

# Strategic Trends in Intermodal Logistics & Rail Modernization

Implications for Technology Scouting & Capability Development

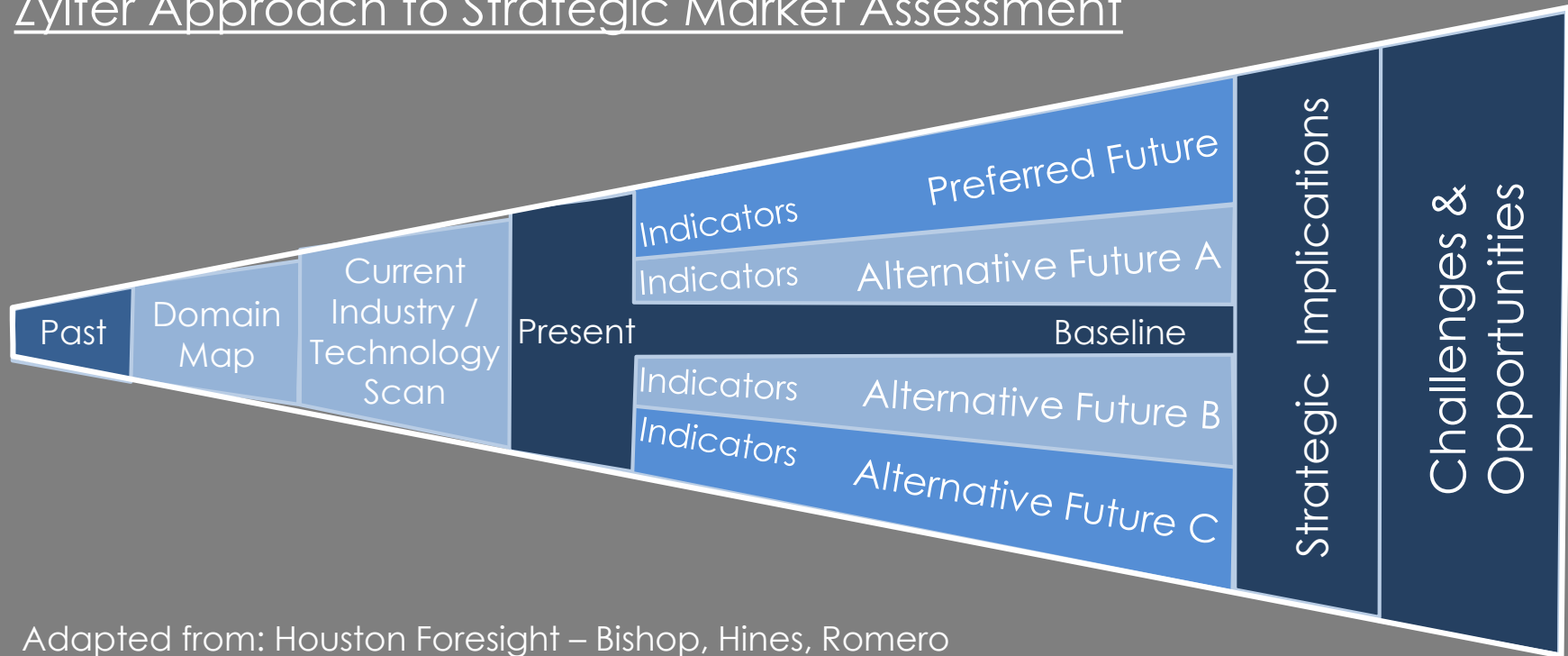


# Zylder and our commercial partners are seeing four major trends in logistics tech adoption

1. The automation tech market is delivering many technologies, but few integrated capabilities
2. Organizational planning is not keeping up with automation technology advancement
3. Successful tech adoption requires coordinated planning, exploration and adaptation
4. Leading companies are starting early, but with a flexible and pragmatic strategy

# Commercial Tech Trends: Assessing key indicators and strategic implications

## Zylter Approach to Strategic Market Assessment



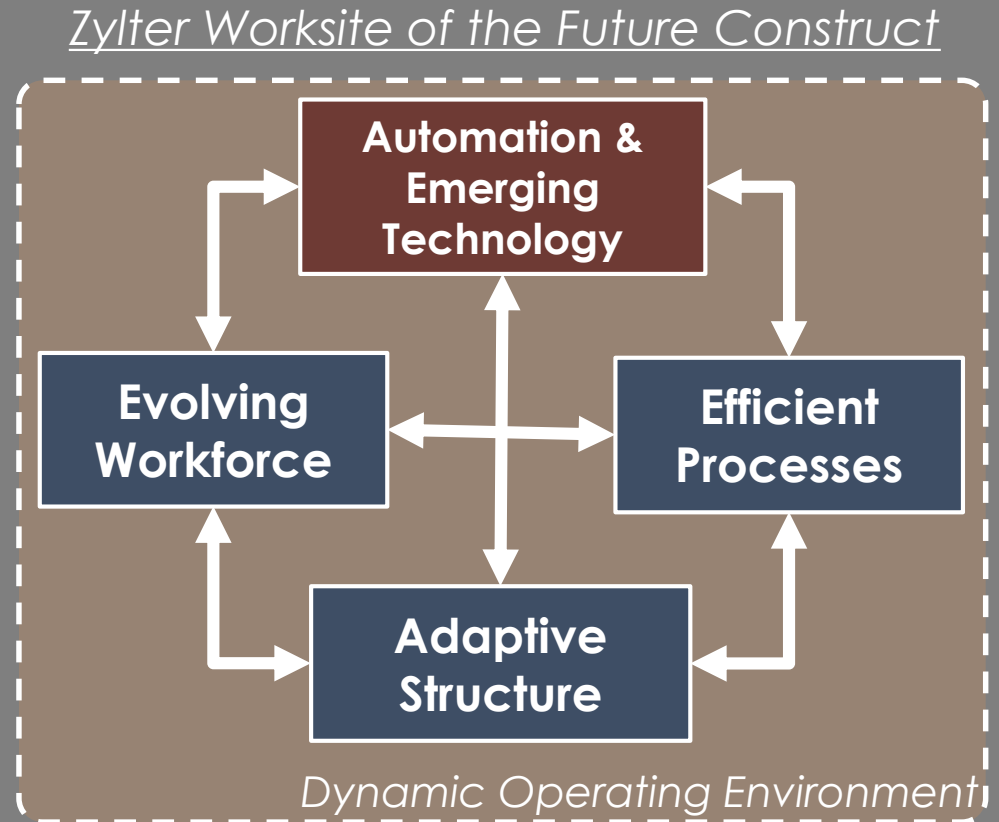
Adapted from: Houston Foresight – Bishop, Hines, Romero

*Zylter uses this assessment approach to help clients identify and realize commercial emerging technology opportunities*



# Domain Map: Intermodal ops include five key aspects that operating companies must address

- Zylter's WOTF construct provides a systematic approach to guiding technology integration
- Four interconnected elements of worksite operations
- Sector- and location-specific operating environments create unique tech requirements and challenges



*We apply our Worksite of the Future construct to guide integration of emerging commercial technologies*

# Current Industry / Technology Scan: Major trends in intermodal logistics & rail operations technology

TREND	LIKELY REQUIREMENTS
<b>Increasing Unitization Of Shipments</b>	<ul style="list-style-type: none"> <li>▪ More adaptive and coordinated tracking, categorization, and break bulk capabilities</li> </ul>
<b>Increasing Interest in Making Short-haul More Competitive</b>	<ul style="list-style-type: none"> <li>▪ More distribution of intermodal nodes and faster transfer between modes</li> <li>▪ Increased rail efficiency and responsiveness</li> </ul>
<b>Increased Demand for Precise End-to-end Visibility</b>	<ul style="list-style-type: none"> <li>▪ Increased fidelity and density of tracking systems</li> <li>▪ Interoperability between systems for each key supply chain actor</li> </ul>
<b>Aging Workforce</b>	<ul style="list-style-type: none"> <li>▪ Increasing average age of workforce presents strategic issues for negotiating and supporting new technology implementation</li> <li>▪ Workforce recruitment and retention impacted by perceived organizational modernization and fluence with technology</li> </ul>
<b>Increased Use of Telematics and Analytics</b>	<ul style="list-style-type: none"> <li>▪ Integration of systems to capture, collect, store analyze and distribute data</li> <li>▪ Continuing need to translate collected data into actionable insights for key tactical and strategic decisions</li> </ul>

# Key Indicators: Strategic factors impacting tech adoption in intermodal logistics & rail operations

WORKSITE ASPECT	KEY STRATEGIC INDICATORS
<b>AUTOMATION &amp; EMERGING TECHNOLOGY</b>	<ul style="list-style-type: none"> <li>▪ <b>Maturity of Autonomous Systems:</b> Gantry cranes, lifts, etc.</li> <li>▪ <b>Development of Supporting Infrastructures Required:</b> Physical, communications, IT, etc.</li> <li>▪ <b>Evolution of “Smart” Railroad Components:</b> Connected engines ,cars, etc.</li> <li>▪ <b>System / Data Security Threats and Capabilities:</b> ISPs, Blockchain, etc.</li> </ul>
<b>TASKS &amp; PROCESSES</b>	<ul style="list-style-type: none"> <li>▪ <b>Automated Mode Transfer:</b> Requires automated classification, handling and tracking of cargo</li> <li>▪ <b>In-Transit Visibility:</b> Need to track contents through all phases of supply chain and across modes</li> <li>▪ <b>Safety Improvements:</b> Immediate and easily-defined ROI for investments</li> </ul>
<b>ADAPTIVE ORGANIZATIONAL STRUCTURES</b>	<ul style="list-style-type: none"> <li>▪ <b>Remote-/ Tele-Op Technologies:</b> Potential for remote execution and oversight with high-speed communications infrastructure</li> <li>▪ <b>Role of and Impact on Organized Labor:</b> Impact of technology on existing agreements with Teamsters, Longshoremen, etc.</li> </ul>
<b>EVOLVING WORKFORCE</b>	<ul style="list-style-type: none"> <li>▪ <b>Technical Expertise Requirements:</b> Increased demand for integration and technical support expertise</li> <li>▪ <b>System Integration Demands:</b> Ability to bring together multiple technologies to build a value-creating, sector-specific capability</li> </ul>
<b>OPERATING ENVIRONMENT</b>	<ul style="list-style-type: none"> <li>▪ <b>Regulation:</b> National and international regulation (DOT, OSHA, DHS, etc.)</li> <li>▪ <b>Standardization Across Rail Carriers:</b> Level of common infrastructure and protocols for national and short line haulers</li> </ul>

# Key Opportunities: Technology implementation and support for rail and intermodal operations

## ▪ Key tech opportunity areas include:

- ❑ System integration and solution development to support automation
- ❑ Retrofit of existing equipment to support automation & telematics
- ❑ Upgrading of existing tech infrastructure
- ❑ Design and construction of new infrastructure
- ❑ Development support for sector-specific adaptation of emerging technologies

Identifying, prioritizing and developing priority opportunity areas requires a systematic and detailed approach

# Zylter provides expertise, analysis & support to develop & implement commercial tech offerings

- Zylter provides practical analysis and support across our five-phase development approach based on client needs and priorities

ZYLTER PRODUCT DEVELOPMENT PHASE	DESCRIPTION
<b>1. CORE TECHNOLOGY CREATION</b>	<ul style="list-style-type: none"><li>▪ Initial development and integration of core technologies and system components required to address fundamental aspects of a general purpose</li></ul>
<b>2. USE CASE DEVELOPMENT</b>	<ul style="list-style-type: none"><li>▪ Assessment of the performance and cost implications of applying core technology in a specific application</li></ul>
<b>3. PROOF OF CONCEPT</b>	<ul style="list-style-type: none"><li>▪ Prototype development and field demonstration (e.g., pilot project) in a realistic operating environment to demonstrate product viability</li></ul>
<b>4. FINAL PRODUCT DEVELOPMENT</b>	<ul style="list-style-type: none"><li>▪ Final engineering and manufacturing development based on outcomes from the proof of concept to enable full production of complete product</li></ul>
<b>5. PRODUCT DELIVERY &amp; SUPPORT</b>	<ul style="list-style-type: none"><li>▪ Introduction of the new product into the market(s) through marketing, sales and distribution</li></ul>

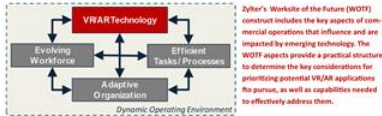


# Example Product: Zylter mapping & assessment of commercial applications for virtual reality

## Market Map for Commercial Virtual and Augmented Reality (VR/AR) Applications



### 1 Zylter "Worksite of the Future" Construct for Technology Integration



### 2 Key Indicators of Promising VR / AR Applications

Task Description	Organization	User / Audience	Operating Environment
<b>Informative</b>	Product Development	Product Design	Product Design
<b>Training/ Knowledge Transfer</b>	Product Development	Product Design	Product Design
<b>Data as an Experience</b>	Product Development	Product Design	Product Design
<b>Field Data Collection</b>	Product Development	Product Design	Product Design

**Key indicators of promising AR/VR application within each use category and WOTF aspects**

### 3 VR/AR Application Types

Application Type	Business Description
<b>In Situ Product Visualization</b>	Product Design
<b>Virtual Product Observation</b>	Product Design
<b>Product Cataloging</b>	Product Design
<b>Inserted Advertising</b>	Product Design
<b>Interactive Advertising</b>	Product Design
<b>Recognition &amp; Targeting</b>	Product Design
<b>Retail Experience</b>	Product Design
<b>Training</b>	Product Design
<b>Experiential Education</b>	Product Design
<b>Systems Analysis &amp; Understanding</b>	Product Design
<b>Field-Based Data Collection</b>	Product Design
<b>Task Improvement</b>	Product Design
<b>Cooperative Execution</b>	Product Design
<b>Entertainment Events &amp; Experiences</b>	Product Design

**Key indicators of promising AR/VR application within each use category and Worksite of the Future aspects**



### 6 Key Assumption Required to Assess Total Addressable Market

**Qualitative assumptions for assessing the total market (TM) and total addressable market (TAM)**



### 7 Industry-Specific Market Assessment

NAICS Code	Industry	Market Size	Workers	Assessment
20	Manufacturing	...	...	...
30	Mining, Quarrying, and Oil and Gas Extraction	...	...	...
40	Transportation and Warehousing	...	...	...
50	Retail Trade	...	...	...
60	Health Care and Social Assistance	...	...	...
70	Accommodation and Food Services	...	...	...
80	Arts, Entertainment, and Recreation	...	...	...
90	Other Services (except Public Administration)	...	...	...

**Total market estimation by three-digit NAICS sector**

### 4 Use Category

Use Category	Assessment
AR/VR use category	...

### 5 ASSESSMENT OF

Task Description	Organization	User / Audience	Operating Environment
...	...	...	...

**Assessment of capabilities to address each commercial application type by WOTF aspect**

### 8 Estimated U.S. Market Assessment

Application Type	Market Size	Workers
...	...	...

**Assessment of total U.S. market for each application type in total firms and total workers**

### 9 Prioritization of Applications for Further Analysis

Application Type	Priority
...	...

### AR/VR Market Mapping Approach

- 1 Conceptual Framework for Technology Integration: Zylter's Worksite of the Future (WOTF) construct explains how emerging technology impacts and interacts with other key facets of commercial operations. These aspects dictate the potential for successful use of AR/VR technology and are used to prioritize potential applications.
- 2 Identify Key Indicators of Promising VR and AR Applications: Review and analyze key indicators of promising VR and AR applications within each use category and WOTF aspects.
- 3 Detailed Description of Market: Review and analyze key indicators of promising VR and AR applications within each use category and WOTF aspects.
- 4 Detailed description of market
- 5 Detailed description of market
- 6 methodology steps
- 7 Detailed description of market
- 8 Detailed description of market
- 9 Prioritize Potential VR Applications: Final prioritization of applications based on task capabilities and the estimated total market to identify the priority applications for further analysis and development. Other factors should also inform prioritization, such as current capabilities and barriers to entry.



The delivered version of this market map was a 1.2m x 2.1m wall-mounted product for team review and long-term use



# Visit the Zylter website for other publications or email us for more information

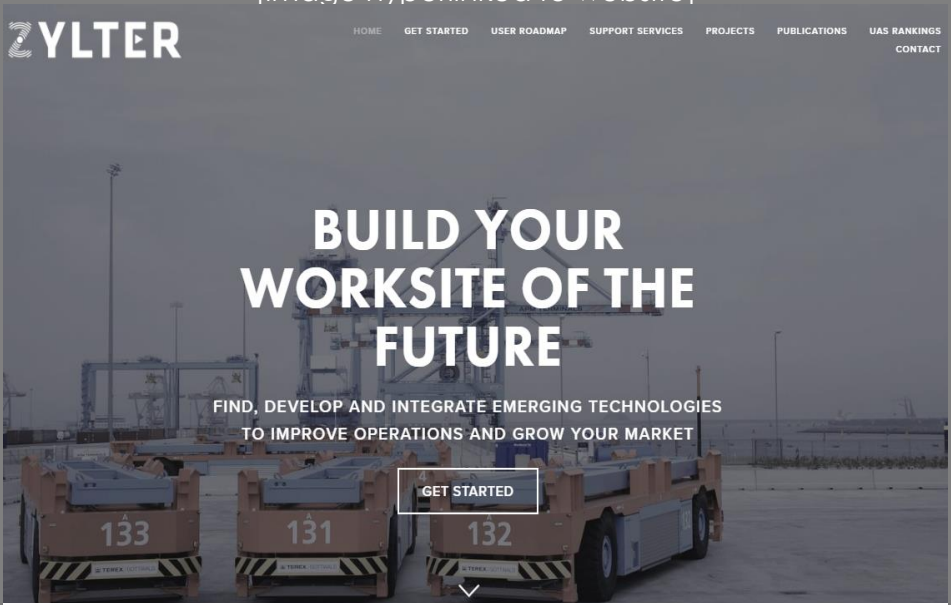
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[image hyperlinked to website]



## TECHNOLOGY SCOUTING AND INTEGRATION FOR ENGINEERING, LOGISTICS, ENERGY AND SECURITY USES



### TECH SCOUTING

Leverage Zylter expertise and global network of expertise to identify and assess the technologies and innovative capabilities you seek.



### INTEGRATION

Leverage our system design and development expertise to turn emerging technologies into your value-producing capabilities.



### LIFE-CYCLE SUPPORT

Draw on Zylter's project management, training and support resources to launch and sustain your technology-enabled program or system.



# ZYLTER

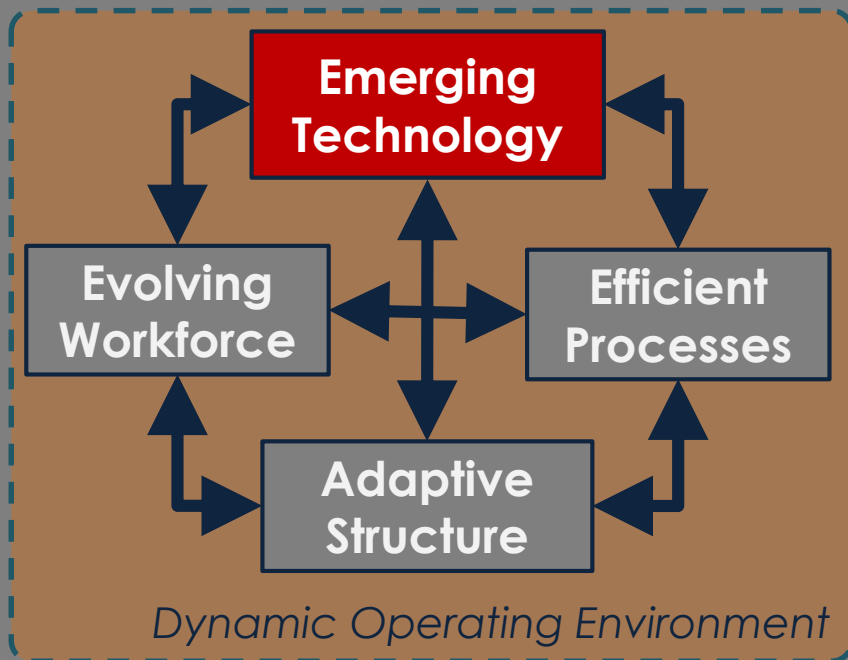
*Integrate. Technology. Zylter.*



**ZYLTER**

# We work across a portfolio of technologies to meet commercial needs

## Zylder Worksite of the Future Construct



## Zylder Technology Product Areas

