Optimizing Terminal Rail Operations Through the Lens of Precision Railroading

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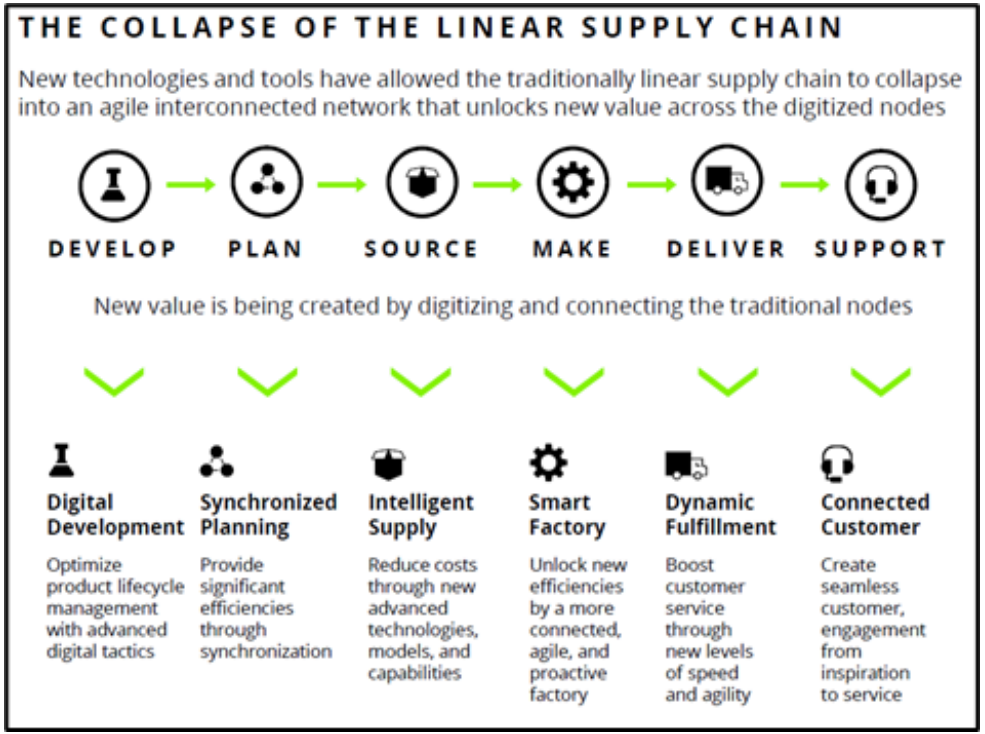
The Supply Chain

- We need to find ways of working together closely because our individual successes are dependent upon each others successes
- Crude by Rail is reliant upon multiple modes of transportation, such as inbound arrivals by truck or pipeline, and outbound departures by rail
- Business success is dependent upon getting product to market reliably, efficiently, and at a reasonable cost
- Supply chains are fragile systems, disruptions and/or delays can disrupt the entire chain
- This presentation will focus on the specific link between terminals and Railways, where responsibility for getting product to market is dependent upon a third party (Railway)
- So how can terminals and Railways collaborate to optimize operations, reduce risks, improve reliability, efficiency, and safety while reducing costs and providing value to customers

CRUDE BY RAIL CONFERENCE 2023
OPTIMIZING TERMINAL RAIL OPERATIONS THROUGH THE LENS OF PRECISION RAILROADING

The traditional Linear Supply Chain model is no longer valid – why?

- Lack of resiliency – just in time
- Lack of transparency – sharing intel
- Lack of agility – ability to react quickly
- Lack of forecasting – recovery plans, resource allocations
- Inability to adapt – continuous learning, improvement



Deloitte, 2018 Digital Supply

Resiliency – what is it ?

- “the ability of a system to adapt to changing conditions, as well as to withstand and rapidly recover from disruption”

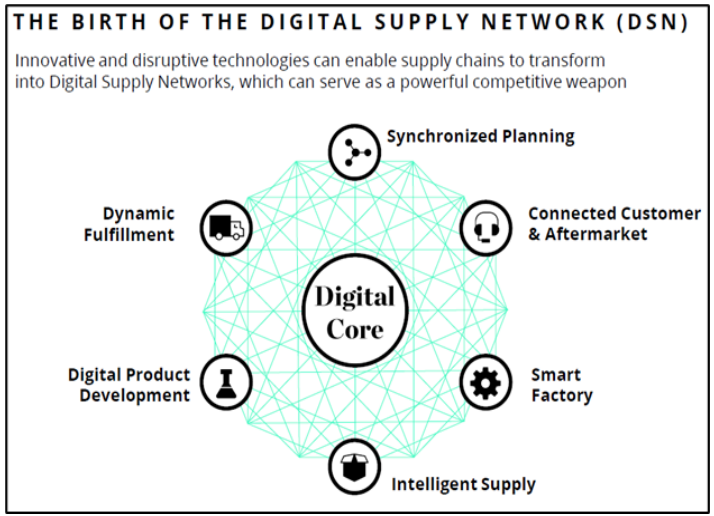
Properties of resilient systems:

- access to diverse components (e.g., materials, suppliers, carriers, and routes) that provide redundancy in case one component in the system fails
- highly connected, secure, flexible, and adaptive systems to enable easy transitions from one component to another
- capability of being quickly repaired or restored to limit the duration of any one disruption
- “just in case” approach to system optimization – greater ability to adapt and recover

FHWA, February 2022, Supply Chain Assessment of the Transportation Industrial Base: Freight and Logistics

Supply Chain Ecosystem / Digital Supply Networks

Viewing the Supply Chain as an Ecosystem today, based on a mesh of interdependencies between stakeholders, provides a much more resilient “network”, as opposed to a “chain”



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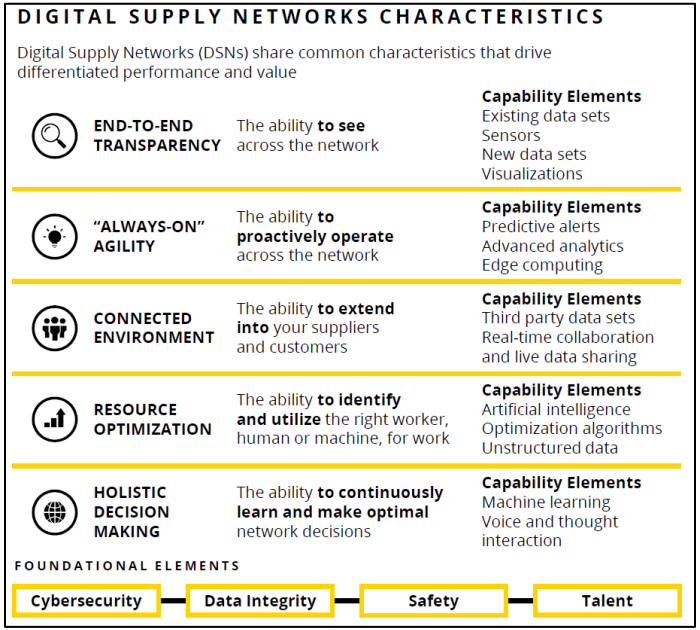


PSR - why does this matter ?

- Rail transportation supports domestic and international supply chains, driving profitability and economic growth
- Local disruptions to rail traffic translates into extensive delays over thousands of kilometers congesting rail lines, yards, and terminals
- Recovery from short term delays locally require extended timeframes to re-establish network fluidity resulting in lost productivity
- Delays translate into higher demand for resources (railcars, locomotives, crews, storage), driving up costs, and causing network and terminal congestion

PSR - why is it important ?

- PSR benefits translate to a competitive advantage in global and domestic marketplaces, lower costs for goods, and opportunities for sustainable growth
- Terminal operators need to understand how Railways operate, and more importantly, what is needed to work collaboratively, and how to integrate and optimize their operations with the Railways
- PSR benefits everyone (producers, transloaders, refineries, and consumers), not just Railways

PSR - what is it ?

- A set of principles to guide Railway business and operating practices governed by:
  - Corporate Guiding Principles
  - Service Design Principles

Goals and Objectives

- Excellence in rail service through safe, efficient, predictable, and reliable operations
- Reliability through efficient and fluid railway networks involving seamless interface between rail yard/terminal operations and rail line operations

  “Industry terminal operations need to be integrated with railway operations through a common set of operating principles and objectives – this is mutually beneficial”
- Sustainable and dependable service at a competitive cost with a reasonable return on investment

PSR - A Railway Perspective

Objectives - safe, cost-effective, efficient, reliable, and timely rail service

How does it work ?

- Controlling costs, maximizing asset utilization, highly precise but flexible operations planning, and synergy across all processes
- Optimizing the rail network from a comprehensive end to end perspective (not from a regional perspective)
- Focusing on carloads (customer shipment), scheduling trains, and having them run on time to meet customer commitments (as opposed to waiting to fill out the train)
- Optimizing every process effecting on-time delivery, and constantly fine tuning (plan–execute–monitor– analyze–revise)

Hunter Harrison:

"Assets need to earn their keep, idle assets are not making money, they are costing money – everything needs to keep moving !"

Excellent service requires a good understanding and effective application of all PSR principles simultaneously and collectively across the business – the principles are sound but the application is sometimes imperfect.

PSR - A Railway Perspective

Service Design Principles - balance key, too much focus on one negatively impacts others

1. Optimizing Car Asset Utilization
   - ↓ no. cars >> ↓ car dwell in yards/terminals; ↓ car cycle; ↓ terminal space; ↓ terminal switching; ↓ cost
2. Optimizing Fuel Efficiency, Power Requirements, and Train Builds
   - Over-powering creates more waste than productive speed – right-size power to load is important
   - ↑ train length >> ↓ train starts; ↓ locomotives; ↓ crews; ↓ fuel; ↓ network congestion; ↓ costs
3. Optimizing Train Service Type (Manifest and Unit Trains)
   - PSR promotes mixed traffic >> ↓ train starts; ↓ locomotives; ↓ crews; ↓ fuel; ↓ network congestion; ↓ costs
   - Unit Train efficiency: 7 day/week operations; 100+ car train length; single O/D pair
4. Optimizing The Service Plan (network performance)
   - Multiple traffic outlets: ↑ operating flexibility; ↓ operating risk; ↓ network congestion
   - Balancing traffic in both directions: ↑ reliability; ↓ terminal dwell; ↓ network congestion; ↓ costs

PSR - A Railway Terminal Planning Perspective

Industry Rail Terminals : interface between Industry and Railways operations

Basis for Terminal production planning:

- Product type, properties, production
- Railcar type and capacity
- Type of rail service – manifest or unit trains
- Frequency of rail service – production based
- Material and railcar storage requirements
- Railcar repair requirements
- Daily rail terminal operating plan
- “just in case” optimization – need to balance resiliency with cost while mitigating risk

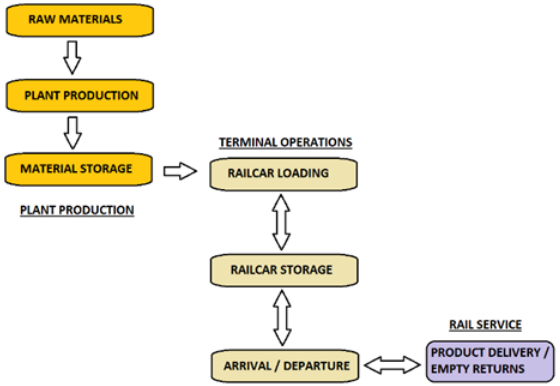
Optimizing Terminal Production and Assets:

- Optimizing number of cars loaded/unloaded, arriving/departing – requires Railway input
- Track configuration selection - loops and ladders
- Optimizing number and length of rail terminal tracks
  - Arrivals/departures
  - Loading/unloading
  - Railcar storage
  - Bad order repairs
- Optimizing number of loading stations, speed of loading, labour
- High efficiency operating equipment and innovative technology

PSR - A Railway Terminal Operating Perspective

Rail Terminal Operations (integrated processes)

- With these three operating components, disruptions in any one will likely impact the others
- Product and railcar storage is the relief valve to compensate for day to day production variations and unplanned disruptions



Optimizing Material and Railcar Storage Assets:

- Operations and cost based risk assessment is required to determine the number of days of production storage is acceptable
- Excess > waste of assets, unnecessary costs
- Insufficient > risk to plant, rail terminal, and rail service operations

PSR - A Railway Terminal Operating Perspective

On Site Railcar Storage

- More property for more service/storage tracks (↑ capital and operating costs)
- More rail yard switching (↑ operating costs)
- Direct Railway service to the Terminal
- Limited space and ability to handle railcar repairs

Altex Lashburn Crude Terminal

Off Site Railcar Storage

- Less property, fewer service/storage tracks (↓ capital and operating costs)
- Less rail yard switching (↓ operating costs)
- Additional service expense
- Direct Railway service to storage facility
- Opportunities for railcar maintenance services

Midland Railcar Storage Yard

PSR - A Railway Terminal Operating Perspective

Terminal Rail Service

- PSR promotes a 7 day/week operation
- Assuming no service disruptions, railcars will cycle from origin to destination and back again as planned
- 7 day operations promotes reliable rail service with a consistent and predictable level of service:
  - Steady demand for locomotives and train crews
  - Balanced 2-way traffic – less rail line congestion
  - Reduced terminal/yard dwell time – less terminal/yard congestion
- Other than daily rail service, whether unit or manifest train service:
  - Creates imbalances in 2-way traffic flow, network congestion
  - Irregular demand for locomotives and train crews
  - Requirement for additional storage and switching operations
  - Requirement for larger railcars fleet
  - Requirement for more rail terminal and fleet maintenance

PSR - A Railway Terminal Operating Perspective

Railcar Fleet Optimization

- Largest gross car weight permitted with largest load capacity (typically 286,000 lbs.)
- Shortest railcar length to minimize rail terminal track lengths and maximize useable space
- Location - avoid weight & speed restricted lines (↓ no. cars; ↓ car cycle; ↓ space; ↓ switching; ↓ cost)
- Allowances for bad-order repairs, maintenance, transit delays – involves an operations and cost based risk assessment

Fleet (Asset) Management

Railcar health and utilization data

- Service time, distance travelled, % loaded/unloaded
- Component service life, repair history, preventative maintenance schedules
- Railcar monitoring data (sensors) - track location, measure load and brake status, wheel and bearing performance, and hatch or door securement

Telemetrics platforms:

- Collects accurate, real-time data which can generate actionable and predictive intelligence
- Converts each railcar into a smart digital asset
- Allows for the development and execution of a terminal recovery plan due to service delays
- Optimizes fleet performance and number of assets required, improves safety, and reduces costs

PSR - A Railway Terminal Operating Perspective

The Digital Railway

- Multi-faceted end-to-end, seamless, digital platform - real-time connectivity using state-of-the-art technologies
- Transparency and alignment between rail service and terminal operations through access to Railroad real-time data
- CN's Track and Trace API:
  - APIs allow effective transmission of real-time data between computer systems
  - Real-time GPS tracking
  - Status reports – ETAs at interchange points, rail destinations, and customer site

Telemetrics:

- Multi-purpose platform which utilizes leading edge IoT technology to create a digit twin of the supply chain
- Asset management, real-time railcar tracking, shipment management, yard/terminal management, and transportation cost management
- Performance metrics, predictive and prescriptive analytics
- Machine learning, ability to learn from past performance and adapt to changing conditions

PSR - A Railway Terminal Operating Perspective

Rail Terminal Operating Technologies

Benefits:

- Improve safety, efficiency, reliability
- Lower operating and maintenance costs
- Reduce dwell time – fewer moves, errors
- Optimize assets – infrastructure, equipment

Challenges:

- Capital and implementation costs
- Scalable tools (right tool, right job)
- Skilled labour
- System integrity and integration
- Resistance to change

Rail Yard Equipment and Technologies:

Railcar Detection and Location Systems

- AEI car readers – detect inbound cars and rail yard track locations
- Weigh scales – detect overloads, custody transfer

Rail Yard Hazard Detection Systems

- Electronic hazard protection systems to protect workers from track mounted equipment
- Equipment mounted monitoring systems to detect objects in the path of track mounted equipment

Rail Yard Control Systems

- Rail yard control systems to allow users to throw switches, initiate pre-programed routes, and monitor rail yard activity from a remote dispatch center

Rail Yard Asset Management Systems

- Manage track maintenance programs, prioritizing safety, automating estimates, and optimizing budgets

Conclusions

PSR has taken the railroading industry to a higher standard of performance - these concepts and principles will continue to evolve

The reliability of efficient and fluid railway networks relies on the seamless interface between Industry terminal and Railroad operations – benefits include:

- Faster and more reliable transportation service, lower transportation costs, overall supply chain stability, competitive advantage in global and domestic marketplaces, lower costs for goods, and opportunities for sustainable economic growth

Future Potential:

- When operating practices between competing railways, terminals, ports and other supply chain entities, become standardized, generating closer collaboration and alliances, resulting in greater benefits for customers and businesses
- Is dependent upon innovation and the ongoing development and implementation of new technologies, and comprehensive and integrated support services, through the evolution of the Digital Railroad and resilient supply chains leading to improved safety, reliability, efficiency, and utilization of assets, lower costs, and superior service

Acknowledgements / References

- E. Hunter Harrison (2005) How We Work and Why - Running a Precision Railroad; Canadian National Railway Company
- Supply Chain Definition – Corporate Finance Institute https://corporatefinanceinstitute.com/resources/knowledge/strategy/supply-chain/
- CN Track and Trace API https://www.cn.ca/en/customer-centre/tools/api/

QUESTIONS