The Chartered Institute of Logistics and Transportation of North America

L'Institut agréé de la logistique et des transports en Amérique du nord

Capacity challenges and solutions

Some fundamentals

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Outline

- Our assumption about the goal
- Best of times — opportunity and potential
- Risks, symptoms, and challenges
- Weaknesses of current approaches
- Fundamentals of constraints management
- Creating flow

What is the primary goal?

- Make money now and in future
- Growth and profit
- Responsive service to system users
- Maximize asset utilization
- Be economical
- Be efficient
- Operate safely
- Provide security
- Operate in an environmentally sustainable manner
- Facilitate the best use of all transportation modes
- Provide service at lowest cost
- Improve cost competitiveness for entire supply chain
- System stability

The future

Amazing potential to achieve the goal

- Worldwide burgeoning middle class who have never been in an airplane but they want to = an unsurpassed-in-history opportunity for growth
- Forecast increase in containers shipped from Asia to West Coast of Canada from 4.4 million TEU s in 2016 to 10 million by 2027
- New grain terminals, expansion of fertilizer throughput capacity
- Cold cargo

Trouble in paradise

Symptoms

- Shortage of skilled people pilots, rail workers, mariners, drivers, mechanics
- Consolidation among shippers ➔ more port facilities vying for fewer customers
- Infrastructure like *George Massey Tunnel* is not scalable
  - creates unacceptable variation for scheduling, varies from 5 min to 2 hrs
  - this turns assets into bottlenecks
- First and last mile service shortfall

Trouble in paradise

Symptoms (con't)

- Rail congestion at port of Vancouver lowers throughput in autumn 2018
  - CN and CP embargo traffic
- Grain and forest-products shippers can be dissatisfied with rail service
  - largely a congestion problem; TC creating data centre to increase transparency
  - dissatisfaction is a symptom, not a constraint
- Growth of Toronto Pearson constrained by capacity of ground-access
- Urban road and transit capacity is not providing adequate mobility
  - Vancouver is NA's 4th most congested city, Toronto 8th, Montréal 11th, Ottawa 14th

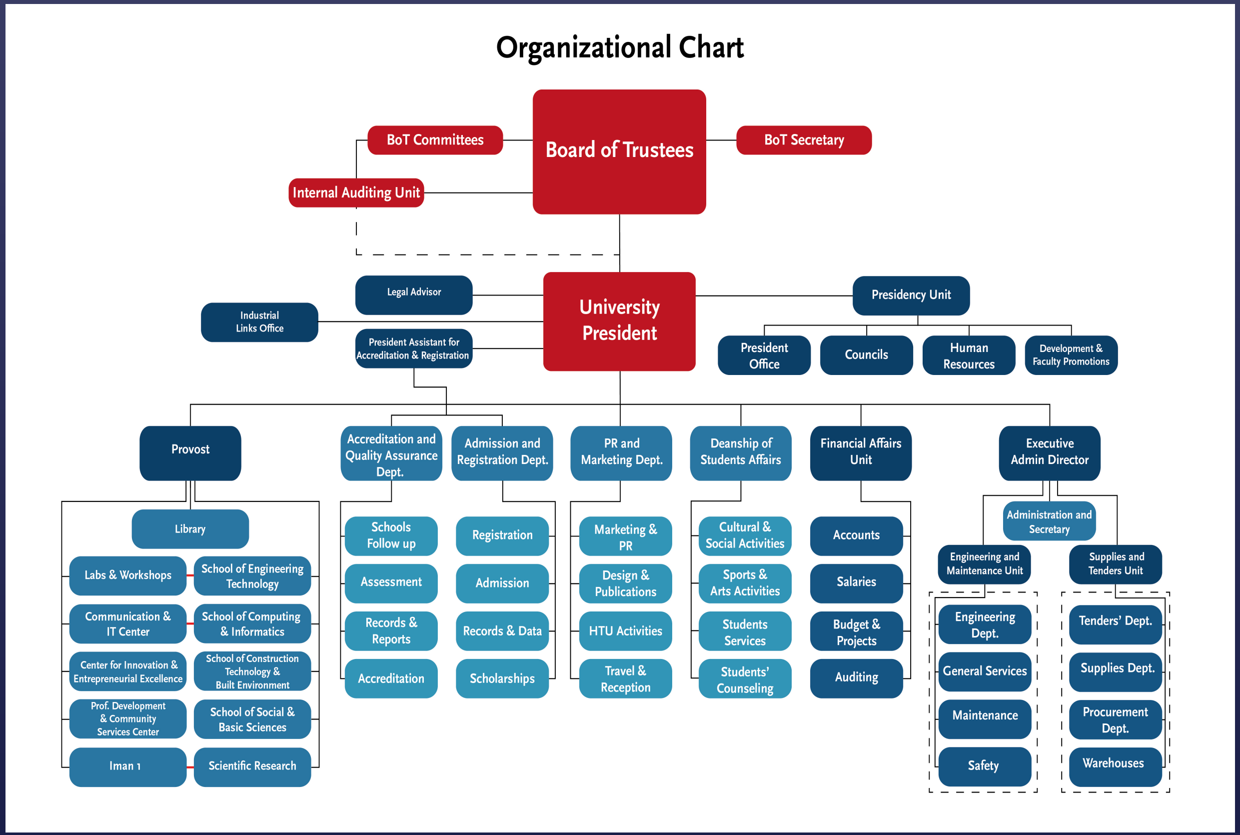
Adding to challenge: complexity of large organizations

- Multiple locations, each with its own resources and capacity limitations
- Multiple services needing multiple inputs w/ complex processes and schedules
- Diversity of shippers and markets, with high levels of variation and uncertainty
- Complex and interdependent buyers and sellers:
  - many internal and external people and organizations
    - each with its own perspective and priorities
- Many internal and external rules, regulations, and metrics

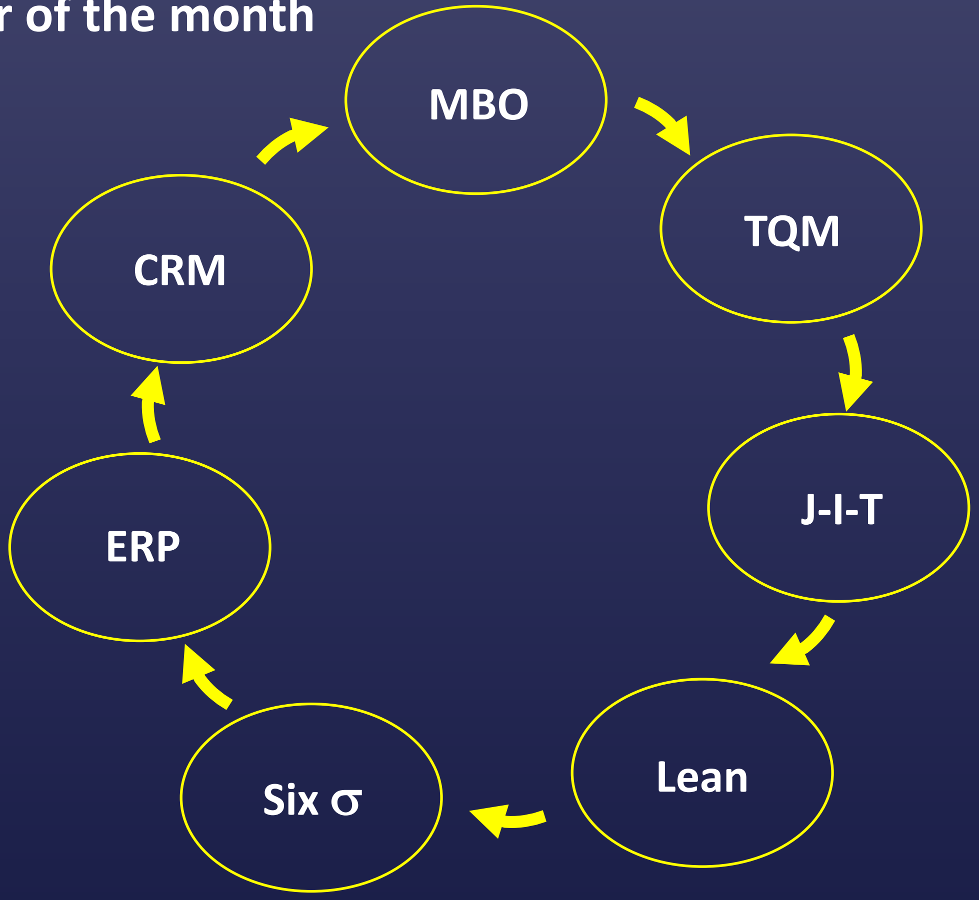
Source of vacillation

Conventional approaches

The old standby: divide and conquer



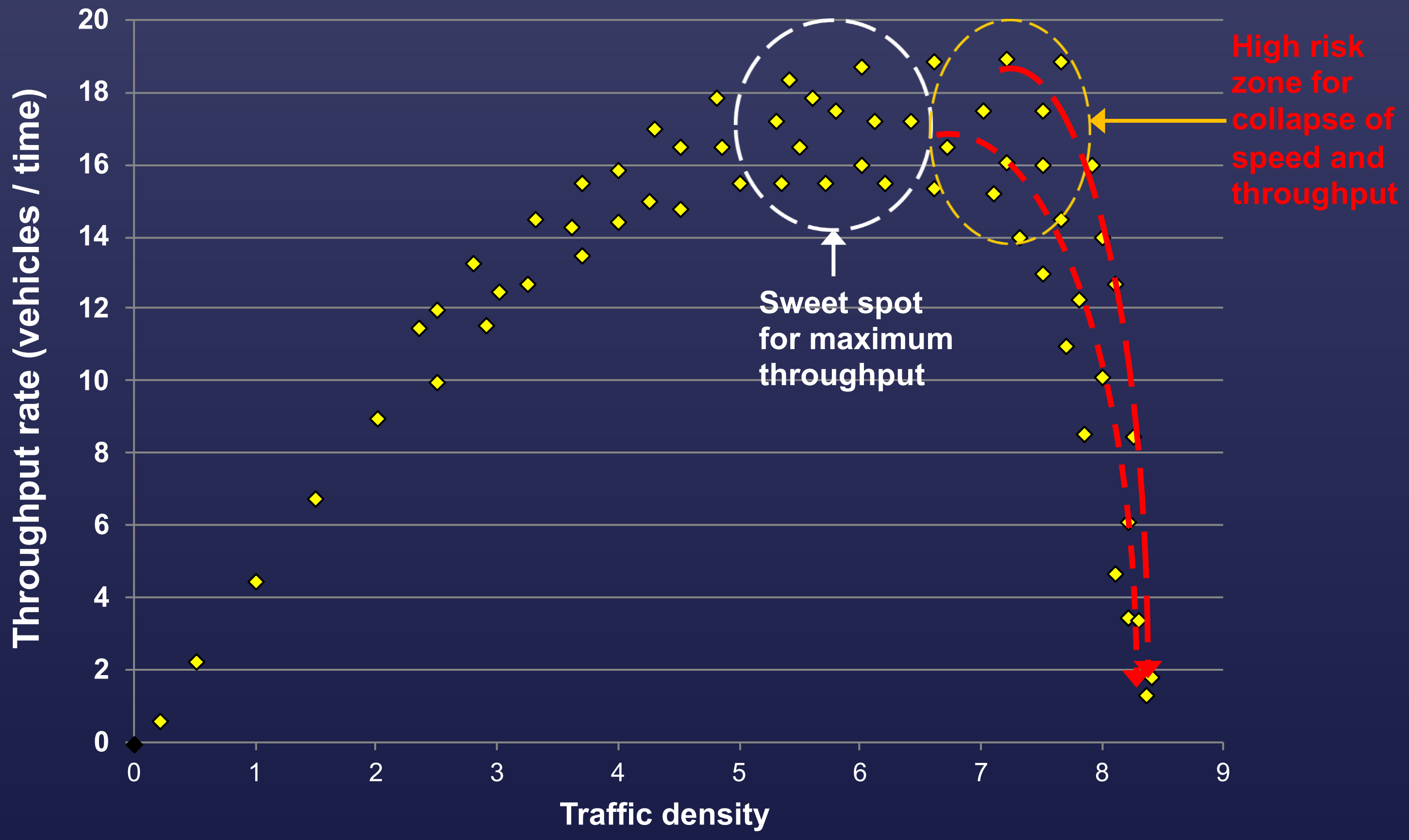
Flavour of the month



Supply chains and optimization theory

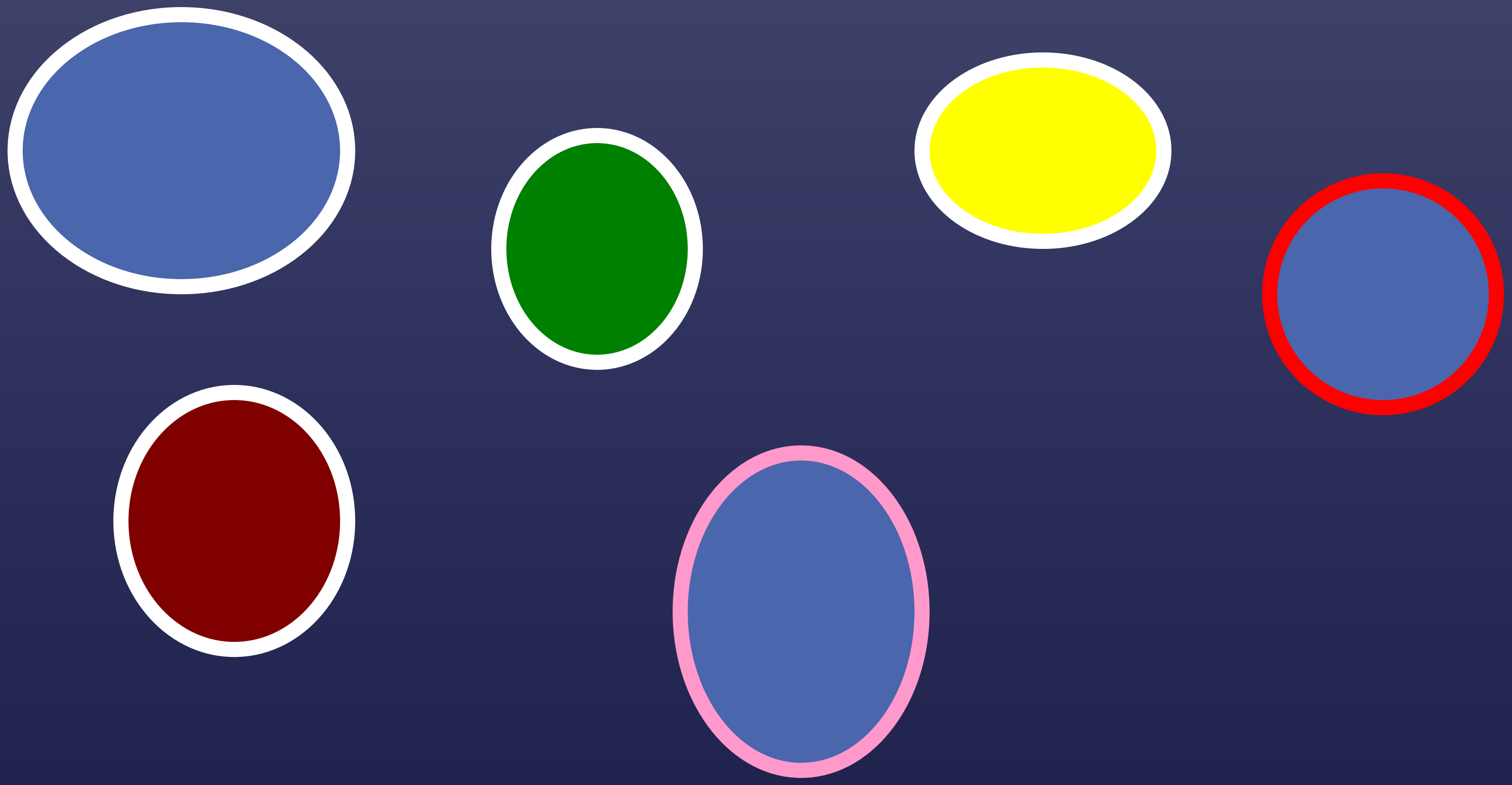
When infrastructure capacity is the constraint

Notional throughput *vs*. density on a traffic network



Supply chains and optimization theory

Importance of “what to change”



Supply chains and optimization theory

What is a constraint

Constraint:

"Anything that prevents a system from achieving a higher performance relative to its goal."

Internal

- **bottleneck**
- **corporate policy or procedure**

External:

- **resources**
- **market demand**
- **competitors' actions**
- **legislation or regulations**
- **physical plant and equipment**
- **other players' business practices**

It’s kinky

- Low capacity = symptom of low flow-rate
- Constraints limit throughput of the entire system, not just where they are located
- Often we can find the constraint by detecting these symptoms:
  - low throughput
  - high work-in-progress inventory
  - stretched-out delivery times to end customers
  - longer lead times for customers
  - lower quality of what the supply chain produces
  - lower efficiency

Recipe for creating flow

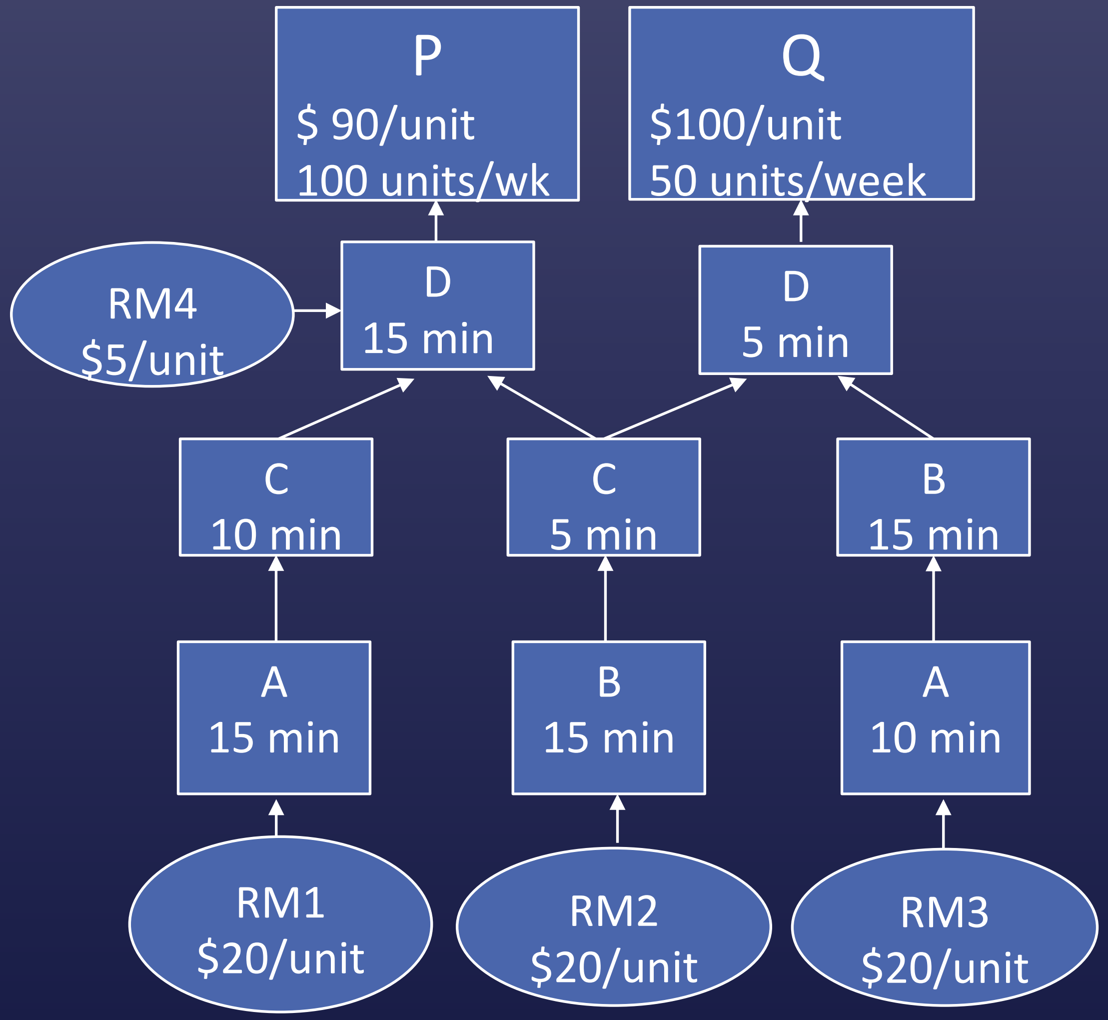
Beginning step:

1. Establish the primary goal

Focusing steps:

2. Identify the governing constraint
3. Exploit it:
   - eliminate variation at the constraint
   - keep it busy 24 / 7
   - schedule the most profitable work per hour at the constraint
4. Subordinate everything else to the constraint
   - make all other assets serve the constrained operation
   - tolerate inefficiencies in un-constrained operations
5. Elevate the constraint (if the constraint has not been broken)
6. Repeat

The case of P and Q



Resources A, B, C, D

- 1 unit each
- Manned full time
- No cross training

Available time/resource

- 40 hours/week

Payroll

- 4 resources
- 40 hrs/wk
- $10/ hr $1600

Overhead

- All other expenses
- O/H = 2.75* DL

$4400

Total $OE/wk $6000

Buffers in the service of flow

What are the optimum kinds of buffer for the system, and are they being held and used in the best possible place in the supply chain, and are the right organizations paying for them?

Protective capacity

- **Buffers should be measured in time-supply (e.g., two days' production) and placed where they keep the constraint operating always**
  - **buffers directly ahead of the constraint should be large enough to recover from any disruption of arriving flow, before the constraint itself runs out of work**
- **Non-constrained operations must have enough productive capacity to recover before the constrained operation's throughput gets affected**
- **Sometimes time-buffers are placed immediately after an upstream resource with high variability, until that variability is reduced**

Top five fundamentals

In conclusion

1. Organizations and supply chains need clarity about their fundamental goal
2. The end result of local optimization is never the optimum of the total system
3. Constraints limit throughput of the whole system
   – a minute lost at the constraint is a minute lost to the whole system
4. Congestion is the enemy of flow
   – a system pushed close to capacity risks sudden collapse
5. Follow the “focussing steps” to create more flow
6. Invest in additional capacity (elevate the constraint) only after the constrained operation is working as fast as it can, 24 / 7