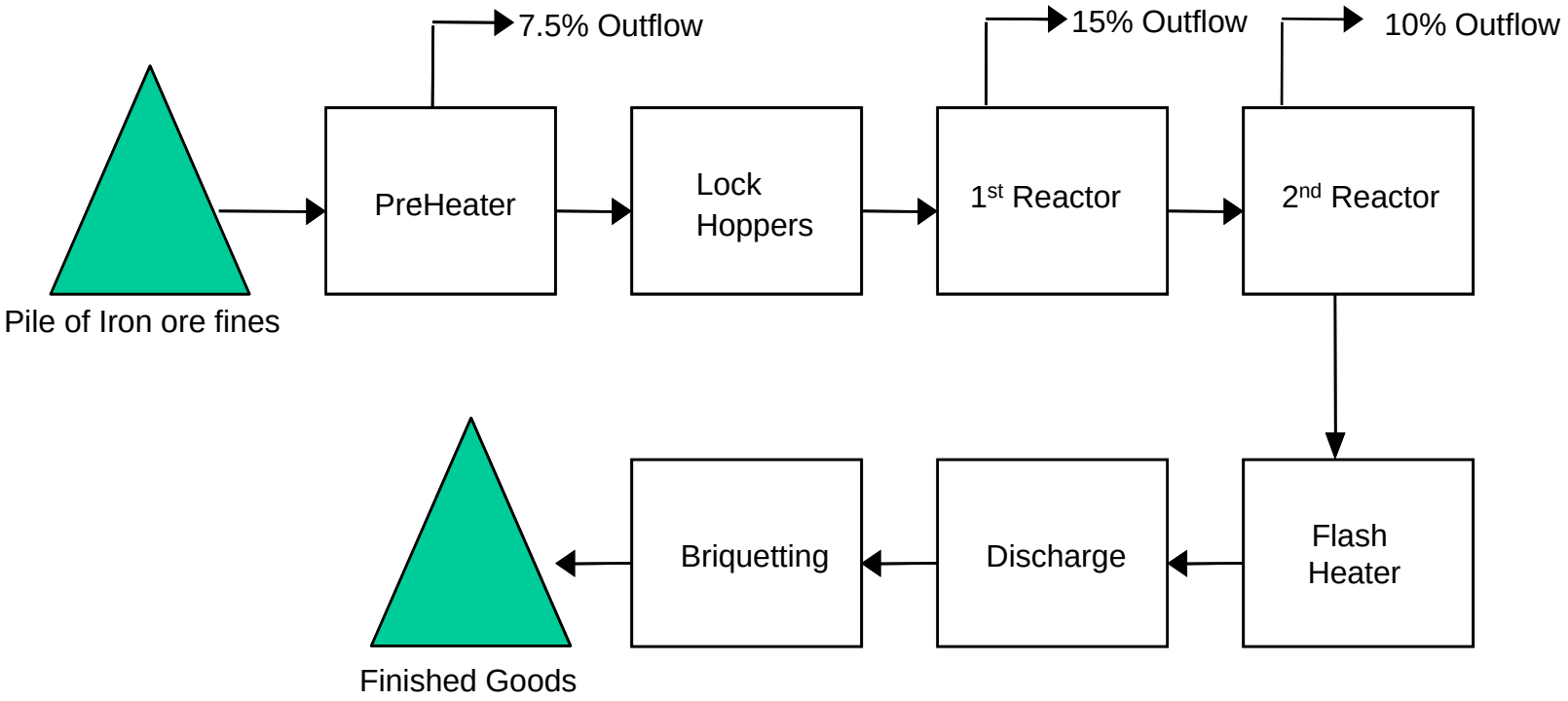
Source: Adapted from *The challenge of crime in a free society*. President's Commission on Law Enforcement and Administration of Justice, 1967. This revision, a result of the Symposium on the 30th Anniversary of the President's Commission, was prepared by the Bureau of Justice Statistics in 1997.

Bottleneck process and capacity

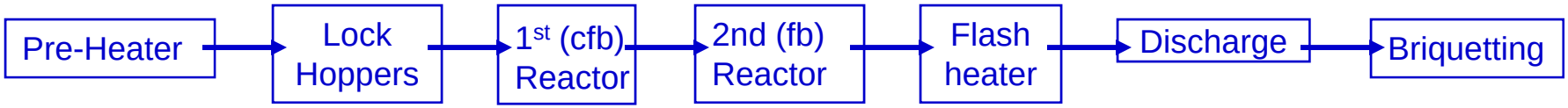
- Capacity: Number (amount) of units that can be processed per time
  - » A student can solve 30 multiple choice questions per hour.
  - » Each briquetting machine has a capacity of 55 tons per hour
- Overall capacity of a sequence of processes is determined by the slowest process, i.e. the resource with the smallest capacity.
  - » Process capacity=Min{Capacity of Res 1, …., Capacity of Res 2}
- Incorporating available input rate and demand rate,
  - » Thruput=Min{Input rate, Process capacity, Demand rate}



Choosing the Unit of Analysis



The process capacity of circored plant in Trinidad



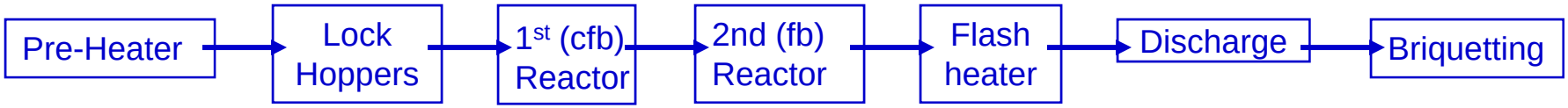
- Capacities
  - Preheater 120 tons/hour
  - Lock Hoppers 110 tons/hour
  - 1st (cfb) Reactor 112 tons/hour. Processes 28 tons every 15 minutes
  - 2nd (fb) Reactor 100 tons/hour. Processes 400 tons every 4 hours
  - Flash heater 135 tons/hour
  - Discharge 118 tons/hour
  - Briquetting 165 tons/hour

- Process Capacity

  = min{120,110,112,100,135,118,165}

  = 100 tons/hour

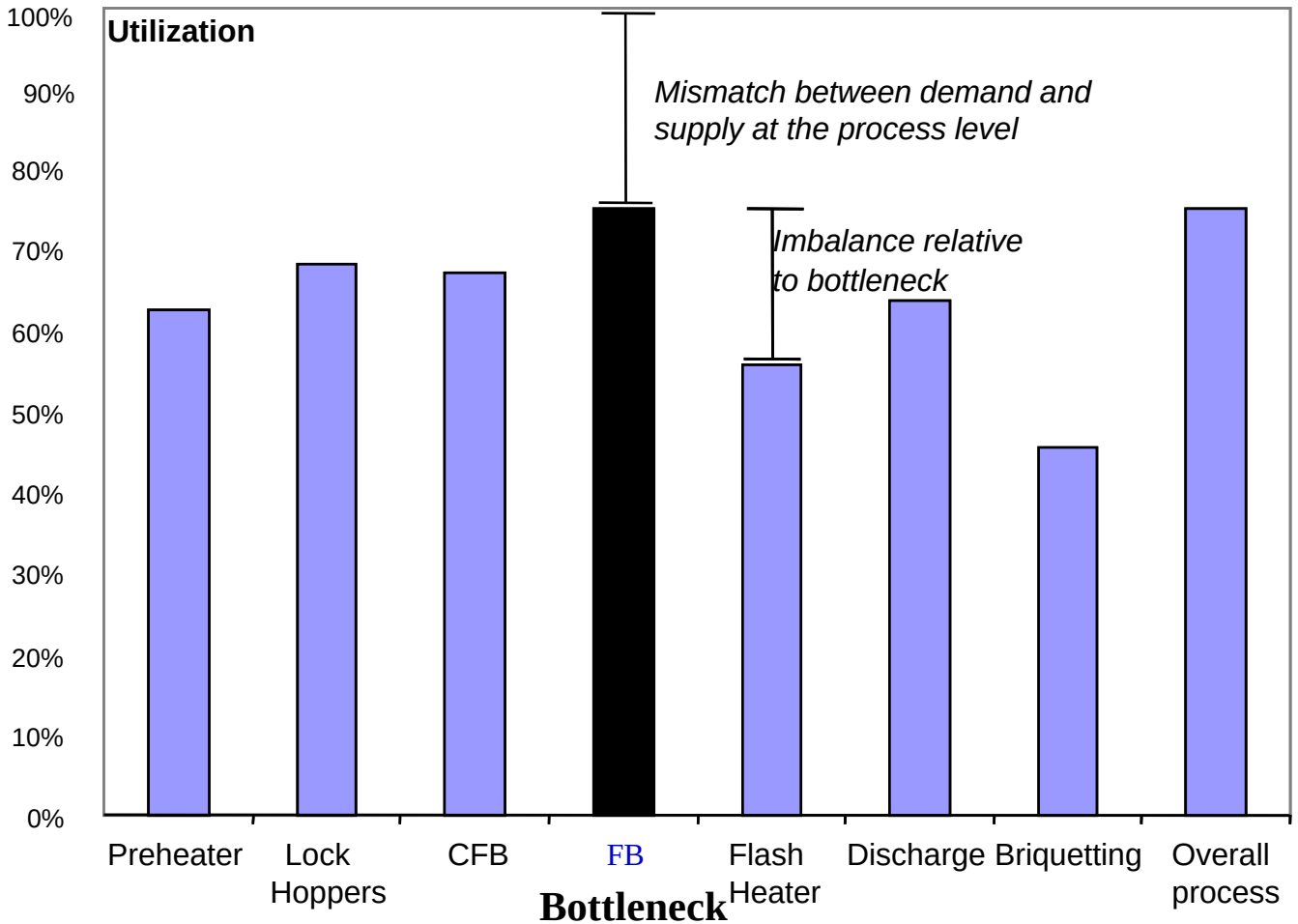
The cycle time of circored plant in Trinidad



- Cycle time: Amount of time taken to process 1 unit in repetitive processing.
  - Since different units can be processed in parallel, cycle time is not the flow time.
- Cycle time (designed) = 1 / Process Capacity
- How long does it take to process 1 ton of iron ore?
  - Since 1 hour is required for 100 tons, 1/100 hour suffices for 1 ton.
  - That is, the cycle time is 0.01 hour = 0.6 min = 36 seconds
  - Every 36 seconds 1 ton of iron briquet is completed.

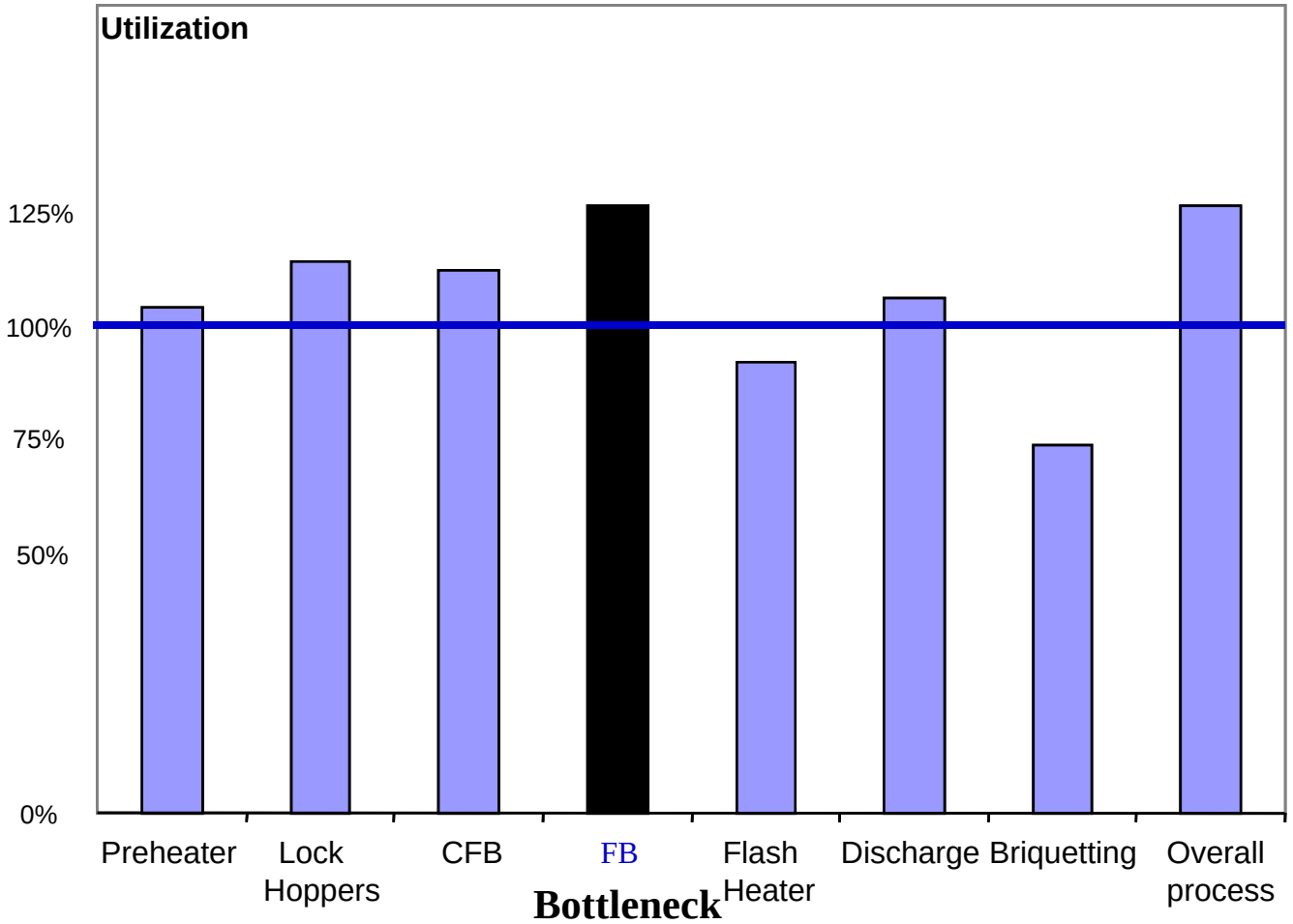
The utilization with demand of 657,000 tons/year

- Utilization of a resource = Thruput/(Capacity of the resource)



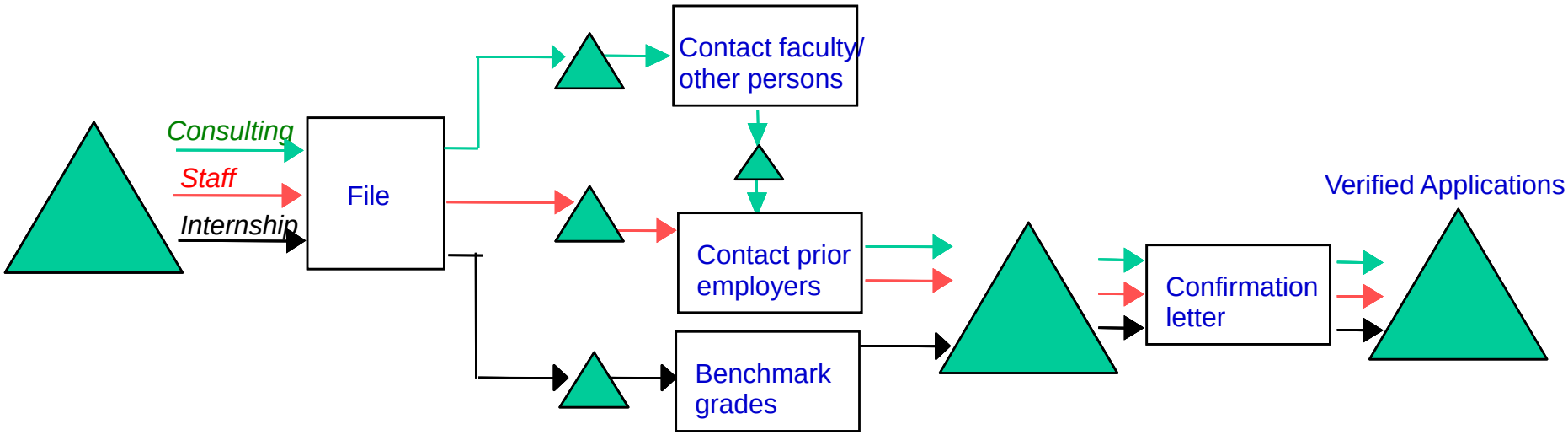
The utilization with demand of 1,095,000 tons/year

- Implied (requested) Utilization of a resource = Demand / Capacity of the resource



Different units flowing in the same system

- Outsourcing business processes is common
  - Billing, Recruiting, Maintenance, Customer call centers, etc
- The company which handles the outsourced process is likely to deal with various kinds of units
- Case in point: A company that provides resume validation service:



An application as a unit

Demand per hour for validation: 3 for consulting; 11 for staff; 4 for internship.

	Activity Time (min) Per applct	Number of workers	Available Capacity Applct/hr	Consulting Workload Per hour	Staff Workload Per hour	Intern Workload Per hour	Total	Implied Utilization
File	**3**	**1**	20	3	11	4	18	18/20= 90%
Contact Persons	**20**	**2**	6	3	0	0	3	3/6= 50%
Contact Employers	**15**	**3**	12	3	11	0	14	14/12= 117%
Benchmark Grades	**8**	**2**	15	0	0	4	4	4/15= 27%
Confirmation Letter	**2**	**1**	30	3	11	4	18	18/30= 60%

An application as a unit

	Activity Time Per applct	Number of workers	Available Capacity Applct/hr	Consulting Workload Per hour	Staff Workload Per hour	Intern Workload Per hour	Total	Implied Utilization
File	3	1	20	3	11	4	18	18/20= 90%
Contact Persons	20	2	6	3	0	0	3	3/6= 50%
Contact Employers	15	3	12	3	11	0	14	14/12= 117%
Benchmark Grades	8	2	15	0	0	4	4	4/15= 27%
Confirmation Letter	2	1	30	3	11	4	18	18/30= 60%

- What is the minimum number of people to hire so that the implied utilization of contact employers is below 100%?
- What happens to implied utilizations when staff applications decrease to 8 per hour? Compute the new utilizations.

A minute as a unit

Demand per hour for validation: 3 for consulting; 11 for staff; 4 for internship.

	Activity Time Per applct	Number of workers	Available Capacity **Minute/hr**	Consulting Workload Per hour	Staff Workload Per hour	Intern Workload Per hour	Total	Implied Utilization
File	**3**	**1**	60	3 x 3	11 x 3	4 x 3	54	54/60= 90%
Contact Persons	**20**	**2**	120	3 x 20	0	0	60	60/120= 50%
Contact Employers	**15**	**3**	180	3 x 15	11 x 15	0	210	210/180= 117%
Benchmark Grades	**8**	**2**	120	0	0	4 x 8	32	32/120= 27%
Confirmation Letter	**2**	**1**	60	3 x 2	11 x 2	4 x 2	36	36/60= 60%

Production Management to Handle Demand Fluctuations

Chase strategy

- In a chase production plan, a firm produces quantities exactly to match the demand.
- If there is regular time and overtime possibility, sum of the regular time and over time capacity is set equal to the demand. Since the regular time is cheaper, no overtime is scheduled before entire regular time is used up.
- Example with a regular time capacity of 4000 units/week.

Week	Demand	Regular time production	Overtime production
1	2800	2800	0
2	4300	4000	300
3	3800	3800	0
4	5100	4000	1100

Production Management to Handle Demand Fluctuations

Level strategy with Sufficient Regular Time

- In a level production, a firm produces in constant quantities during regular time.
- If the regular time capacity is enough to produce total demand, no overtime.
- Example with a regular time capacity of 4000 units/week.

Week	Demand	Beginning Inventory	Regular time production	Overtime production	Ending Inventory
1	2800	0	4000	0	1200
2	4300	1200	4000	0	900
3	3800	900	4000	0	1100
4	5100	1100	4000	0	0

Production Management to Handle Demand Fluctuations

Level strategy with Insufficient Regular Time

- If the regular time capacity is insufficient, use overtime.
- Example with a regular time capacity of 3000 units/week.

Week	Demand	Beginning Inventory	Regular time production	Overtime production	Ending Inventory
1	2800	0	3000	0	200
2	4300	200	3000	1100	0
3	3800	0	3000	800	0
4	5100	0	3000	2100	0

Summary

- Process flow chart (diagram)
- Capacity, bottleneck, utilization
- Chase and level production plans

The fate of the plant as of May 2004

- Outokumpu's new CIRCORED® Technology for Iron Reduction Boosted by the CAL - ISG Deal. ISG Venture Inc., a subsidiary of International Steel Group Inc., has announced its agreement to purchase the idled Circored® Hot Briquette Iron (HBI) facility in Trinidad and Tobago from Cliffs and Associates Limited (CAL).
- The Trinidad and Tobago HBI project began in the mid-1990s as a joint venture between Cleveland Cliffs, Lurgi Metallurgie (then of Germany, but now known as Outokumpu Technology GmbH of Finland), and LTV Steel. Lurgi Metallurgie developed and delivered the first-of-its-kind Circored® plant for the HBI facility in Trinidad.
- The plant is designed to produce 500,000 tons/annum of HBI using Outokumpu's new fluidized bed based Circored® technology. HBI production with Circored® began in 2000 in the first industrial scale plant in Trinidad, but ceased in 2001 due to depressed global HBI prices. Along with increasing steel prices and ISG Venture investing now in the Trinidad HBI production and restarting the plant, Outokumpu Technology sees great possibilities to market the ground-breaking Circored® technology to other steel producers, too, as a highly cost-effective process.

Business process outsourcing (BPO) Local and recent example

- **Top Spanish Financial Services Firm la Caixa (lacaixa.es) Extends EDS Relationship**
  - Representatives of EDS announced a €200 million agreement for information technology services (IT) and BPO with la Caixa that will extend the relationship for an additional four years. Since 1996, EDS has provided a range of IT services for la Caixa. The nearly decade-long relationship with la Caixa has enabled the financial institution to increase profits while lowering operating costs.
  - EDS will continue managing "la Caixa's" technology infrastructure using the EDS data center in Barcelona and managing contingency and security services. Additionally, EDS will develop new banking and insurance software solutions and applications architecture and will manage the Contact Centre, providing support to the bank branches. EDS financial BPO solutions afford la Caixa the ability to differentiate itself from its competitors, focus on its core business and increase its efficiency while using world-class technology platforms.
  - With almost 4,800 branches across Spain, the agreement enables la Caixa to continue its market share growth by opening new branches and increasing sales while reducing overall costs. The agreement provides operational efficiencies by allowing EDS to integrate mainframe, midrange and network operations and improve processes for managing risk.
  - The renewed relationship with la Caixa, on the heels of the contract with First International Bank of Israel, demonstrates EDS' global operational excellence in the financial services industry, said Rafael Roa, President EDS Iberia.

Announced in the second week of Jan 2006.